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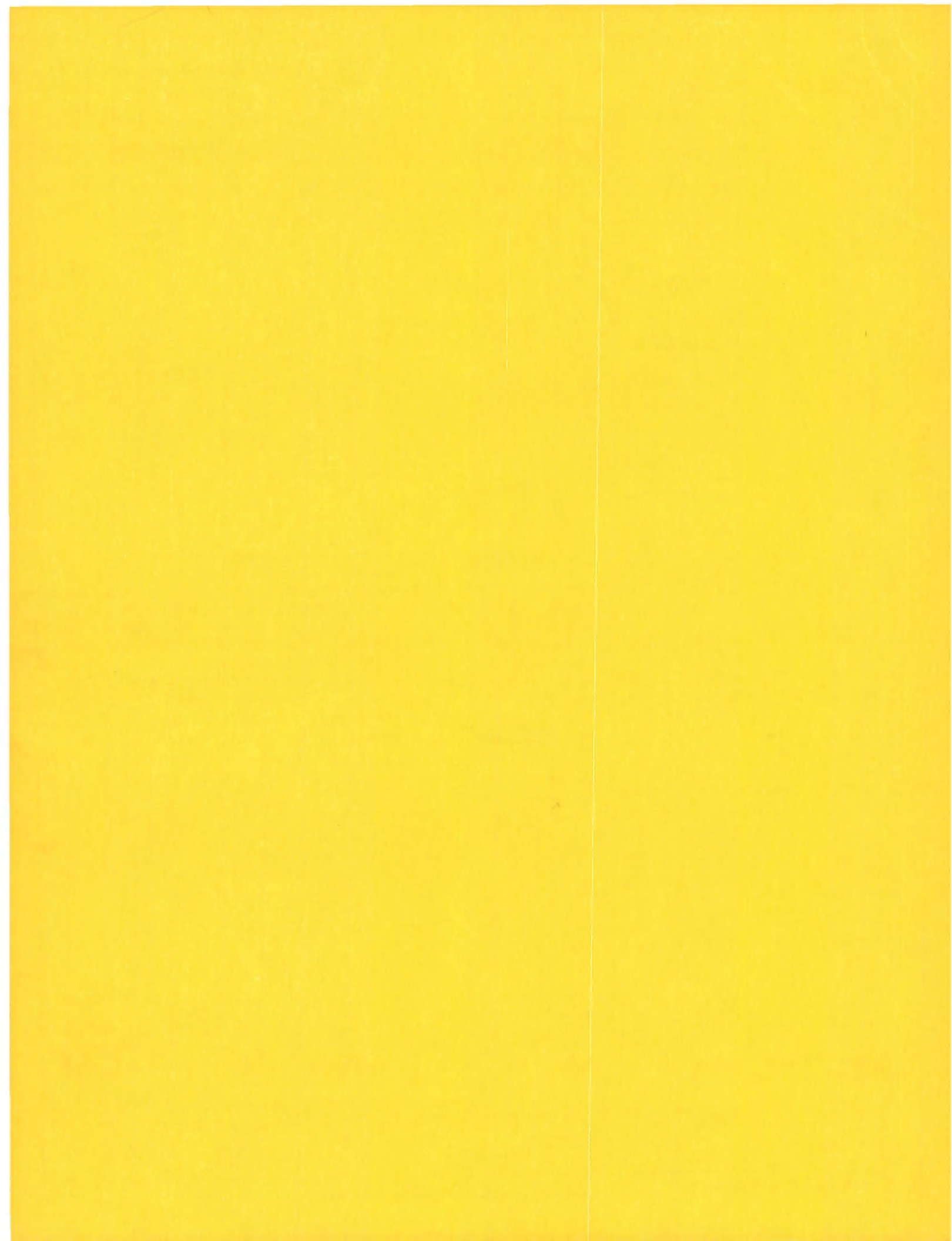
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Research on Construction of Transportation Facilities



Bibliography With Abstracts October 1976

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16. Abstract Summaries of 158 recent ongoing research projects are listed in Section 1. Abstracts of more than 2800 research reports, technical papers and journal articles from U.S. and non-U.S. sources pertaining to construction of transportation facilities are listed in Section 2 of this publication. Indexes with explanatory notes are included for each section at the end of the respective sections. An analysis of the abstracts and summaries is given in the manuscript section that precedes Section 1. The analysis illustrates a method to program the funding of research projects within three major categories of construction of transportation facilities, namely; (1) system construction, management and quality control; (2) optimization of materials selection and utilization; and (3) construction methods and equipment. The abstracts and summaries (document records) are classified to one of seven research payoff categories and to one of seven transportation facilities within the 3 major categories. The gaps in research payoff/facility type matrices thus indicate areas where little or no research is being funded and suggest areas where research projects may be initiated. Following Section 2 are explanatory notes about the availability of documents cited by the abstracts and explanatory notes on document record content and format.			
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FOREWORD

During the last decade, the cost of construction associated with transportation systems—particularly urban systems—has increased at an alarming rate. As a first step in an effort to better understand the cause for this inflation and to assist in developing a means of reducing the rate of increase, the Transportation Research Board was requested to determine the research and development that is being conducted in the United States and the areas of this research.

The purpose of this analysis is to catalog present and past research and development efforts in construction technology without reference to a particular mode of transportation (i.e., highway, railway, transit), to identify possible areas of overlap and oversight, and to provide an additional tool to research managers in establishing priorities for research and development.

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INTRODUCTION

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The Office of the Assistant Secretary for Systems Development and Technology of the U.S. Department of Transportation requested the Highway Research Information Service (HRIS) of the Transportation Research Board (TRB) to classify and analyze information related to research on the construction of transportation facilities. Information was retrieved from the data bases of three information services operated by TRB: HRIS, the Railroad Research Information Service, and the Maritime Research Information Service. Two types of information were retrieved:

1. Abstracts of published technical papers, journal articles, and research reports acquired from sources throughout the United States and abroad; and
2. Summaries of ongoing research projects reported to TRB during 1974 and 1975.

The search of the data bases identified 2811 published works and 153 ongoing research projects that were relevant

to transportation construction. The retrieved information was classified into three areas of construction research. It was then classified with respect to types of payoffs or benefits that might be expected from successful research and implementation. Seven payoff categories were used. And finally, it was classified with respect to transportation facilities that would be primary beneficiaries of the construction research. Seven categories of transportation facilities were used. Table 1 gives the research areas and the payoff and transportation facility categories.

In the analysis, six retrievals were made from the data base, one for each research area both for recent ongoing research and for published research. Results of these retrievals are given in Table 2. The retrieved records are mutually exclusive within each research area. However, there is overlap of records among areas, for some records are relevant to more than one research area.

Table 3 gives the distribution of the 1184 abstracts and summaries by categories and research areas. The sections below further discuss this analysis. Forty percent of all the document records contained in this publication were analyzed. Analysis of the remaining 60 percent probably would not significantly change the results, trends, or conclusions stated.

Table 1. Research areas and categories used to classify abstracts and research summaries.

Research Areas	Payoff Categories	Transportation Facility Categories
System construction, management, and quality control	Increased safety	Earthwork and drainage
	Protected environment	
Optimization of materials selection and use	Conserved energy or natural resources	Bridges, piles, buildings, and locks
	Extended life expectancy or improved quality	Tunnels
Construction methods and equipment	Lowered capital investment or initial cost	Roadside fixtures: sign structures, guardrail, markers, and vegetation establishment
	Reduced construction time or improved construction efficiency	Pavements
	Provided additional user amenities or improved facility performance	Guideways and traffic
		Pipelines for commodity transport

ABSTRACTS OF PUBLISHED TECHNICAL PAPERS, JOURNAL ARTICLES, AND RESEARCH REPORTS

Approximately a third of the abstracts of published technical papers, journal articles, and research reports were classified (Table 2). The number of abstracts given in the cells of Table 2 provides a measure of the research effort that has been expended on the construction of transportation facilities by facility and payoff categories. Much of the completed research has been concentrated in the area of life expectancy of earthwork and drainage and of pavements. There has also been a significant level of activity in improving construction efficiency for earthwork and drainage and for pavements.

The listing below gives the accession numbers of all the abstracts of papers, articles, and reports according to the categories under which they are classified.

Some abstracts relate to the results obtained by the implementation of research findings, for example, the abstract of the journal article, *Computer Speeds Monitoring of Fill and Base Construction* (accession no. 215330) listed under the research area of system construction, management, and quality control. The abstract of the workshop proceedings paper by McDonald and Potter, *Review of Highway Design and Construction Through Expansive Soils in South Dakota on I-95-Missouri River West—135 Miles* (accession no.

Table 2. Number of abstracts and research summaries retrieved and analyzed.

Information Type and Research Area	Retrieved	Analyzed	
		Number	Percent of Retrieved
Abstracts of papers, articles, and reports			
System construction, management, and quality control	307	307	100
Optimization of materials selection and utilization	1400	350	25
Construction methods and equipment	1104	369	33
Subtotal	2811	1026	33.4
Summaries of recent ongoing research projects			
System construction, management, and quality control	32	32	100
Optimization of materials selection and utilization	58	58	100
Construction methods and equipment	68	68	100
Subtotal	158	158	100
Total	2969	1184	40

Table 3. Number of abstracts and research summaries by transportation facility and payoff categories and by research area.

Transportation Facility Category	Payoff Category and Area																											All Categories				
	Safety			Environment			Energy and Natural Resources			Life Expectancy			Initial Cost			Construction Time			User Amenity			Multiple or Not Specified			Total							
	MQC	MSU	ME	MQC	MSU	ME	MQC	MSU	ME	MQC	MSU	ME	MQC	MSU	ME	MQC	MSU	ME	MQC	MSU	ME	MQC	MSU	ME	MQC	MSU	ME					
Abstracts of Papers, Articles, and Reports																																
Earthwork and drainage		3			1	2					25	31	29	6	3	10	24	14	16				5	57	18	60	111	75	246			
Bridges, piles, buildings, and docks	4	1	3			1		1			3	6	16	1	1	15	10	4	22	1		2	1	6	15	20	19	74	113			
Tunnels	2		1			2					1	2	1	7	2	5	4	2	17					8	17	14	14	43	71			
Roadside fixtures																																
Pavements		5	4			2	1				7	1	43	53	21	3	9	14	21	15	30	3		2	2	7	17	18	77	110	91	278
Guideways and trackage													1	1					1									2	1	3		
Pipelines												1																1		1		
Multiple	1	1		1				1	3			10	10		1	1	5	10	3	8				5	17	16	29	35	29	93		
Not specified	2			2	2			6	1	9			38	25	7	6	4	7	18	8	20	1			19	12	14	107	58	56	221	
Total	9	10	10	3	3	12	2	22	1	120	129	75	24	20	56	107	47	113	5	2	4	37	117	98	307	350	369	1026				
Summaries of Ongoing Research Projects																																
Earthwork and drainage											3	7	2			3	1	1	1			1	1	2	4	5	10	11	26			
Bridges, piles, buildings, and docks	2		1									2	4			3	1	1	2					1	1	3	4	11	18			
Tunnels		1	1			1						1											1		2	1	2	4	7			
Roadside fixtures																																
Pavements		4	4							2		4	8	9		1	5	1	2	2				1	2	5	18	22	45			
Guideways and trackage																																
Pipelines																																
Multiple	2							3			6	5					3		3						1		11	9	3	23		
Not specified	1	1	1	1							1	9	4		1		4	2	4					2	8	7	15	17	39			
Total	5	6	7	1		1		5		14	32	19		2	11	10	6	12			1	2	7	17	32	56	68	158				
Abstracts and Summaries																																
Total	14	16	17	4	3	13	2	27	1	134	161	94	24	22	67	117	53	125	5	2	5	39	124	115	339	408	437	1184				
All categories	47			20			30			389			113			295			12			278			1184							

Note: MQC, MSU, and ME are abbreviations of the research areas given in Table 1.

Table 4. Funding of recent ongoing research projects in the United States.

Transportation Facility Category	Payoff Category																			
	Safety		Environment		Energy and Natural Resources		Life Expectancy		Initial Cost		Construction Time		User Amenity		Multiple or Not Specified		Total			
	Number	Amount	Number	Amount	Number	Amount	Number	Amount	Number	Amount	Number	Amount	Number	Amount	Number	Amount	Number	Amount		
Earthwork and drainage								5	1 409 900	2	60 100	1	410 000	1	80 800	3	2 135 800	12	4 096 600	
Bridges, piles, buildings, and docks								5	565 400	1	756 600	1	195 000			1	142 000	8	1 658 400	
Tunnels	2	701 400	1	98 000											2	101 700	5	961 100		
Roadside fixtures																				
Pavements		686 800			2	223 000	6	750 300	2	215 000	2	152 000					2	74 500	19	2 101 600
Guideways and trackage	5																			
Pipelines																				
Multiple																				
Not specified			1	80 000	2	197 300	7	741 600				3	281 700			1	30 000	12	1 300 600	
								5	377 800			1	200 000			3	344 700	10	1 002 500	
Total	7	1 388 200	2	176 000	4	420 300	28	3 645 000	5	1 031 000	8	1 238 700	1	80 800	12	2 978 700	67	11 050 800		

Note: Number indicates the number of projects. Amounts are dollars.

233514), listed under research area of optimization of materials selection and utilization, illustrates the usefulness of the abstracts to identify individuals who have carried out research projects that have improved transportation and thus have demonstrated their competence in specific areas of research in the construction of transportation facilities.

System Construction, Management, and Quality Control

Earthwork and Drainage

Life Expectancy

080544 083780 096986 099611 129025 212057 214468
 214625 214874 215203 215449 215456 215716 215872
 215936 217019 217823 230583 231048 231453 232497
 234447 235271 236379 236643

Initial Cost

096291 214445 215478 231943 232147 232551

Construction Time

125290 214433 214441 214444 214450 214843 214752
 215221 215323 215330 215488 230596 230615 230616
 230916 231021 231051 231172 231695 232001 232437
 232498 232890 235570

Multiple or not specified

214872 216231 216730 231685 231725

Bridges, Piles, Buildings, and Docks

Safety

125294 126128 208177 215543

Life Expectancy

080488 128800 214789

Initial Cost

215588

Construction Time

212426 215079 215373 215418 215581 215592 216726
 230759 243061 264664

User Amenity

208799

Multiple or not specified

215587

Tunnels

Safety

091373 236585

Life Expectancy

260465

Initial Cost

039272 091372 091757 091758 094294 127939 129113
 215588

Construction Time

125437 236544 236588 264756

Pavements

Life Expectancy

081474 081654 081762 082810 097488 099622 127336
 127337 200420 205350 211791 214424 214437 214471
 214477 214504 207038 207395 207442 210420 211467
 214559 214619 214621 214627 214678 214737 214835
 214960 214813 214974 215145 215219 215457 215610
 215672 216911 217911 229808 230681 232310 232576
 264754

Initial Cost

081396 099711 211356

Construction Time

081395 200734 205961 206464 214427 214442 214447
 210330 210776 211400 211445 214525 214812 214940
 214975 215120 215234 215235 215747 219351 232976

User Amenity

128662 214560 215348

Multiple or not specified

080708 214875 215317 215365 215515 216489 216589

Multiple

Safety

219891

Environment

236639

Energy and Natural Resources

260275

Life Expectancy

080574 129453 214466 214506 214618 214768 214818
 215167 215192 215357

Initial Cost

200440

Construction Time

200302 200456 200681 200686 206454 206486 215129
 216264 216909 263105

Multiple or not specified

200399 215125 215155 217849 233820

Not Specified

Safety

215124 263764

Environment

260478 264579

Energy and Natural Resources

265648

Life Expectancy

080387 083611 126833 127797 202518 205310 212254
 212259 213384 214461 214474 214485 214495 214499
 214511 214524 214527 214687 214731 214760 214810
 214837 214516 214791 214811 215091 215119 215174
 215189 215190 215224 215371 215399 215557 216917
 238435 260415 261493

Initial Cost

096034 127968 128495 214740 214851 261511

Construction Time

080799 090683 096995 200102 200727 200730 200731
 201810 214124 214459 214620 261495 264569 264587
 214724 214781 214799 214800 215068 215206 215236
 215250 215254 215263 215264 215272 215293 215324
 215346 215484 215507 215529 215674 215680 215708
 218516 232621 232653

User Amenity

207700

Multiple or not specified

051065 084213 091495 099755 129021 200117 213194
 207758 214640 214704 214756 215322 215533 238346
 238272 238686 238687 238688 260639

Optimization of Materials and Utilization

Earthwork and Drainage

Safety

229924 231306 264642

Environment

234485

Energy and Natural Resources

092025 212798

Life Expectancy

084068 096693 128116 203480 213202 214444 215095
 217596 228582 228628 229282 229376 230137 230597
 230673 230834 230902 230944 231113 231173 231239
 231601 231616 231829 232373 232430 232511 233776
 234119 263479 264282

Initial Cost

083729 230351 263786

Construction Time

096249 096371 099743 214615 214872 215110 215231
 215270 228804 229729 231953 232063 263943 265216

Multiple or not specified

040032 090197 090789 097352 228871 229134 229204
 229533 229561 229626 229665 230556 230791 230865
 230922 231075 231371 231394 231473 231502 231540
 231580 231591 231642 232193 231807 231918 231925
 232031 232051 232086 232129 232229 232562 232639
 232878 233100 233141 233303 233340 233409 233458
 233506 233518 233706 233772 235031 235316 235663
 235097 237555 237776 237951 262219 262990 265669
 272092

Bridges, Piles, Buildings, and Docks

Safety

217698

Energy and Natural Resources							Not specified							
081016							Energy and Natural Resources							
Life Expectancy							090679	097042	129341	217434	217687	217715	217923	
093188	207711	208159	210028	215409	217557	260270	260983							
Initial Cost							Life Expectancy							
209428							083302	096024	097335	125132	129681	205308	210624	
Construction Time							211954	212262	214066	214325	214566	214682	214726	
098641	127474	127899	214192				214800	215825	216344	216460	216889	217538	217679	
Multiple or not specified							217873	229808	260911	263383				
039236	208559	208989	209662	214909	236006									
Tunnels							Initial Cost							
Life Expectancy							080925	214740	231743	238348				
037198	263680						Construction Time							
Initial Cost							128665	213529	214003	214628	215040	215478	215564	
260465	262402						215603							
Construction Time							Multiple or not specified							
125099	236580						081420	081685	125241	212668	213172	214665	217143	
Multiple or not specified							217406	230546	231770	232703	237278			
047278	081148	095267	091373	203910	215341	236542								
Pavements							Construction Methods and Equipment							
Safety							Earthwork and Drainage							
047304	125294	214933	218332	221292			Environment							
Environment							215626	232819						
126292	215640						Life Expectancy							
Energy and Natural Resources							083690	125298	204378	230142	230560	230763	231871	
083729	095557	095561	127958	217204	261675	264167	231893	231925	232337	232456	232523	232657	232775	
Life Expectancy							233168	233265	233675	234209	234407	235365	235605	
080382	082988	093621	097389	125384	125512	127664	236364	238030	238117	238140	260445	262777	263491	
202738	202857	205570	205662	205866	206298	206492	263942							
206552	206770	207031	210265	210825	210859	211016	Initial Cost							
211120	211149	211174	211371	211445	211547	213729	099619	214445	215520	215701	219397	231250	231968	
214477	214520	214886	214960	215466	215747	216514	233629	261505	263648					
217473	217799	217842	217911	219143	229352	229841	Construction Time							
231063	231783	232399	232834	237605	261895	264782	097342	127782	214843	215135	215239	219515	229630	
264913	265101	265685	265694				230921	230957	231239	231858	232014	232067	232903	
Initial Cost							235631	235082						
080711	097678	127527	200924	205046	214841	231439	Multiple or not specified							
233510	233533						081220	083883	214542	214558	214855	214954	215487	
Construction Time							230443	231073	231376	231672	232085	232261	232356	
083579	096900	205526	205767	210753	210780	211063	233582	234099	265672	265751				
211480	214431	214588	214697	214863	215142	215205	Bridges, Piles, Buildings, and Docks							
215512							Safety							
User Amenity							128279	208177	260476					
092588	219323						Environment							
Multiple or not specified							082778							
092531	092535	203257	205782	210514	210890	211712	Life Expectancy							
211864	212555	215622	231658	231666	231734	231896	080988	099912	125653	206397	207728	207755	207843	
232933	233473	238066					Initial Cost							
Guideways and Trackage							207911	208082	209258	209453	209549	209655	209897	
Life Expectancy							214528	218200						
037923							Construction Time							
Construction Time							208258	208320	208589	208701	209017	209109	209763	
215704							210219	214669	214891	215055	215058	215122	215594	
Pipelines							265001							
Life Expectancy							Multiple or not specified							
217018							080701	081918	082871	083330	096685	099601	125380	
Multiple							128520	129674	129985	208029	214717	215109	215212	
Safety							215214	215352	215373	215434	216306	231195	261998	
081886							263104							
Energy and Natural Resources							User Amenity							
082750	130712	215995					208434	214580						
Life Expectancy							Multiple or not specified							
207616	213848	214378	214768	214818	215167	215309	081775	083767	084088	096788	125615	207714	210180	
216203	232314	236643					Initial Cost							
Initial Cost							214917	214930	215588	215693	215737	232152	233527	
231709							260091							
Construction Time							Tunnels							
090682	214783	215357					Safety							
Multiple or not specified							214967							
081770	125827	205445	213363	216063	230534	231446	Environment							
231272	231685	231983	232272	233480	233514	237471	209999	215770						
237526	242993	265565					Life Expectancy							
Multiple or not specified							234633							
Initial Cost							039240	215244	215340	235688	236859			

Multiple or not specified

125113	128712	208190	210154	214370	214922	215301
219309	231959	235214	235232	236463	236890	237152
260780	276009	291079				

Pavements

Safety

206960	210829	215188	225908			
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Environment

219510

Energy and Natural Resources

217942

Life Expectancy

082752	093223	127533	203651	205429	205497	205573
206265	206323	206949	207032	207158	211330	211440
211560	211956	213489	213807	214589	217737	264610

Initial Cost

080826	081742	082804	097186	200206	205685	205772
210892	214646	218418	218628	231439	231726	264392

Construction Time

081762	082810	083166	097679	097844	127338	128661
205543	206196	210780	211060	211178	211510	211802
213126	214417	214421	214473	214702	214821	214874
214998	215081	215183	215317	215510	216827	230928
231722	261755					

User Amenity

206787 210561

Multiple or not specified

090075	096407	206091	211400	211888	212215	212725
214597	214614	214738	214866	214994	231115	231461
231466	231660	231690	231769			

Guideways and Trackage

Life Expectancy

207484

Multiple

Initial Cost

090759 208903 215635 218026 219501

Construction Time

041554 080979 081064 097370 125220 127929 214460
265242

Multiple or not specified

080982	081143	081932	082788	096478	096883	125087
129018	130627	210249	212718	215020	215536	216509
219389	233380					

Not specified

Safety

214227 219353

Environment

095841 219466 219504 229921 240027 261274

Life Expectancy

126481 210349 212609 216917 217389 237742 264799

Initial Cost

083320 201772 214628 215233 215685 215762 265569

Construction Time

099536	200687	210067	214003	214810	215164	215261
215266	215271	215293	215399	215564	216108	219110
219279	219358	219367	219404	219520	260354	

Multiple or not specified

081640	095786	096078	096994	098090	098960	127475
205945	215784	218981	219290	228717	237385	264571

SUMMARIES OF RECENT ONGOING RESEARCH PROJECTS

All of the summaries of the recent ongoing research projects were classified by payoff category for each of the transportation facility categories. For example, the project, *Design and Construction Guidelines for Shale Embankments* (accession no. 109551), being performed by the Joint Highway Research Program of the Indiana State Highway Commission and Purdue University, was placed in the research area of system construction, management, and quality control. It was

classified under the transportation facility category of earthwork and drainage and the payoff category of life expectancy.

The listing below gives the accession numbers of all the research summaries according to the categories under which they are classified. Accession numbers followed by an "F" indicate that the research is being performed outside the United States. Seventy-one of the recent ongoing research projects are being performed outside the United States. The greatest number of projects under way in the United States are concerned with increasing the life expectancy of pavements (Table 2), a finding similar to that for completed research. Only five projects indicate research on energy and natural resource conservation; no records indicate research on guideways and trackage or on pipelines. Funding data for 67 U.S. projects are given in Table 4. The largest expenditure is for research to increase the life expectancy of earthwork and drainage. No funding data were available for the other 20 U.S. projects.

System Construction, Management, and Quality Control

Earthwork and Drainage

Life Expectancy

109504 109551 115490F

Construction Time

115111F 020877

Multiple or not specified

020877

Bridges, Piles, Buildings, and Docks

Safety

085787F 086435F

Construction Time

085786F

Tunnels

Multiple or not specified

048653

Pavements

Life Expectancy

101481 102037 103634 115500F

Construction Time

101592F

Multiple

Safety

085475F 115837F

Life Expectancy

021188 082042 082245 085590F 100140 104699F

Construction Time

061123F 086273F 100227

Not specified

Safety

115257F

Environment

105748

Life Expectancy

082638

Construction Time

083649 085647F 115254F 115945

Optimization of Materials Selection and Use

Earthwork and Drainage

Life Expectancy

082318 101231 105319F 109353F 115262F 115733F

Construction Time

105226F

Multiple or not specified

104652

Multiple or not specified

085782F 109545

Bridges, Piles, Buildings, and Docks

Life Expectancy

102992 021389

Construction Time
 115813F
Multiple or not specified
 102787
Tunnels
Safety
 000061
Life Expectancy
 125933F
Pavements
Safety
 048913 055848 101371F 102064
Energy and Natural Resources
 082296 105113
Life Expectancy
 101520F 102032 102043 103577 103581 105317F
 115509F 115693F
Initial Cost
 103895F
Construction Time
 109373F 109531
Multiple or not specified
 105116
Multiple
Energy and Natural Resources
 086637F 082119 082601
Life Expectancy
 021088 101274F 101317F 104328 104619
Multiple or not specified
 082554
Not specified
Safety
 086435F
Life Expectancy
 020892 083104 085341F 086386F 086440F 104331
 082196 104373F 105106
Initial Cost
 104672
Construction Time
 115323F 115668F
Multiple or not specified
 083093 101279F
Construction Methods and Equipment
Earthwork and Drainage
Life Expectancy
 020022 082277
Initial Cost
 020415 104332 105658

Construction Time
 100785
User Amenity
 104589
Multiple or not specified
 020584 085782F 115797 109915F
Bridges, Piles, Buildings, and Docks
Safety
 08578F
Life Expectancy
 021389 082570 103770 105052
Initial Cost
 102810 109478 115848F
Construction Time
 085407F 082559
Multiple or not specified
 109011F
Tunnels
Safety
 110088
Environment
 048984
Multiple or not specified
 045960 105536F
Pavements
Safety
 082381 101335F 101730F 102045
Life Expectancy
 020875 021196 082498 087022F 101631F 105235F
 110412F 115400F 128911F
Initial Cost
 082572 101808F 102017 103894F 103895F
Construction Time
 083019 101486
Multiple or not specified
 021201 115860F
Multiple
Construction Time
 085647F 105656 111369
Not specified
Safety
 115257F
Life Expectancy
 082051 082638 085336F 115510F
Construction Time
 085590F 086273F 104699F 115254F
Multiple or not specified
 082110 082299 102869 103090F 104330 104601
 105108 115323F

PART 1

SUMMARIES OF RECENT ONGOING RESEARCH PROJECTS

1R 020877

DEVELOPMENT OF IMPROVED PERFORMANCE CRITERIA FOR USE IN NUCLEAR GAGE SPECIFICATIONS
THIS PROJECT WILL DEVELOP THE CRITERIA FOR EFFICIENT "STATE OF THE ART" SPECIFICATION FOR NUCLEAR MOISTURE-DENSITY GAGES FOR USE IN HIGHWAY COMPACTION CONTROL. WORK IS NEARING COMPLETION ON THE SPECTRUM ANALYSIS AT THE CALIFORNIA DENSITY STANDARDS, USING THE RADIOISOTOPES CO-60, RA-226, CS-137, IN A COMBINATION OF THE POSSIBLE GEOMETRIC ARRANGEMENTS. THE BASIC FACTORS AFFECTING RESPONSE TO DENSITY, AND CHEMICAL SENSITIVITY ARE BEING IDENTIFIED. OTHER TOPICS BEING STUDIED ARE PRIMARY SHIELDING, DETECTOR SHIELDING (FILTERING), AND THE CHARACTERISTICS OF VARIOUS DEFECTORS CURRENTLY AVAILABLE.

PERFORMING AGENCY: California Department of Transportation, Division of Highways, Transportation Laboratory Branch, Study No 19-632108
INVESTIGATOR: Forsyth, RA Hannon, JB Chang, J
SPONSORING AGENCY: California Department of Transportation, Division of Highways; Federal Highway Administration, Department of Transportation
RESPONSIBLE INDIVIDUAL: Mitchell

HP&R F-4-24

STATUS: Active NOTICE DATE: Oct. 1974 START DATE: July 1969 COMPLETION DATE: June 1975 TOTAL FUNDS: \$40,700

ACKNOWLEDGMENT: California Department of Transportation, Federal Highway Administration (196089351)

1R 021188

APPLICATION OF STATISTICAL QUALITY CONTROL METHODS

THE OBJECTIVE OF THIS STUDY IS TO DEVELOP SPECIFICATIONS IN COMBINATION WITH SAMPLING AND TESTING PROCEDURES WHICH ARE STATISTICALLY SOUND AND WILL PROVIDE THE CONSTRUCTION ENGINEER WITH REASONABLE ASSURANCE THAT THE DECISIONS HE MAKES WITH REGARD TO ACCEPTING OR REJECTING A MATERIAL ARE CORRECT. THE USE OF STATISTICAL METHODS IN CONTRACT CONTROL WILL BE MONITORED AND REVISED SPECIFICATIONS WILL BE EVALUATED.

PERFORMING AGENCY: California Department of Transportation, Division of Highways, Transportation Laboratory Branch, Study No 19-631146
INVESTIGATOR: Ames, WH Sundquist, CR Benson, PE
SPONSORING AGENCY: California Department of Transportation, Division of Highways; Federal Highway Administration, Department of Transportation
RESPONSIBLE INDIVIDUAL: Granley

HP&R F-1-03

STATUS: Active NOTICE DATE: Oct. 1974 START DATE: July 1967 COMPLETION DATE: June 1975 TOTAL FUNDS: \$276,000

ACKNOWLEDGMENT: California Department of Transportation, Federal Highway Administration (295120356)

1R 048653

COMPREHENSIVE STUDY CONTRACTING PRACTICES USED FOR UNDERGROUND CONSTRUCTION IN THE UNITED STATES

This Reimbursable Agreement transfers funds to the National Science Foundation to support the U.S. National Committee on Tunneling Technology, for a comprehensive study of contracting practices used for underground construction in the United States.

PERFORMING AGENCY: National Science Foundation
SPONSORING AGENCY: Office of Systems Development and Technology, Department of Transportation
RESPONSIBLE INDIVIDUAL: McFarland, RK (Tel 202-426-9638)

IA DOT-AS-40032

STATUS: Active NOTICE DATE: Aug. 1975 START DATE: Feb. 1974 TOTAL FUNDS: \$25,000

ACKNOWLEDGMENT: TRAIS

1R 082042

QUALITY CONTROL RESEARCH STUDY

This study aims to: 1) determine the level of quality of ready mix concrete presently being incorporated into construction projects of D.C. Department of Highways & Traffic; and 2) develop realistic requirements for level of quality and procedures for controlling quality of ready mix concrete used on highway projects.

PERFORMING AGENCY: District of Columbia Department of Transportation
INVESTIGATOR: Martin
SPONSORING AGENCY: District of Columbia Department of Transportation; Federal Highway Administration, Department of Transportation
RESPONSIBLE INDIVIDUAL: Granley

HP&R 617

STATUS: Active NOTICE DATE: Dec. 1974 TOTAL FUNDS: \$36,000

ACKNOWLEDGMENT: Federal Highway Administration (167029356)

1R 082245

DETERMINATION OF STATISTICAL PARAMETERS PHASE II: CONCRETE PAVEMENT AND STRUCTURES

The goal of this study is to develop realistic and fully enforceable acceptance specifications for concrete pavement and structures which will ensure that the quality level of currently acceptable construction is maintained in future work.

PERFORMING AGENCY: Materials Research and Development, Woodward-Gardner and Associates, Incorporated
INVESTIGATOR: Hudson
SPONSORING AGENCY: Pennsylvania Department of Transportation; Federal Highway Administration, Department of Transportation
RESPONSIBLE INDIVIDUAL: Granley

HP&R 73-3A

STATUS: Active NOTICE DATE: Dec. 1975 COMPLETION DATE: Dec. 1975 TOTAL FUNDS: \$110,000

ACKNOWLEDGMENT: Federal Highway Administration (033294356)

1R SYSTEM CONSTRUCTION, MANAGEMENT & QUALITY CONTROL

1R 082638

EVALUATION OF UTAH'S QUALITY CONTROL PROCEDURES RELATED TO CONSTRUCTION

The objectives are to establish an overall plan to improve Utah's quality control system. Also those areas of quality control that can be immediately changed or improved will be implemented through this study; those areas requiring a more extensive change-over will be identified for later implementation. Information will be gathered from various individuals throughout Utah related to construction to help identify problem areas and possible solutions. This information will be compared to a literature search or questionnaire aimed at the same problem areas to detect existing problems and their solutions and where these solutions will help improve quality construction and control in Utah.

PERFORMING AGENCY: Utah State Department of Transportation, Materials and Tests Division, Study No. 500-927

INVESTIGATOR: Leatham, J Peterson, GE Peterson, DE

SPONSORING AGENCY: Utah State Department of Transportation; Federal Highway Administration, Department of Transportation

HP&R

STATUS: Active NOTICE DATE: Oct. 1974 START DATE: July 1974 COMPLETION DATE: June 1975 TOTAL FUNDS: \$12,000

ACKNOWLEDGMENT: Utah State Department of Transportation

1R 083649

CONSTRUCTION MANAGEMENT

A system for the operational management of construction engineering and inspection will be developed and field tested.

PERFORMING AGENCY: Michigan Department of State Highways & Transport; Jorgensen (Roy) and Associates

SPONSORING AGENCY: Michigan Department of State Highways & Transport; Federal Highway Administration, Department of Transportation
RESPONSIBLE INDIVIDUAL: Granley

HP&R 97414

STATUS: Active NOTICE DATE: Dec. 1974 COMPLETION DATE: June 1975 TOTAL FUNDS: \$200,000

ACKNOWLEDGMENT: Federal Highway Administration (214031356)

1R 085475

SAFETY ON CONSTRUCTION SITES

This project is attempting to obtain a better understanding of the factors influencing safety in building construction through investigations into the causes and costs of accidents, and to reduce accidents during construction operations by improving equipment and methods and providing design data that accurately reflect site conditions and methods. Research into scaffolding design and practice is proceeding and similar studies in relation to excavation and shoring methods will commence during the year. A start will also be made on an analysis of the cost of accidents to worker, contractor, client and the public purse. An assessment is being made of the hazards which occur on building sites through the use of electricity at mains voltage. A survey of crane accidents and usage will continue. /IRRD/IRF/

PERFORMING AGENCY: Building Research Establishment

INVESTIGATOR: Griffiths, TJ Eden, JF

SPONSORING AGENCY: Department of the Environment, England

STATUS: Active NOTICE DATE: Aug. 1975 START DATE: 1975

ACKNOWLEDGMENT: International Road Research Documentation, OECD (IRRD-603626), International Road Federation (IRF 1r(86))

1R 085590

NON-DESTRUCTIVE TEST METHODS IN CONSTRUCTION CONTROL

This project involves evaluating non-destructive apparatus and methods used in or available for construction practice, for precision, reliability and durability, and developing non-destructive methods for quality control, based on probabilistic principles. /IRF/

REFERENCES:

Precision and Reliability of a Nuclear Meter for Soil and Bituminous Mix Density Determination, Rule, B, Internal Report, Feb. 1975

Assessment of Capacitance Method for Bituminous Materials Density Determination, Rule, B, Internal Report, Nov. 1974

Development of Test Method for Density/Moisture Determination of Earthen Materials, Rule, B, Apr. 1975

PERFORMING AGENCY: Queensland Main Roads Department, Australia

INVESTIGATOR: Spies, R Rule, B

SPONSORING AGENCY: Queensland Main Roads Department, Australia

STATUS: Active NOTICE DATE: May 1975 START DATE: 1974 COMPLETION DATE: 1976 TOTAL FUNDS: \$18,900

ACKNOWLEDGMENT: International Road Federation (IRF 6(49))

1R 085647

THE INFLUENCE OF LAYOUT AND MANAGEMENT POLICIES ON THE PRODUCTIVITY OF MATERIAL FLOW PROCESSES ON CONSTRUCTION SITES

The objective of the study is to establish current practice at the planning levels and to develop improved practical techniques suitable for both head office and field agents. This will be achieved by site visits to dams, major road construction, tunnels, high rise buildings and other sites. /IRF/

PERFORMING AGENCY: New South Wales University, Australia, School of Civil Engineering, Dept of Engr Constr & Managemnt

INVESTIGATOR: Woodhead, RW Birdsall, GC

SPONSORING AGENCY: Australian Government

STATUS: Active NOTICE DATE: May 1975 START DATE: Feb. 1975 COMPLETION DATE: 1978

ACKNOWLEDGMENT: International Road Federation (IRF 10f(19))

1R 085786

BRIDGE CONSTRUCTION OPERATIONS

The aim is to investigate the characteristics of bridge building operations and the ways in which these can be improved by changes in procedures and processes associated with design, construction and contractual matters. The techniques adopted will include: (1) analysis of available data from past contracts; (2) analysis of contractors' planning, programming, accounting and performance; and (3) observation and measurement of site activities, including time-lapse photography. /IRRD/IRF/

PERFORMING AGENCY: Transport and Road Research Laboratory, Department of the Environment

INVESTIGATOR: Price, WI Hall, BO Johnston, RH

SPONSORING AGENCY: Department of the Environment, England

STATUS: Active NOTICE DATE: Apr. 1975 START DATE: Jan. 1974 COMPLETION DATE: 1980

ACKNOWLEDGMENT: International Road Research Documentation, OECD (IRRD-603091), International Road Federation (IRF 1a(449))

1R 085787

LOADING AND PERFORMANCE OF FALSEWORK IN BRIDGE CONSTRUCTION

Loads on falsework used for building bridges are being determined to improve safety during construction. The methods used are based on site measurements, backed by laboratory tests and theoretical analysis. Measurements have just been made on falsework used on successive spans of a motorway viaduct. Results are being analysed. /IRRD/IRF/

PERFORMING AGENCY: Transport and Road Research Laboratory, Department of the Environment

INVESTIGATOR: Price, WI Taylor, ME Price, AR

SPONSORING AGENCY: Department of the Environment, England

STATUS: Active NOTICE DATE: Apr. 1975 START DATE: Jan. 1974 COMPLETION DATE: 1980

ACKNOWLEDGMENT: International Road Research Documentation, OECD (IRRD-603092), International Road Federation (IRF 1a(450))

1R 086123

NETWORK ANALYSIS APPLIED TO CIVIL ENGINEERING SYSTEMS COMPUTER ANALYSIS-CIVIL ENGINEERING PROJECT COSTING TENDERING AND CONTRACTING

A set of computer based network/cost/decision models are being developed which will assist project management in the pre-tender, pre-contract and

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in-contract phases. It is hoped that the research will provide guidance to management on problems which are outside the scope of the existing commercially available programs. /IRRD/IRF/

PERFORMING AGENCY: Aston University, England, Department of Civil Engineering
INVESTIGATOR: Ford, LM

STATUS: Active NOTICE DATE: Jan. 1975 START DATE: 1971

ACKNOWLEDGMENT: International Road Research Documentation, OECD (IRRD-603262), International Road Federation (IRF 140(21))

1R 086273

COMPUTER ASSISTANCE IN PRODUCTION PLANNING FOR ROAD CONSTRUCTION

This project consists of coordinating existing computer programs and developing new ones that will be helpful in production planning for road construction. The computer programs are meant to include planning of costs, scheduling of time (pert), planning of needs for resources (machinery) and planning of costs/time. /IRRD/IRF/

PERFORMING AGENCY: Norwegian Institute of Technology, Foundation of Scientific and Industrial Research
INVESTIGATOR: Berger, A
SPONSORING AGENCY: Public Roads Administration, Norway

STATUS: Active NOTICE DATE: June 1975 START DATE: 1975 TOTAL FUNDS: \$21,200

ACKNOWLEDGMENT: International Road Research Documentation, OECD (IRRD-603498), International Road Federation (IRF 5b(6))

1R 086435

STRUCTURAL ENGINEERING STUDIES REGARDING A NEW SAFETY THEORY IN THE FIELD OF STEEL CONSTRUCTION

Many national and international proposals have been made which relate to the development of a generally valid theory of safety; these have mostly resulted from theoretical and probabilistic studies. These proposals have to be checked for their practical applicability, and if necessary modified to meet the requirements of a generally valid concept of safety. The work is to be carried out as follows; 1) inspection and evaluation of the literature; 2) statistical evaluation of the strength properties of structural steels st 37 and st 52; 3) design of a standard concept on a semi-probabilistic basis and checking this on actual building projects by means of comparative calculations; 4) study of steel supports subjected to compressive stress, with particular reference to imperfections; 5) studies of the literature on the statistical significance of test results; 6) tabulation of the results for specifications to support the work on standardization in steel engineering; 7) preparation of final report. /IRRD/IRF/

PERFORMING AGENCY: Technical University of Munich, West Germany, Department of Steel Structures
INVESTIGATOR: Petersen
SPONSORING AGENCY: Construction Techniques Institute

STATUS: Active NOTICE DATE: Mar. 1974 START DATE: Nov. 1973

ACKNOWLEDGMENT: International Road Research Documentation, OECD (IRF-700913), International Road Federation (IRF 28p(1))

1R 100140

DEVELOPMENT OF A LABORATORY DATA SYSTEM

THE OBJECTIVES ARE (1) TO UTILIZE ELECTRONIC DATA PROCESSING TO FACILITATE LABORATORY DATA HANDLING, (2) TO INCORPORATE STATISTICAL METHODS TO REDUCE TESTING FREQUENCY, (3) TO PROVIDE MANAGEMENT WITH RAPID AND ORGANIZED MATERIALS INFORMATION, AND, (4) TO EXPEDITE PROCESSING OF MATERIAL TESTING RESULTS FOR PROJECT PERSONNEL. TO ENHANCE JOB QUALITY CONTROL DURING CONSTRUCTION, A COMPUTER SYSTEM (USING UNIVAC 1106 HARDWARE) WILL BE DESIGNED FOR THE MATERIALS TESTING LABORATORY, INCORPORATING ALL PHASES OF MATERIAL TESTING.

REFERENCES:

Development of a Laboratory Data System--Report 1 Christman, R, Mar. 1973

Development of A Laboratory Data System--Report 2 Christman, R,

Nov. 1973

PERFORMING AGENCY: Connecticut Department of Transportation, Bureau of Highways, Study No. HPR-360

INVESTIGATOR: Christman, R Attardi, SC

SPONSORING AGENCY: Connecticut Department of Transportation, Bureau of Highways; Federal Highway Administration, Department of Transportation

RESPONSIBLE INDIVIDUAL: Runt

HP&R HPR-360

STATUS: Active NOTICE DATE: Sept. 1974 START DATE: Nov. 1972 COMPLETION DATE: May 1975 TOTAL FUNDS: \$65,500

ACKNOWLEDGMENT: Connecticut Department of Transportation, Federal Highway Administration (314012357)

1R 100227

OPTIMAL HIGHWAY INVESTMENTS BY DYNAMIC PROGRAMMING

THE OBJECTIVES ARE TO DEVELOP OR ADOPT APPROPRIATE DYNAMIC PROGRAMMING METHODS THAT WILL ASSIST IN THE ESTABLISHMENT OF OPTIMAL ANNUAL PRIORITIES FOR HIGHWAY CONSTRUCTION, MAINTENANCE, AND SAFETY IMPROVEMENT PROJECTS. THE TASK OF DECIDING WHICH PROJECTS TO IMPLEMENT UNDER A GIVEN BUDGET AND WHICH TO DEFER UNTIL LATER IS CENTRAL TO THE MANAGEMENT AND PLANNING OF HIGHWAY SYSTEMS. DYNAMIC PROGRAMMING TRANSFORMS A MULTISTAGE DECISION PROBLEM INTO A SERIES OF ONE-STAGE DECISIONS.

REFERENCES:

Optimal Highway Safety Improvement Investments by Dynamic Programming, Pigman, JG; Agent, KR; Mayes, JG; Zegeer, CV, Research Division, Kentucky DOT, Bureau of Highways, TRB Record, Aug. 1974

PERFORMING AGENCY: Kentucky Department of Transportation, Bureau of Highways, KYP-73-47

INVESTIGATOR: Pigman, JG

SPONSORING AGENCY: Kentucky Department of Transportation, Bureau of Highways

STATUS: Active NOTICE DATE: Feb. 1975 START DATE: Mar. 1973 COMPLETION DATE: June 1976 TOTAL FUNDS: \$21,700

ACKNOWLEDGMENT: Kentucky Department of Transportation

1R 101481

SURFACE TREATMENT STUDY

THE OBJECTIVES OF THIS RESEARCH STUDY ARE TO INVESTIGATE IN DEPTH ALL PHASES OF SURFACE TREATMENT WORK AND FROM THIS STUDY TO DEVELOP SPECIFICATIONS, QUALITY CONTROL PROCEDURES, CONSTRUCTION GUIDES, AND TRAINING AIDS. THIS WILL PROVIDE ENGINEERS WITH BACKGROUND INFORMATION AND SPECIFIC DETAILS OF REQUIREMENTS AND PROCEDURES NEEDED TO ATTAIN HIGH QUALITY RESULTS IN SURFACE TREATMENT WORK.

PERFORMING AGENCY: Georgia Department of Transportation, Study No 7301; Mills (William H) and Associates

INVESTIGATOR: Mills, WH Stapler, T Fowler, G Thornton, JB

SPONSORING AGENCY: Georgia Department of Transportation; Federal Highway Administration, Department of Transportation

RESPONSIBLE INDIVIDUAL: Lentz

HP&R 7301

STATUS: Active NOTICE DATE: Oct. 1974 START DATE: May 1974 COMPLETION DATE: Nov. 1975 TOTAL FUNDS: \$38,000

ACKNOWLEDGMENT: Georgia Department of Transportation, Federal Highway Administration (182014351)

1R 101592

PAVEMENT MANAGEMENT STUDY

THE INTERRELATIONSHIPS BETWEEN THE PLANNING, DESIGN, CONSTRUCTION AND MAINTENANCE ASPECTS OF PAVEMENTS HAVE NOT BEEN WELL DEFINED IN THE PAST. IT IS HOPED THAT A GUIDE WILL BE PRODUCED WHICH RECOG-

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NIZES AND IDENTIFIES THESE INTERRELATIONSHIPS SO THAT THE MOST EFFECTIVE USE CAN BE MADE OF FUNDS ALLOCATED TO PAVEMENTS. /RTAC/

PERFORMING AGENCY: Roads and Transportation Association of Canada
INVESTIGATOR: Tessier, GR Hass, RCG
SPONSORING AGENCY: Roads and Transportation Association of Canada

STATUS: Active NOTICE DATE: Oct. 1975 COMPLETION DATE: 1976

ACKNOWLEDGMENT: Roads and Transportation Association of Canada

1R 102037

EVALUATION OF BITUMINOUS MIXES IN PAVEMENT STRUCTURES

THE PRIMARY OBJECTIVE IS THE EVALUATION OF ASPHALT CONCRETE SURFACE MOISTURE AND CORRELATION WITH SPECIFIC DISTRESS CONDITION. SECONDARY OBJECTIVES INCLUDE (1) THE REVIEW OF PRESENT ASPHALT MIX DESIGN METHODS, MATERIAL SPECIFICATION, CONSTRUCTION SPECIFICATION AND TECHNIQUES AND MAINTENANCE METHODS FOR POSSIBLE REVISION TO ALLEVIATE THESE PAVEMENT DISTRESS PROBLEMS; AND (2) RELATION OF SUCH DISTRESS CONDITION FACTORS PERTAINING TO STRUCTURE DESIGN, I. E., LAYER QUALITY AND THICKNESS, CONDITION OF LOADING, ETC. FOR ADDITIONAL OR SUBSEQUENT INVESTIGATION.

PERFORMING AGENCY: Oklahoma State University, /School of Civil Eng, 72-03-3

INVESTIGATOR: Manke, P

SPONSORING AGENCY: Oklahoma Department of Highways, 72-03-3

ACKNOWLEDGMENT: Oklahoma State University

1R 103634

IMPLEMENTATION OF STATISTICAL SPECIFICATIONS FOR BITUMINOUS CONCRETE

THE OVERALL PERFORMANCE OF THE STATISTICAL SPECIFICATION, IN PARTICULAR THE QUANTITATIVE VALUES OF THE VARIOUS PARAMETERS AND SUB LOTS USED IN SETTING UP THE SPECIFICATIONS, IS BEING ASSESSED. TRIAL SPECIFICATIONS HAVE BEEN DEVELOPED AND ARE BEING IMPLEMENTED ON A TRIAL BASIS ON FOUR CONSTRUCTION PROJECTS: TWO OVERLAYS AND TWO NEW CONSTRUCTION PROJECTS.

REFERENCES:

Implementation of Statistical Specifications for Control of Bituminous Concrete; Report I, Sternberg, FE, Feb. 1974

PERFORMING AGENCY: Connecticut Department of Transportation, Bureau of Highways, Study No. 376

INVESTIGATOR: Sternberg, FE

SPONSORING AGENCY: Connecticut Department of Transportation, Bureau of Highways; Federal Highway Administration, Department of Transportation

RESPONSIBLE INDIVIDUAL: Granley, E

HP&R HPR-376

STATUS: Active NOTICE DATE: Sept. 1974 START DATE: July 1973 COMPLETION DATE: June 1975 TOTAL FUNDS: \$40,000

ACKNOWLEDGMENT: Connecticut Department of Transportation, Federal Highway Administration (212073356)

1R 104699

METHODS FOR SAMPLING AND CONTROL OF ROAD CONSTRUCTION

THE NIRR IS AIMING AT INTRODUCING ITS SCHEME FOR QUALITY CONTROL INTO GENERAL ROAD PRACTICE IN SOUTH AFRICA. THE FEASIBILITY OF USING THE SCHEME IN PRACTICAL ROAD CONSTRUCTION WILL BE TESTED. ASSISTANCE IS BEING OFFERED TO ROAD AUTHORITIES IN THE DRAFTING OF SPECIFICATIONS IN ACCORDANCE WITH THE SCHEME. DATA WILL BE COLLECTED ON COSTS AND ON THE VARIABILITY OF PARAMETER, WHICH CAN BE USED TO

IMPROVE THE EFFECTIVENESS OF THE PRACTICAL USE OF THIS QUALITY CONTROL SCHEME. /IRF/

PERFORMING AGENCY: Nat Inst Road Research /S Africa/, 9431/4541; Cncl Scient & Indus Res /S Africa/
INVESTIGATOR: Kuhn, SH Walker, RN
SPONSORING AGENCY: Nat Inst Road Research /S Africa/, 9431/4541

STATUS: Active NOTICE DATE: Jan. 1974 START DATE: 1970 COMPLETION DATE: 1975

ACKNOWLEDGMENT: International Road Federation IRF 1A(66), 2R33600799

1R 105748

DETERMINE FEASIBLE NOISE LIMITS FOR CONSTRUCTION AND MAINTENANCE EQUIPMENT AND STUDY NOISE REDUCTION METHODS

THE OBJECTIVES OF THIS RESEARCH ARE TO DEVELOP TEST METHODS AND SYSTEMS FOR REDUCING THE NOISE EMANATIONS FROM EXISTING TYPES OF CONSTRUCTION EQUIPMENT AND ROADWAY EQUIPMENT. THE PROGRAM WILL STUDY ALL TYPES OF EQUIPMENT POWERED BY INTERNAL COMBUSTION ENGINES. DYNAMOMETER TESTS WILL BE FAVORED ON COMPATIBLE EQUIPMENT (WITH DRIVE WHEELS) AND FIELD TESTS WILL BE EMPLOYED FOR NON-COMPATIBLE EQUIPMENT.

PERFORMING AGENCY: California Department of Transportation, Division of Highways, Transportation Laboratory Branch, Study No. 19-954110 19-657083

INVESTIGATOR: Shirley, EC Bourget, L

SPONSORING AGENCY: California Department of Transportation, Division of Highways; Federal Highway Administration, Department of Transportation

RESPONSIBLE INDIVIDUAL: Jongedyk

HP&R A-8-08

STATUS: Active NOTICE DATE: Oct. 1974 START DATE: Dec. 1971 COMPLETION DATE: June 1976 TOTAL FUNDS: \$80,000

ACKNOWLEDGMENT: California Department of Transportation, Federal Highway Administration (319211352)

1R 109504

DYNAMIC APPROACH TO EMBANKMENT CONSTRUCTION CONTROL

THIS PROJECT WILL DEVELOP A PROCEDURE TO EVALUATE AND DIRECTLY CONTROL THE QUALITY OF COMPACTED FILL IN TERMS OF ITS ELASTIC PROPERTIES. THIS WILL MAKE IT POSSIBLE TO USE THE FINITE ELEMENT METHOD FOR DESIGN AND ANALYSIS OF HIGHWAY EMBANKMENTS UNDER EITHER STATIC OR DYNAMIC LOADINGS. RESONANT-COLUMN TESTS, CYCLIC STRESS OR STRAIN CONTROL TRIAXIAL TESTS WILL BE EMPLOYED TO DETERMINE THE ELASTIC PROPERTIES OF SOIL IN THE LABORATORY. IMPACT-TYPE VIBRATION AND STEADY-STATE VIBRATION TESTS WILL BE CONDUCTED IN THE FIELD TO DETERMINE THE IN-SITU ELASTIC PROPERTIES OF EMBANKMENT MATERIALS.

PERFORMING AGENCY: California Department of Transportation, Division of Highways, Transportation Laboratory Branch, Study No 19-632304
INVESTIGATOR: Forsyth, RA Hannon, JB Chang, JC

SPONSORING AGENCY: California Department of Transportation, Division of Highways; Federal Highway Administration, Department of Transportation

RESPONSIBLE INDIVIDUAL: Sallberg

HP&R F-4-27

STATUS: Active NOTICE DATE: Oct. 1974 START DATE: Aug. 1972 COMPLETION DATE: June 1976 TOTAL FUNDS: \$136,100

ACKNOWLEDGMENT: California Department of Transportation, Federal Highway Administration (224302353)

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IR 109551

DESIGN AND CONSTRUCTION GUIDELINES FOR SHALE EMBANKMENTS

The objectives of the shale study include: A survey of current experience to evaluate existing provisional embankment construction guidelines. A development of the laboratory testing techniques required to define design and construction parameters. A set of procedures for subsurface exploration of shale such that it will be possible to anticipate possible problems at the time of the evaluation of the subsurface exploration data. The findings of this study should have immediate application in the form of improved design and construction guidelines for embankments built of shales. Specifically, there will be recommendations for conducting the subsurface exploration in shales which are potentially embankment materials. Simple index tests conducted on extracted shale samples so obtained will permit classification of the shale and reasonable prediction of its compacted behavior. To accomplish the latter goal, it will be necessary to develop compaction and degradability measures, as well as strengths or strength parameters, for the compacted shales.

PERFORMING AGENCY: Purdue and Indiana State Highway Commission JHRP, Joint Highway Research Project, Study No. C-36-5L
INVESTIGATOR: Wood, LE Lovell, CW, Jr Sisiliano, WJ
SPONSORING AGENCY: Indiana State Highway Commission; Purdue University; Federal Highway Administration, Department of Transportation
RESPONSIBLE INDIVIDUAL: Fohs

HP&R 394

STATUS: Active NOTICE DATE: Dec. 1974 COMPLETION DATE: Oct. 1976 TOTAL FUNDS: \$52,000

ACKNOWLEDGMENT: Purdue and Indiana State Highway Commission JHRP, Federal Highway Administration (240013351)

IR 115111

PRODUCTIVITY EVALUATION IN EARTHWORKS

Productivity evaluation is made of outputs and costs through field measurements in each phase of earthworks. A checking method is presented to qualify time and volume of operations: hauling, spreading, compaction, with conventional equipment. /IRF/

PERFORMING AGENCY: Federal District Highway Department-Tenth, Brazil, National Highway Department
INVESTIGATOR: Brugnara, CM
SPONSORING AGENCY: National Highway Department, Brazil

IB-House

STATUS: Active NOTICE DATE: Sept. 1974 START DATE: Jan. 1973

ACKNOWLEDGMENT: International Road Federation (IRF 21(1))

IR 115254

PLANNING AND CONTROL OF CONSTRUCTION PROCESS

Based on many observations and studies for operations and circumstances in some constructions, a planning and controlling system of the project with a computer model that simulates the construction process, is developed. This system gives the optimum decision in planning and controlling of the construction process. /IRRD-IRF/

PERFORMING AGENCY: Public Works Research Institute, Japan, Ministry of Construction, Chiba Branch
INVESTIGATOR: Chida, S Kumagai, K Aida, M
SPONSORING AGENCY: Ministry of Construction, Japan

IA

STATUS: Active NOTICE DATE: Sept. 1974 START DATE: Apr. 1972 COMPLETION DATE: Mar. 1977

ACKNOWLEDGMENT: International Road Federation (IRF 1B(155)), International Road Research Documentation. OECD

IR 115257

SAFETY IN CONSTRUCTION MACHINERY

The purpose of this study is to investigate the security of construction machineries. Operator-protecting equipments are being evaluated in field tests of different construction machines. /IRRD-IRF/

PERFORMING AGENCY: Public Works Research Institute, Japan, Ministry of Construction, Chiba Branch
INVESTIGATOR: Senzawa, T Nakano, S
SPONSORING AGENCY: Ministry of Construction, Japan

IA

STATUS: Active NOTICE DATE: Sept. 1974 START DATE: Apr. 1974 COMPLETION DATE: Mar. 1977 TOTAL FUNDS: \$65,000

ACKNOWLEDGMENT: International Road Federation (IRF 1B(158)), International Road Research Documentation. OECD

IR 115490

QUALITY CONTROL OF DENSITY AND MOISTURE CONTENT USING NUCLEAR METERS

Investigations are conducted into the use of Nuclear Density/Moisture Gauges as a means of quality control for roadworks. /IRF/

REFERENCES:

SIX MONTH'S USE OF A NUCLEAR MOISTURE/DENSITY GAUGE Hamory, G, Main Roads Department, Western Australia, 73/21, Materials Engr Sect RP, 1973

PERFORMING AGENCY: Western Australia Main Roads Department, Australia
INVESTIGATOR: Goodram, LW Hamory, G Ladner, PA
SPONSORING AGENCY: Western Australia Main Roads Department, Australia

STATUS: Active NOTICE DATE: Oct. 1974 START DATE: 1972

ACKNOWLEDGMENT: International Road Federation (IRF 9(20))

IR 115500

FIELD STUDIES OF PAVEMENT DEFORMATION AND DEFLECTION

As part of a total systems approach to pavement design and construction, field trials involving the installation of deformation gauges in actual stabilized pavement structures subject to substantial traffic duty (1000 v.p.d.) have been initiated and are still being extended. /IRF/

PERFORMING AGENCY: New South Wales University, Australia, School of Civil Engineering
INVESTIGATOR: Lee, IK Ingles, OG
SPONSORING AGENCY: New South Wales University, Australia

STATUS: Active NOTICE DATE: Oct. 1974 START DATE: 1970 COMPLETION DATE: 1977

ACKNOWLEDGMENT: International Road Federation (IRF 10F(3))

IR 115837

DEVELOPMENT OF CONSTRUCTION TECHNIQUES AND EQUIPMENT COMPATIBLE WITH OPERATING REQUIREMENTS ON HIGH SPEED HIGHWAYS

The speed and density of traffic on high-speed roadways, especially limited-access urban freeways, make standard construction operations extremely difficult and dangerous to the worker as well as the motorist. Closure of one or more lanes for repairs can be intolerable for proper operations. Construction equipment and procedures and barriers or protective devices, may be inadequate for full protection of workmen as they may prove to be safety hazards for the users of the facilities. As a result, some efficient compromises must be made to permit the construction necessary to provide a serviceable highway while minimizing the interruption or inconvenience of traffic. /IRF/

PERFORMING AGENCY: Department of Public Highways, Philippines, Construction Division
INVESTIGATOR: Alfonso, MS Concepcion, SH Bandelaria, AE Roa, MR

STATUS: Active NOTICE DATE: Nov. 1974

ACKNOWLEDGMENT: International Road Federation (IRF 1E(1))

1R SYSTEM CONSTRUCTION, MANAGEMENT & QUALITY CONTROL

1R 115945

FACTORS THAT INFLUENCE SUCCESSFUL CONSTRUCTION PROJECT MANAGEMENT

Description: One reason that a construction organization is unique and different from other industries is that project management is based upon solving a continuous stream of crisis situations. Therefore, little effort is directed toward repetitious management decisions which become standard operating procedures in most businesses. This research will examine construction project management by interviewing successful project managers, superintendents, general contractor and subcontractor foremen, and to a lesser degree, upper level management in the home office. Then a comparison will be made between interview data and research findings of

management techniques employed in other organizations to improve the effectiveness of construction project managers.

PERFORMING AGENCY: Texas University, Austin, School of Engineering, Dept of Architectural Engineering

INVESTIGATOR: Borcharding, JD Lott, W

SPONSORING AGENCY: Texas University, Austin

STATUS: Active NOTICE DATE: Dec. 1974 START DATE: July 1973

ACKNOWLEDGMENT: Science Information Exchange (NTX 264)

2R 000061

TEST FIELD MEASUREMENT SYSTEM FOR TUNNEL CONSTRUCTION

THE PURPOSE IS TO (1) RESEARCH AND DEMONSTRATE THE CAPABILITIES OF FIELD-INSTRUMENTATION SYSTEMS IN DEEP, BRACED CUTS AND TUNNEL STRUCTURES OF THE TYPE COMMONLY USED IN SUBWAY CONSTRUCTION, AND (2) DEVELOP DESIGN APPROACHES AND PRINCIPLES WHICH WILL ENABLE ENGINEERS ON LATER PROJECTS TO DESIGN MORE ECONOMICAL AND SAFE TUNNEL STRUCTURES AND SYSTEMS OF ENACTING AND BRACING FOR DEEP CUTS. THE PROJECT INVOLVES THE INSTALLATION OF FIELD INSTRUMENTATION SYSTEMS ON SHEETING AND BRACING SYSTEMS IN CUT-AND-COVER EXCAVATION AND TUNNEL CONSTRUCTION FOR AN NBTA SUBWAY EXTENSION. THE INSTRUMENTS MEASURE PORE-WATER PRESSURE, EARTH PRESSURE, AND SOIL DEFORMATIONS, PROVIDING DATA ON THE BEHAVIOR OF ORGANIC SILTS AND SHEETING, AND THE BRACING SYSTEM USED DURING SUBWAY CONSTRUCTION.

PERFORMING AGENCY: Massachusetts Bay Transportation Authority, 3.3
INVESTIGATOR: Silien
SPONSORING AGENCY: Urban Mass Transportation Administration, Department of Transportation

STATUS: Active NOTICE DATE: Mar. 1975 START DATE: Nov. 1966 TOTAL FUNDS: \$347,400

ACKNOWLEDGMENT: Massachusetts Bay Transportation Authority

2R 020892

PROCEDURAL RESEARCH FOR REPORTING OF MATERIALS TEST DATA USING COMPUTER SYSTEMS

AN ATTEMPT IS MADE TO REMEDY THE PRESENT BURDENSOME METHOD OF MANUALLY REPORTING AND FILING CONSTRUCTION MATERIALS TEST DATA BY USING COMPUTERIZED STORAGE RETRIEVAL TECHNIQUES. A NUMBER OF METHODS OF COLLECTING THE DATA FOR EASY REPORTING AND STORAGE WILL BE TRIED INCLUDING: PREPARED CODED FORMS AND REMOTE TERMINALS. THE NEW SYSTEM WILL PROVIDE A MORE MEANINGFUL LIBRARY OF INFORMATION ON VARIOUS FACETS OF CONSTRUCTION DATA FOR SUBSEQUENT STATISTICAL QUALITY CONTROL EVALUATION. REFERENCES:

Computerization of Material Test Data Reporting System Shah, SC; Smith, JT; Hirschmann, JJ, Louisiana Department of Highways, Interim Report, Sept. 1973

PERFORMING AGENCY: Louisiana Department of Highways, Study No. 70-1G

INVESTIGATOR: Shah, SC Hirschmann, JJ

SPONSORING AGENCY: Louisiana Department of Highways; Federal Highway Administration, Department of Transportation

HP&R 70-1G

STATUS: Active NOTICE DATE: Nov. 1974 START DATE: July 1970 COMPLETION DATE: June 1975 TOTAL FUNDS: \$187,332

ACKNOWLEDGMENT: Louisiana Department of Highways

2R 021088

STRENGTH COEFFICIENT OF MATERIALS

THE COEFFICIENTS ESTABLISHED AT THE AASHO TEST ROAD WERE DETERMINED SPECIFICALLY FOR THE VARIOUS COMPONENT MATERIALS USED IN THE CONSTRUCTION OF THE TEST ROAD. THIS RESEARCH IS INTENDED TO DETERMINE THE APPLICABILITY OF THESE COEFFICIENTS TO SEVERAL TYPICAL HIGHWAY MATERIALS USED IN THE CONSTRUCTION OF THE HIGHWAYS IN SOUTH DAKOTA AND TO DETERMINE COEFFICIENTS WHICH ARE REALISTIC FOR THE VARIOUS MATERIALS.

PERFORMING AGENCY: South Dakota Department of Transportation, Study No. 613(70)

INVESTIGATOR: Crawford, RA

SPONSORING AGENCY: South Dakota Department of Transportation; Federal Highway Administration, Department of Transportation

HP&R 613(70)

STATUS: Completed NOTICE DATE: Apr. 1975 START DATE: July 1970 COMPLETION DATE: Sept. 1974 TOTAL FUNDS: \$43,075

ACKNOWLEDGMENT: South Dakota Department of Transportation HRIS 31 022757, 2R22214088

2R 021389

LONG SPAN BRIDGE DEFLECTION STUDY

FIELD DEFLECTION DATA ARE BEING ACCUMULATED ON SEVERAL SELECTED LONG SPAN BRIDGES. REDUCTION OF DATA AND STATISTICAL ANALYSIS WILL BE MADE AND CHARTS OR GRAPHS WILL BE PREPARED WHICH WILL AID BRIDGE DESIGNERS IN PREDICTING SHORT AND LONG TERM DEFLECTIONS AS INFLUENCED BY CONSTRUCTION METHODS, SEQUENCE OF CONSTRUCTION, AND CONSTRUCTION MATERIALS.

PERFORMING AGENCY: California Department of Transportation, Division of Highways, Office of Structures, Study No. 14-624122

INVESTIGATOR: Bezouska, TJ Mancarti, GD Nelson, BH

SPONSORING AGENCY: California Department of Transportation, Division of Highways; Federal Highway Administration, Department of Transportation

RESPONSIBLE INDIVIDUAL: Ballinger

HP&R D-4-043

STATUS: Active NOTICE DATE: Oct. 1974 START DATE: 1970 COMPLETION DATE: June 1978 TOTAL FUNDS: \$70,000

ACKNOWLEDGMENT: California Department of Transportation, Federal Highway Administration (324520353)

2R 048913

INNOVATIVE MATERIALS AND TECHNIQUES FOR CONSTRUCTION AND MAINTENANCE TO INSURE RESISTANT SURFACES

The project is designed to locate, classify, and field test evaluate the various innovative skid resistant treatments currently in use in the State of California and adjacent states for their potential to provide and reasonable retain adequate levels of friction and texture and also to field-test evaluate selected recommended innovative materials systems developed under NCHRP project 1-12(3).

PERFORMING AGENCY: California Department of Transportation, Division of Highways

INVESTIGATOR: Doty

SPONSORING AGENCY: Federal Highway Administration, Department of Transportation, RFP-303 PR# 41-22-0271

RESPONSIBLE INDIVIDUAL: Smith, R Gale, HG (Tel 202-426-0743)

Contract DOT-FH-11-8480 (CPFF)

STATUS: Active NOTICE DATE: Oct. 1975 START DATE: June 1974 TOTAL FUNDS: \$200,000

ACKNOWLEDGMENT: Federal Highway Administration (170024351)

2R 055848

PRIMARY REFERENCE SURFACES FOR THE FHWA FIELD TEST AND EVALUATION CENTERS

The contractor shall construct 10 experimental test surfaces at a site selected by the contracting officer at the Research Center of the Texas Transportation Institute near College Station, Texas. Each test surface shall be 100 feet long and 7 and one half feet wide. The cover aggregates shall be selected and furnished by the contracting officer. The purpose of these experimental surfaces is to evaluate the construction process, the levels of skid resistance and skid number-speed gradient achieved.

PERFORMING AGENCY: Adhesive Engineering Company

SPONSORING AGENCY: Federal Highway Administration, Department of Transportation

RESPONSIBLE INDIVIDUAL: Gale, HG (Tel 202-4260743)

Contract DOT-FH-11-8308

STATUS: Active NOTICE DATE: Oct. 1975 START DATE: Aug. 1974 TOTAL FUNDS: \$180,000

ACKNOWLEDGMENT: Federal Highway Administration (RFP-91)

2R 082119

UTILIZATION OF WASTE BOILER ASH IN HIGHWAY CONSTRUCTION IN ARIZONA

The project will establish effective design criteria for the utilization of fly ash from the Colla, Navajo, and Four Corners Power Plants as highway construction materials.

PERFORMING AGENCY: Engineers Testing Laboratories
 INVESTIGATOR: Rosner
 SPONSORING AGENCY: Arizona Department of Transportation, Highway Division; Federal Highway Administration, Department of Transportation
 RESPONSIBLE INDIVIDUAL: Dikeou

HP&R PR-94

STATUS: Active NOTICE DATE: Dec. 1974 COMPLETION DATE: June 1976 TOTAL FUNDS: \$123,000

ACKNOWLEDGMENT: Federal Highway Administration (225014351)

2R 082196

ANALYSIS OF FRESH CONCRETE

The objective of the research is to develop practical methods of measuring with sufficient accuracy the critical parameters of fresh concrete--cement content, water content, and entrained air content. These methods will be sufficiently simple and rapid to permit batch by batch testing of concrete on a construction site before it is placed and has set. It is anticipated that these methods would be put in standard form and incorporated in the procedures and specifications of organizations undertaking concrete construction.

PERFORMING AGENCY: Purdue and Indiana State Highway Commission JHRP, Joint Highway Research Project, C-36-19E
 INVESTIGATOR: Winslow, DN Dolch, WL
 SPONSORING AGENCY: Indiana State Highway Commission; Federal Highway Administration, Department of Transportation

HP&R

STATUS: Active NOTICE DATE: Dec. 1974 START DATE: May 1974 COMPLETION DATE: 1978 TOTAL FUNDS: \$79,500

ACKNOWLEDGMENT: Purdue and Indiana State Highway Commission JHRP

2R 082296

ASPHALT RECLAIMER EVALUATION

A new construction method whereby old, abandoned, or worn asphaltic concrete pavements can be removed, recycled, and relaid as new asphaltic composition will be developed. The objective of the project is to determine, evaluate, and demonstrate the merits of an alternate method of highway construction or reconstruction using recycled asphaltic materials and to establish their behavior under actual highway service conditions. The recycling process and equipment were developed by private enterprise.

PERFORMING AGENCY: Nevada Department of Highways
 INVESTIGATOR: Gregory, G
 SPONSORING AGENCY: Federal Highway Administration, Department of Transportation

Contract DOT-FH-11-8173

STATUS: Active NOTICE DATE: Nov. 1974 START DATE: Aug. 1974 COMPLETION DATE: Sept. 1975 TOTAL FUNDS: \$30,000

ACKNOWLEDGMENT: Nevada Department of Highways

2R 082318

PERMEABILITY OF NEW JERSEY SOIL AGGREGATE BASES

Determination will be made of the permeability and load-bearing values for soil aggregate base and subbase materials that are used in New Jersey highways. The information gathered will be used to review the adequacy of New Jersey's gradation based acceptance criteria for base and subbase materials. If deficiencies are identified modifications to these criteria will be formulated and new base and subbase usage practices will be proposed.

PERFORMING AGENCY: New Jersey Department of Transportation, Study No. 7775
 INVESTIGATOR: Cosaboom, B Kozlov, G
 SPONSORING AGENCY: New Jersey Department of Transportation; Federal Highway Administration, Department of Transportation
 RESPONSIBLE INDIVIDUAL: Ring

HP&R 7775

STATUS: Active NOTICE DATE: Dec. 1974 START DATE: Sept. 1974 COMPLETION DATE: Sept. 1977 TOTAL FUNDS: \$85,866

ACKNOWLEDGMENT: New Jersey Department of Transportation, Federal Highway Administration (268404353)

2R 082554

ENGINEERING-ECONOMY AND ENERGY CONSIDERATIONS IN DESIGN, CONSTRUCTION AND MATERIALS

The objective is to evaluate the trade-offs or consequences (including as appropriate; cost effectiveness, cost benefits, effectiveness of material utilization, energy-effectiveness and other factors) of alternative practices, specifications, criteria, and procedures used in highway design and construction.

PERFORMING AGENCY: Texas Transportation Institute, Texas A&M University, 2-9-74-214

INVESTIGATOR: McFarland, WF

SPONSORING AGENCY: Texas State Department of Highways & Public Transp

STATUS: Active NOTICE DATE: Jan. 1975 START DATE: June 1974 COMPLETION DATE: Aug. 1975 TOTAL FUNDS: \$80,000

ACKNOWLEDGMENT: Texas Transportation Institute

2R 082601

TECHNOLOGY FOR USING SULFATE WASTE IN ROAD CONSTRUCTION

The Gillette Research Institute and the University of Virginia (as a subcontractor) are cooperating in a study of the chemical and engineering properties of 1) lime fly ash-waste sulfate mixtures and 2) lime-fly ash-waste sulfate-soil and sewage sludge mixtures for use in highways as fill, subgrade, base course and aggregates for asphalt and Portland Cement Concrete.

REFERENCES:

PERFORMING AGENCY: Virginia University, Department of Civil Engineering

INVESTIGATOR: Larew, HG McCormick, FC

SPONSORING AGENCY: Gillette Research Institute; Federal Highway Administration, Department of Transportation

Contract DOT-FH-11-8122

STATUS: Active NOTICE DATE: Oct. 1974 START DATE: Aug. 1973 COMPLETION DATE: July 1975 TOTAL FUNDS: \$74,307

ACKNOWLEDGMENT: Virginia University

2R 083093

INVESTIGATION OF NEW MATERIALS, TESTING METHODS, AND APPARATUS

The objective of this is to determine the characteristics and behavior of new materials for use in concrete including expansive cements, regulated-set cements, sub-bituminous fly ash, and various other new and modified admixtures, to evaluate their usefulness in Corps of Engineers Civil Works Construction and to investigate new methods of testing and apparatus for testing to determine whether such methods or modifications should be standardized for use by the Corps of Engineers. Samples of expansive cements, regulated-set cements, new and improved admixtures, and sub-bituminous fly ash will be obtained from as many sources as necessary to be representative. The chemical and physical properties of these materials will be determined. The concrete-making properties of the cements and cement-admixture systems will be studied. The parameters to be considered will include expansive potential, proportioning, durability, placing, and curing. Acceptance criteria will be established. The sub-bituminous fly ash will be evaluated as a cement-replacement material. Heat of hydration of fly ash-cement blends will be determined. The effects of sub-bituminous fly ash on alkali-silica reaction and alkali-carbonate reaction will be determined. Acceptance criteria will be established and published. Improved admixtures for use in concrete will continue to be evaluated for use in Corps of Engineers Civil Works construction as they become available. The investigation and evaluation of the wide variety of testing methods, apparatus, and techniques applicable to concrete or related construction that are constantly being developed in both the United States and abroad will continue. Each year some of the tasks conducted under this item are completed, specifications

and test methods are published, and other studies are initiated as new methods and new apparatus become available.

PERFORMING AGENCY: Department of the Army, Concrete Laboratory
 INVESTIGATOR: Mather, B Hoff, G
 SPONSORING AGENCY: Army Corps of Engineers, Department of the Army

STATUS: Active NOTICE DATE: Dec. 1974 START DATE: July 1973

ACKNOWLEDGMENT: Science Information Exchange (ZTK 174 1)

2R 083104 EXPLORATION FOR CONSTRUCTION MATERIALS BY REMOTE SENSING

The objective is to develop techniques that can be applied at Corps Division and District levels for the utilization of remote imageries to identify, delineate, and evaluate sources of engineering construction materials in areas of current or proposed CE project activity. Initial step will involve the selection of study areas. A remote sensing package of optimum configuration for the recognition and delineation of pertinent, potentially exploitable landforms will be generated. Such a package should include radar, thermal infrared, and multiband imageries and panchromatic, color, and color infrared photographs. Governmental agencies such as NASA, USAF, and Army units with remote sensing capabilities will be contacted to fly these coverages at no cost to the project.

PERFORMING AGENCY: Waterways Experiment Station, Army Corps of Engineers
 INVESTIGATOR: Dornbusch, WK
 SPONSORING AGENCY: Army Corps of Engineers, Department of the Army, 31215

STATUS: Active NOTICE DATE: Dec. 1974 START DATE: July 1973

ACKNOWLEDGMENT: Science Information Exchange (ZTK 294)

2R 085341 APPLICATION OF NEW MATERIALS TO CONCRETE STRUCTURES

New materials such as expansive concrete and plastic concrete were investigated in application to concrete structures. ;IRRD;IRF;

PERFORMING AGENCY: Tokyo University, Japan
 INVESTIGATOR: Higuchi, Y Kobayashi, K Okamura, H
 SPONSORING AGENCY: Ministry of Education, Japan

STATUS: Active NOTICE DATE: 1975 START DATE: 1972

ACKNOWLEDGMENT: International Road Research Documentation, OECD, International Road Federation (IRF 23a(15))

2R 085782 ARID AREA CONSTRUCTION TECHNIQUES

Techniques are to be developed for compacting materials in their dry state and the properties of materials which have been compacted in this condition are to be studied. The work is in the planning phase. /IRRD/IRF/

PERFORMING AGENCY: Transport and Road Research Laboratory, Department of the Environment
 INVESTIGATOR: Bofinger, HE Russell, RB Buchan, EB
 SPONSORING AGENCY: Transport and Road Research Laboratory, Department of the Environment

STATUS: Programmed NOTICE DATE: Apr. 1975 START DATE: 1975 COMPLETION DATE: 1978

ACKNOWLEDGMENT: International Road Research Documentation, OECD (IRRD-603085), International Road Federation (IRF 1a(445))

2R 086386 LONG-TERM BEHAVIOR OF EPOXY RESINS IN CONCRETE CONSTRUCTION

Systematic studies of the long-term behavior of epoxy resins, in particular their strength, weather resistance and deformation behavior (creep), are to be carried out. The shear strength of glued connections subjected to fatigue loading under various environmental conditions is to be determined, as is the strength of glued connections under combined compression and shear stress

under various conditions and with varying types of load. Preliminary tests will be done on the long-term behavior of epoxy resins as epoxy resin concrete and structural epoxy resin mortar, surfacing mortar and grouting resins, and short-term testing procedures which permit a qualitative statement of the long-term behavior of epoxy resins will be developed. ;IRRD;IRF;

PERFORMING AGENCY: Technical University of Aachen, West Germany, Building Research Institute
 INVESTIGATOR: Wesche, K
 SPONSORING AGENCY: Federal Ministry of Planning and Housing, W Ger

STATUS: Active NOTICE DATE: July 1974 START DATE: Dec. 1973

ACKNOWLEDGMENT: International Road Research Documentation, OECD (IRRD-700919), International Road Federation (IRF 16a(13))

2R 086435 STRUCTURAL ENGINEERING STUDIES REGARDING A NEW SAFETY THEORY IN THE FIELD OF STEEL CONSTRUCTION

Many national and international proposals have been made which relate to the development of a generally valid theory of safety; these have mostly resulted from theoretical and probabilistic studies. These proposals have to be checked for their practical applicability, and if necessary modified to meet the requirements of a generally valid concept of safety. The work is to be carried out as follows; 1) inspection and evaluation of the literature; 2) statistical evaluation of the strength properties of structural steels st 37 and st 52; 3) design of a standard concept on a semi-probabilistic basis and checking this on actual building projects by means of comparative calculations; 4) study of steel supports subjected to compressive stress, with particular reference to imperfections; 5) studies of the literature on the statistical significance of test results; 6) tabulation of the results for specifications to support the work on standardization in steel engineering; 7) preparation of final report. /IRRD/IRF/

PERFORMING AGENCY: Technical University of Munich, West Germany, Department of Steel Structures
 INVESTIGATOR: Petersen
 SPONSORING AGENCY: Construction Techniques Institute

STATUS: Active NOTICE DATE: Mar. 1974 START DATE: Nov. 1973

ACKNOWLEDGMENT: International Road Research Documentation, OECD (IRF-700913), International Road Federation (IRF 28p(1))

2R 086440 LONG-TERM BEHAVIOUR OF EPOXY-RESINS IN CONCRETE CONSTRUCTION

The research project is being carried out jointly with the Institute of Construction Research in Aachen, and is concerned with the continuance of systematic studies of the long-term behavior of epoxy resin adhesive mortars for concrete, and structural synthetic epoxy resin mortars and concrete. Preliminary tests are being financed by the German Concrete Association. The studies are being undertaken with a resin of known mix design which can be supplied by various manufacturers. This means that the applicability of the results of the tests is independent of special manufacturing methods. Long-term fatigue tests lasting up to 16 years are being carried out with cement mortar prisms which are being exposed to four different environmental conditions (normal climate, heat, water, and open-air weathering). Other long-term studies on synthetic resin mortars are anticipated; these should provide data on bearing capacity and deformation behaviour in relation to temperature and the duration of temperature effects. Further studies are to be made with methods by means of which the critical temperature of the synthetic resin aggregate system can be determined. /IRRD/IRF/

PERFORMING AGENCY: Stuttgart University, West Germany, Official Research and Materials Testing Inst. for Constr
 SPONSORING AGENCY: Federal Ministry of Planning and Housing, W Ger

STATUS: Active NOTICE DATE: July 1974 START DATE: Dec. 1973 COMPLETION DATE: 1989

ACKNOWLEDGMENT: International Road Research Documentation, OECD (IRRD-700917), International Road Federation (IRF 33e(21))

2R 086637

THE USE OF WASTE PRODUCTS AND BY-PRODUCTS IN ROAD CONSTRUCTION

The aim of the project is to study the possibility of using by-products and waste products in road construction. The 1975 program will comprise: 1) an inventory of existing waste and by-products (nature, composition, form, tonnage, geographical location, etc); 2) research on their use in road construction as binders, admixtures, aggregates, taking into account the above parameters; 3) follow up studies of investigations started in 1974 in the use of pvc and sludge oil waste products; 4) a study of a hardened bituminous mixture (evolution in mix design and binder) with a view to using the mixture at a later date for regenerating bituminous mixtures. /IRR-D/IRF/

PERFORMING AGENCY: Central and Regional Labs of Bridges & Highways, Fr, Ministry of Equipment and Housing

INVESTIGATOR: Grignard, A

SPONSORING AGENCY: Ministry of Equipment and Housing, France

STATUS: Active NOTICE DATE: Mar. 1975 START DATE: 1975 TOTAL FUNDS: \$64,500

ACKNOWLEDGMENT: International Road Research Documentation, OECD (IRRD-500477), International Road Federation (IRF 1e(686))

2R 101231

EFFICIENCY OF SHREDDED HARDWOOD BARK FOR ROADSIDE MULCHING AND EROSION CONTROL

This study was initiated for the purpose of establishing more precisely erosion control capabilities of shredded hardwood bark when used as a seeding mulch on freshly disturbed slopes similar to those encountered on highway construction projects, and to determine to what extent these erosion control capabilities are affected by changes in the rates of application, and changes in the textural composition of the shredded bark mulches. The erosion control efficiencies of the various types of mulching media are to be determined under simulated conditions in a rainfall droptower where slope gradient and the intensity and length of exposure to which the slope models are exposed to rainfall can be controlled. The quantities of surface water runoff, soils and the quantities of mulching media eroded from the model surfaces, and the amount of water percolating down through the soil profile of the model are to be measured and are the variables that will be used to determine which media applied at what rates is the most effective mulching media. Measurements of these same variables, when the model is mulched with straw and emulsified asphalt are applied at the rate of two tons of straw and 200 gallons (760 dm³) of asphalt per acre will be used as a standard for comparing the effectiveness of the bark materials. Three replications of test runs using shredded bark applied at 20, 30, 40, and 50 cubic yards (15, 30, 22, 95, 30.00, 28.25 h to 3rd power) per acre on two slopes (3:1 and 2:1) at two different rainfall rates (6" and 9", 0.1524 m and 0.2286 m, per hour for 30 minutes) have been completed. Also sawdust applied at 30 and 40 cubic yards (22.95 and 30.00 m to the 3rd power) per acre and coarse and fine shredded hardwood bark mulching media have also been tested. Work with the straw and emulsified asphalt treatments are in progress and should be completed in December 1974. Preliminary examinations show that significant differences between the various types of mulches applied at different rates are being observed. It is hoped that a final report for this project can be completed by mid June 1975.

PERFORMING AGENCY: Illinois University, Urbana, ILLU-55-0312

INVESTIGATOR: Yocum, TR

SPONSORING AGENCY: Illinois University, Urbana, Agricultural Experiment Station

STATUS: Active NOTICE DATE: Mar. 1975 START DATE: July 1972 COMPLETION DATE: June 1975

ACKNOWLEDGMENT: Illinois University, Urbana

2R 101274

THE DESIGN AND CONSTRUCTION OF ROADS FOR LIGHT DENSITY TRAFFIC

A REPORT WAS PREPARED BY L.F. LODER OUTLINING PRINCIPLES FOR THE DESIGN AND CONSTRUCTION OF ROADS FOR LIGHT DENSITY TRAFFIC. DURING 1967 EXPERIMENTAL SECTIONS OF RURAL ROAD WERE CONSTRUCTED AT TWO SITES IN WESTERN AUSTRALIA, HAVING SIGNIFICANTLY DIFFER-

ENT CLIMATIC CONDITIONS WITH AVERAGE RAINFALL OF 14 AND 35 INCHES. THE SECTIONS INCORPORATED COMPACTION OF THE CLAYEY SOIL SUBGRADE CLOSE TO ITS DRIEST NATURAL MOISTURE. REPORTS HAVE BEEN PREPARED, BUT NOT YET PUBLISHED, DESCRIBING CONSTRUCTION OF THE SECTIONS AND THEIR PERFORMANCE DURING WINTER 1967 WHEN THERE WAS CONSIDERABLE DETERIORATION UNDER TRAFFIC AT THE WETTER OF THE TWO SITES. OBSERVATIONS OF PERFORMANCE OF THE EXPERIMENTAL SECTIONS ARE BEING CONTINUED. /IRF/ REPORTS ISSUED: THE DESIGN AND CONSTRUCTION OF ROADS FOR VERY LIGHT DENSITY TRAFFIC, L.F. LODER, 1966. OBSERVATIONS ON SECTIONS OF RURAL ROAD NEAR MERREDIN AND BUNBURY WEST AUSTRALIA, 1967-1970, H.M. BEAVIS, AUSTRALIAN ROAD RESEARCH BOARD, 1971.

PERFORMING AGENCY: Australian Road Research Board; Main Roads Dept, West Australia

INVESTIGATOR: Beavis, HM

SPONSORING AGENCY: Australian Road Research Board; Main Roads Dept, West Australia

STATUS: Active NOTICE DATE: Dec. 1971 START DATE: 1964 TOTAL FUNDS: \$46,000

ACKNOWLEDGMENT: International Road Federation IRRD R29329, 2R25060065

2R 101279

THE ELASTIC PROPERTIES OF VARIOUS ROAD MATERIALS AND THEIR EFFECT ON STRESS DISTRIBUTION

THE ELASTIC CONSTANTS AT DIFFERENT STRESS INTENSITIES AND RATES OF CHANGE OF STRESS FOR VARIOUS ROAD MATERIALS ARE BEING EVALUATED. THE VARIATION IN STRESS DISTRIBUTION IN A LAYERED ROAD PAVEMENT RESULTING FROM THE VARIATION OF THE RATE OF APPLICATION OF THE LOAD WAS EXAMINED. FOR A GIVEN LOAD THE STRESS DISTRIBUTION WITHIN A LAYERED SYSTEM SUCH AS A ROAD PAVEMENT IS DEPENDENT UPON THE ELASTIC CONSTANTS OF THE CONSTITUENT LAYERS. IF THE ELASTIC CONSTANTS VARY WITH INTENSITY AND RATE OF CHANGE OF STRESS, THEN THE STRESS DISTRIBUTION IN SUCH A LAYERED STRUCTURE IS NOT CONSTANT FOR A GIVEN WHEEL LOAD BUT IS DEPENDENT ON THE RATE OF TRAVEL OF THE WHEEL.

PERFORMING AGENCY: New South Wales University /Australia/; Hwy Eng School

INVESTIGATOR: Dunlop, J

SPONSORING AGENCY: New South Wales University /Australia/

STATUS: Active NOTICE DATE: 1966

ACKNOWLEDGMENT: International Road Federation

2R 101317

TRAIL PAVEMENT SECTIONS: WAITEMATA COUNTY

EIGHT ALTERNATIVE PAVEMENT TYPES EACH OF 330 FEET ARE BEING CONSTRUCTED AS PART OF A SEVEN MILE RECONSTRUCTION CONTRACT ON A COUNTRY ROAD WHICH WILL CARRY RECREATIONAL TRAFFIC OF UP TO 10,000 VEHICLES PER DAY. PERFORMANCE OF LOCAL MATERIALS IS TO BE DETERMINED. THE ALTERNATIVES INCLUDE UNTREATED HIGH QUALITY BASE COURSE, CEMENT TREATED AND BITUMEN TREATED LOCAL AGGREGATE, USE OF MEDIUM QUALITY LOCAL AGGREGATE AS SUBBASE, AND LIME STABILIZATION OF THE INSITU SUBGRADE CLAYS. /IRF/ REPORTS ISSUED: PAVEMENT EXPERIMENTAL STRIP ON EAST COAST ROAD, WAITEMATA COUNTY, A.H. MALCOLM, R.G. HAWKES, ANNUAL CONF OF NZ INST OF COUNTY ENGINEERS, 1969. PROGRESS REPORT ON THE EIGHT PAVEMENT EXPERIMENTAL STRIPS ON EAST COAST ROADS IN THE WAITEMATA COUNTY, A.H. MALCOLM, ANNUAL CONF NZ INST OF COUNTY ENGINEERS, 1971.

PERFORMING AGENCY: Waitemata County Council /New Zealand/
 INVESTIGATOR: Jones, FG
 SPONSORING AGENCY: National Roads Board /New Zealand/: Waitemata
 County Council /New Zealand/

STATUS: Active NOTICE DATE: May 1973 COMPLETION DATE:
 1974 TOTAL FUNDS: \$30,300

ACKNOWLEDGMENT: International Road Federation (Irrd-r36539)IRF 6(1),
 2R25063571

2R 101371

THE SKID RESISTANCE OF ROAD SURFACE

A STANDARD SPECIFICATION OF SKID RESISTANCE ON ROAD SURFACE IS DETERMINED. THIS SPECIFICATION WILL BE APPLIED TO THE FIELD CONTROL OF HIGHWAY CONSTRUCTION OR THE MAINTENANCE OPERATION OF HIGHWAYS. FOR THIS PURPOSE, THE RELATIONSHIP BETWEEN SKID RESISTANCE AND THE TYPE OF BITUMINOUS MIXTURES OR AGGREGATES USED IS BEING STUDIED. IN ADDITION TO THIS THE SKID RESISTANCE OF A SPECIFIC SURFACE COURSE OR AT DANGEROUS SITES IS BEING MEASURED AND THESE RESULTS WILL BE THE BASIC DATA FOR DETERMINING THE LOWER LIMITS OF SKID RESISTANCE OF EXPRESSWAYS. DEVICES OR MECHANISMS FOR MEASURING SKID RESISTANCE ARE BEING CHECKED TO GET MORE PRECISE SKID VALUES. /IRRD/IRF/

REFERENCES:

The Skid Resistance of Road Surface Torii, Y; Uemura, K, Laboratory Report 1970, 1973, J.H.P.C., 1969, 1972

The Skid Resistance of Road Surface Torii, Y; Uemura, K, Technical Journal of Japan Highway Public Corporation, July 1971

PERFORMING AGENCY: Japanese Highway Public Corporation, Expressway Laboratory

SPONSORING AGENCY: Japanese Highway Public Corporation

STATUS: Active NOTICE DATE: Mar. 1974 START DATE: Apr. 1969 COMPLETION DATE: Mar. 1978 TOTAL FUNDS: \$165,000

ACKNOWLEDGMENT: International Road Research Documentation, OECD (IRRD-R51202), International Road Federation (IRF 2a(34))

2R 101520

EXPERIMENTAL PAVEMENTS STUDY IN ARID AREAS

VARIOUS CONFIGURATIONS OF PAVEMENT THICKNESSES AND MATERIALS USED ARE BEING INVESTIGATED UNDER SERVICE CONDITIONS IN AN ARID ENVIRONMENT, UTILIZING NON-DESTRUCTIVE MONITORING METHODS OF OBSERVATION. THE DATA ARE TO BE UTILIZED IN THE OPTIMIZATION OF PAVEMENT DESIGN. /IRF/

Several internal reports on work preparation were issued in 1973 and 1974.

PERFORMING AGENCY: Queensland Main Roads Department, Australia

INVESTIGATOR: Vlastic, Z Gordon, R Gray, W

SPONSORING AGENCY: Queensland Main Roads Department, Australia

ID R522&R524

STATUS: Active NOTICE DATE: May 1974 START DATE: May 1973 COMPLETION DATE: 1978 TOTAL FUNDS: \$86,000

ACKNOWLEDGMENT: International Road Federation (IRF 6(28))

2R 102032

EVALUATION OF CONTINUOUSLY REINFORCED CONCRETE PAVEMENTS

THE PRIMARY PURPOSE OF THIS RESEARCH PROJECT IS TO INVESTIGATE THE REASONS FOR THE POOR PERFORMANCE OF SOME OF THE CONTINUOUSLY REINFORCED CONCRETE PAVEMENTS CONSTRUCTED IN THE STATE OF INDIANA. A STATEWIDE SURVEY WAS MADE OF ALL OF THE CONTINUOUSLY REINFORCED PAVEMENTS CONSTRUCTED IN INDIANA UP TO THE FALL OF 1972. THE SURVEY CONSISTED OF LOGGING THE NUMBER OF FAILURES, PATCHES, EXTENT OF RANDOM CRACKING, PUMPING AND OTHER DISTRESS MANI-

FECTIONS ON THE PAVEMENTS. THE FIELD SURVEY SECTIONS WERE STRATIFIED ON THE BASIS OF KNOWN DESIGN FEATURES THAT WERE INCORPORATED IN THE PAVEMENTS. THESE INCLUDED, BUT WERE NOT RESTRICTED TO, SLIP FORMED VS FORMED PAVEMENT AND DEPRESSED VS PRE-SET STEEL AND SIMILAR DESIGN STRATA. THE SURVEY SHOWED THAT ABOUT TWO-THIRDS OF THE SECTIONS SURVEYED DID NOT HAVE ANY DEFECTS, ABOUT ONE-FOURTH OF THE SECTIONS HAD FROM 1 TO 5 DEFECTS AND LESS THAN 5 PERCENT OF THE SECTIONS HAD MORE THAN 5 DEFECTS PER SECTION. THIS IS BASED UPON DATA OBTAINED FROM 89 SECTIONS, EACH 5,000 FEET LONG. BASED UPON A STATISTICAL ANALYSIS OF THE DATA IT WAS CONCLUDED THAT SUBBASE TYPE WAS A SIGNIFICANT CONTRIBUTOR TO PERFORMANCE OF CRC PAVEMENTS WITH GRAVEL SUBBASES SHOWING THE POOREST PERFORMANCE. FURTHER, PAVEMENTS IN WHICH THE STEEL WAS DEPRESSED HAD SIGNIFICANTLY BETTER PERFORMANCE THAN PRE-SET STEEL USED ON CHAIRS. ALL OTHER FACTORS BEING CONSTANT, LOOSE BARS AND WELDED WIRE FABRIC HAVE SHOWN GOOD PERFORMANCE. THE DATA SHOWED LITTLE DIFFERENCE BETWEEN PERFORMANCE OF PAVEMENTS THAT WERE CONSTRUCTED USING SIDE FORMS COMPARED TO THOSE WHICH WERE SLIP FORMED. CONCRETE SLUMP WAS FOUND TO BE A SIGNIFICANT FACTOR. REPORTS ISSUED: DESIGN AND PERFORMANCE OF CONTINUOUSLY REINFORCED CONCRETE PAVEMENTS, TECHNICAL PAPER, JHRP NO. 17, AUGUST, 1973. EVALUATION OF PARAMETERS SIGNIFICANTLY INFLUENCING THE PERFORMANCE OF CONTINUOUSLY REINFORCED CONCRETE PAVEMENTS, TECHNICAL PAPER, JHRP-74-6, MAY 1974.

PERFORMING AGENCY: Purdue and Indiana State Highway Commission JHRP, Joint Highway Research Project, C-36-52J

INVESTIGATOR: Yoder, EJ Scholer, CF Dolch, WL Walsh, HR

SPONSORING AGENCY: Indiana State Highway Commission

STATUS: Active NOTICE DATE: Dec. 1974 START DATE: June 1972 COMPLETION DATE: June 1975 TOTAL FUNDS: \$30,000

ACKNOWLEDGMENT: Purdue and Indiana State Highway Commission JHRP

2R 102043

CONSTRUCTION AND UTILIZATION OF A RAPID WEAR APPARATUS FOR THE EVALUATION OF ARKANSAS' AGGREGATES

A rapid wear machine has been designed with the capacity of random variation of the wheel path. Limited testing of the machine operation has been accomplished. Actual operation will begin upon final assembly in its permanent location.

PERFORMING AGENCY: Arkansas State Highway Department, G-456

INVESTIGATOR: Kessinger, BG

SPONSORING AGENCY: Arkansas State Highway Department, G-456

STATUS: Active NOTICE DATE: Mar. 1975 START DATE: July 1973

ACKNOWLEDGMENT: Arkansas State Highway Department

2R 102064

SURFACE WEAR AND SKID RESISTANCE PROPERTIES FOR PORTLAND CEMENT CONCRETE PAVEMENTS

OVERALL OBJECTIVES ARE TO EVALUATE, IN THE LABORATORY, AN IMPROVED SMALL WHEEL CIRCULAR TRACK, THE WEAR AND SKID RESISTANCE PROPERTIES OF PORTLAND CEMENT CONCRETE PAVEMENT SURFACES SINCE THESE PROPERTIES ARE AFFECTED BY AGGREGATES, MIXTURE DESIGN, SURFACE TEXTURE, CONSTRUCTION METHODS, CURING METHODS, AND TEST SPEED. FURTHER OBJECTIVES, FOLLOWING SUCCESSFUL LABORATORY TESTS, WOULD CORRELATE WITH LABORATORY AND FIELD MEASUREMENT TECHNIQUES AND THE PREDICTION OF FIELD PERFORMANCE FROM LABORATORY TESTS.

PERFORMING AGENCY: North Carolina State University, Raleigh, Highway Research Program
 INVESTIGATOR: Mullen, WG Whitfield, JK
 SPONSORING AGENCY: North Carolina Department of Transp & Hwy Safety, Division of Highways; Federal Highway Administration, Department of Transportation
 RESPONSIBLE INDIVIDUAL: Smith, R

HP&R 74-3

STATUS: Active NOTICE DATE: Dec. 1974 START DATE: Aug. 1973 COMPLETION DATE: Sept. 1975 TOTAL FUNDS: \$75,000

ACKNOWLEDGMENT: North Carolina State University, Raleigh, Federal Highway Administration (213013351)

2R 102787**INVESTIGATION OF COLD-FORMED STEEL DECKING AS REINFORCEMENT FOR CONCRETE SLABS**

A TYPE OF CONCRETE FLOOR CONSTRUCTION INVOLVING COLD-FORMED STEEL DECKING WHICH REMAINS PERMANENTLY IN PLACE, AND SERVES AS POSITIVE REINFORCEMENT HAS BEEN UTILIZED FOR A NUMBER OF YEARS. THE PURPOSE OF THIS PROJECT IS TO OBTAIN PERTINENT INFORMATION WHICH IS NEEDED FOR THE DEVELOPMENT OF DESIGN SPECIFICATIONS. THE LABORATORY TESTING CONSISTED OF FULL-SCALE TESTING OF 5 SLABS SIMPLY SUPPORTED ON 4 EDGES & SUBJECTED TO CONCENTRATED LOADING. OTHER TESTS WERE CONDUCTED TO DETERMINE EFFECTS OF VARIOUS SURFACE CONDITION TYPES. REPORTS ISSUED: INVESTIGATION OF COLD-FORMED STEEL-DECK-REINFORCED CONCRETE FLOOR SLABS, M.L. PORTER, C.E. EKBERG, PROCEEDINGS OF FIRST SPECIALTY CONFERENCE ON COLD-FORMED STEEL STRUCTURES, DEPT. OF CIVIL ENGINEERING, CONTINUING EDUCATION SERIES, UNIV. OF MISSOURI-ROLLA, PP 179-185, AUGUST 1971. SUMMARY OF FULL-SCALE LABORATORY TESTS OF CONCRETE SLABS REINFORCED WITH COLD-FORMED STEEL DECKING, M.L. PORTER, C.E. EKBERG, INTERNATIONAL ASSOC. FOR BRIDGE & STRUCTURAL ENGINEERING, NINTH CONGRESS, FINAL REPORT, PP 173-183, MAY 1972. COMPOSITE STEEL-DECK-REINFORCED CONCRETE SYSTEMS FAILING IN SHEAR-BOND, R.M. SCHUSTER, INTERNATIONAL ASSOC. FOR BRIDGE & STRUCTURAL ENGINEERING, NINTH CONGRESS, FINAL REPORT, MAY 1972. COMPOSITE STEEL-CONCRETE CONSTRUCTION, M.L. PORTER, C.E. EKBERG, ASCE STRUCTURAL DIVISION JOURNAL, A DISCUSSION, ST 10561, MAY 1974.

PERFORMING AGENCY: Engineering Research Institute, Iowa State University, 7605

INVESTIGATOR: Ekberg, CE Porter, ML

SPONSORING AGENCY: American Iron and Steel Institute

STATUS: Active NOTICE DATE: Nov. 1974 START DATE: July 1967 TOTAL FUNDS: \$142,000

ACKNOWLEDGMENT: Iowa State University, Ames

2R 102992**LATEX-MODIFIED CONCRETE FOR BRIDGE DECK CONSTRUCTION**

A NUMBER OF BRIDGE DECKS WITH VARIOUS STRUCTURAL DETAILS WILL BE SELECTED IN VARIOUS PARTS OF THE STATE TO EVALUATE BOTH CONSTRUCTION AND LONG-TERM PERFORMANCE OF LATEX-MODIFIED CONCRETE OVERLAYS. THIS PROJECT WILL EVALUATE THE HANDLING AND PLACING CHARACTERISTICS OF LATEX-MODIFIED CONCRETE, AND THE CONSTRUCTION AND PERFORMANCE OF THE BRIDGE DECK OVERLAY SYSTEM.

PERFORMING AGENCY: Pennsylvania Department of Transportation, 73-8
 INVESTIGATOR: Kilareski, W

STATUS: Active NOTICE DATE: Oct. 1974 START DATE: Aug. 1973 COMPLETION DATE: Aug. 1980

ACKNOWLEDGMENT: Pennsylvania Department of Transportation

2R 103577**USE OF SYNTHETIC RUBBER-IN-ASPHALT PAVEMENT TO DETERMINE MIXTURE BEHAVIOR AND PAVEMENT PERFORMANCE**

AN ANALYSIS IS BEING MADE IN MEASUREABLE TERMS BY MEANS OF A STATISTICALLY DESIGNED EXPERIMENT OF THE BEHAVIOR AND PERFORMANCE OF BITUMINOUS PAVEMENTS IN WHICH DIFFERENT VISCOSITY ASPHALTS, MODIFIED WITH VARYING AMOUNTS OF RUBBER SOLIDS, WERE INCORPORATED INTO BITUMINOUS MIXES IN AMOUNTS ABOVE AND BELOW THE DESIGNED PERCENTAGE, AND PLACED IN DIFFERENT THICKNESSES ON VARIOUS DEPTHS OF GRANULAR BASE. THE DATA OBTAINED WILL MAKE POSSIBLE AN EVALUATION OF ALL THE MAIN EFFECTS OF THE FACTORS INVOLVED AS WELL AS THE INTERACTIONS BETWEEN THEM. THIS STUDY INVOLVED THE CONSTRUCTION OF THE EXPERIMENTAL SECTIONS ON A CONSTRUCTION PROJECT. CONSTRUCTION OF 16 TEST SECTIONS WAS COMPLETED IN AUGUST 1968. THE PROJECT WAS EXTENDED FROM A 36 MONTH TO A 60 MONTH STUDY TO PERMIT ADEQUATE EVALUATION OF THE PAVEMENT PERFORMANCE. REPORTS ISSUED: SYNTHETIC RUBBER-IN-ASPHALT EXPERIMENTAL TEST SECTION: DESIGN, CONSTRUCTION, AND INITIAL EVALUATION, M.I. DARTER, R. VOKAC, D.E. PETERSON, G.M. JONES, JANUARY 1970 USE OF SYNTHETIC RUBBER-IN-ASPHALT PAVEMENT TO DETERMINE MIXTURE BEHAVIOR, PAVEMENT PERFORMANCE, AND THERMOHEOLIC PROPERTIES, V.K. SORBE, C.C. SY, J.S. LAI, DECEMBER 1972. PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON THE USE OF RUBBER IN ASPHALT PAVEMENTS, VARIOUS AUTHORS FROM THROUGHOUT THE WORLD, MAY 1971. USE OF SYNTHETIC RUBBER IN ASPHALT TO DETERMINE MIXTURE BEHAVIOR, PAVEMENT PERFORMANCE, AND THERMORHEOLOGICAL PROPERTIES, V.K. SORBE, C.C. SY, J.S. LAI, MARCH 73.

PERFORMING AGENCY: Utah State Department of Transportation, Materials and Tests Division, Study No 500-903; Utah University
 INVESTIGATOR: Sorbe, VK Lai, JS

SPONSORING AGENCY: Utah State Department of Transportation; Federal Highway Administration, Department of Transportation

RESPONSIBLE INDIVIDUAL: Kenis

HP&R 903

STATUS: Active NOTICE DATE: Dec. 1974 START DATE: June 1968 COMPLETION DATE: Jan. 1975 TOTAL FUNDS: \$146,000

ACKNOWLEDGMENT: Utah State Department of Transportation, Federal Highway Administration (275880353), Utah University HRIS 31022055, HRIS 31202018, 2R31086944

2R 103581**EXPERIMENTAL TAR BASE COURSE**

THE EFFECTIVENESS OF TAR CEMENTS IN BASE COURSE CONSTRUCTION IS BEING EVALUATED. RESISTANCE TO WATER, STRIPPING AND CHEMICALS, COATING ABILITY, BINDING STRENGTH, AND PHYSICAL STABILITY WILL BE EVALUATED.

PERFORMING AGENCY: Pennsylvania Department of Transportation, 65-7
 INVESTIGATOR: Stewart, PD Nichols, TH

SPONSORING AGENCY: Pennsylvania Department of Transportation

STATUS: Active NOTICE DATE: Oct. 1974 START DATE: June 1965 COMPLETION DATE: June 1975

ACKNOWLEDGMENT: Pennsylvania Department of Transportation

2R 103895**POZZOLAN CEMENT CONCRETE, LIME-POZZOLAN CONCRETE AND LIME-POZZOLAN MIXTURE-BOUND MACADAM IN PAVEMENTS**

THE RHEOLOGY, CONSTRUCTION TECHNIQUES, ECONOMICS, LOAD-CARRYING CAPACITY AND PERFORMANCE OF POZZOLAN CEMENT CONCRETE, LIME-POZZOLAN CONCRETE AND LIME-POZZOLAN MIXTURE-MACADAM ARE BEING STUDIED AS PAVEMENT MATERIAL IN SURFACINGS, COMPOSITE CON-

CONSTRUCTION AND ROADBASE, WITH A VIEW TO PROVIDING ALTERNATIVE AND ECONOMICAL MATERIALS FOR PAVEMENT CONSTRUCTION. /IRF/

PERFORMING AGENCY: Central Road Research Institute, India, Council for Scientific and Industrial Research
 INVESTIGATOR: Ghosh, RK Sethi, KI
 SPONSORING AGENCY: Council for Scientific & Industrial Res. India

STATUS: Active NOTICE DATE: May 1974 START DATE: 1965

ACKNOWLEDGMENT: International Road Federation (IRF 1a(39))

2R 104328

DETERMINATION OF STATISTICAL PARAMETERS-PHASE II; CONCRETE PAVEMENTS AND STRUCTURES

THE OBJECTIVES OF THIS PROJECT ARE: TO DESIGN REALISTIC AND FULLY ENFORCEABLE ACCEPTANCE SPECIFICATIONS FOR PAVEMENT AND STRUCTURE CONCRETE THAT WILL ENSURE THAT THE QUALITY LEVEL OF CONCRETE CURRENTLY UTILIZED IN ACCEPTABLE CONSTRUCTION IS MAINTAINED IN FUTURE WORK; TO COMPLETELY DEFINE ACCEPTABLE PROCEDURE INCLUDING RANDOM SAMPLING, TESTING METHODS, LOT BY LOT ACCEPTANCE; TO DEFINE CONTRACTOR'S RESPONSIBILITIES WITH RESPECT TO QUALITY CONTROL; AND TO DEMONSTRATE THE EFFICACY OF THE PROPOSED SPECIFICATIONS AND SAMPLING PROCEDURES BY A PROGRAM OF SIMULATED APPLICATION TO CURRENT PROJECTS.

PERFORMING AGENCY: Materials Research & Development, 73-3
 INVESTIGATOR: Hudson, SB
 SPONSORING AGENCY: Pennsylvania Department Transp. Federal Highway Administration

STATUS: Active NOTICE DATE: Jan. 1974 START DATE: Sept. 1973 COMPLETION DATE: Dec. 1974 TOTAL FUNDS: \$99,000

ACKNOWLEDGMENT: Materials Research & Development

2R 104331

CONCRETE-POLYMER MATERIALS DATA BANK

THIS DATA SYSTEM WILL PROVIDE A FAST, ECONOMICAL WAY TO SELECT AND OBTAIN DESIRED INFORMATION FROM A LARGE VOLUME OF DATA ON CONCRETE-POLYMER MATERIALS. THE PRESENT EFFORT IS CORRECTING AND UPDATING DATA IN THE BANK WHICH INCLUDES INFORMATION ON MATERIALS USED IN SPECIMENS AND RESULTS OF VARIOUS PHYSICAL PROPERTIES TESTS. THE INFORMATION IS IN A COMPUTER PROGRAM CALLED CONCRETE-POLYMER DATA SYSTEM (COPODS) WHICH WILL BE USEFUL IN STRUCTURAL DESIGN AND TESTING PROJECTS.

PERFORMING AGENCY: Bureau of Reclamation, DR-374
 INVESTIGATOR: Nelson, CA
 SPONSORING AGENCY: Bureau of Reclamation

STATUS: Active NOTICE DATE: Feb. 1974 START DATE: Jan. 1972 COMPLETION DATE: Jan. 1975

ACKNOWLEDGMENT: Bureau of Reclamation

2R 104373

STUDY OF POLYMER MATERIALS FOR CONCRETE

THE AIM OF THE STUDY IS TO DEVELOP A POLYMER IMPREGNATED CONCRETE COMPOSITOR FOR USE AS IMPROVED MATERIAL IN CONSTRUCTION. IN THE STUDY IT IS PROPOSED TO INVESTIGATE THE PROPERTIES AND USEFULNESS OF SOME OF THE POLYMER RESINS AVAILABLE IN INDIA. /IRF/

PERFORMING AGENCY: Tamil Nadu Highways & Rural Works Dept. India, Highway Research Station
 SPONSORING AGENCY: Tamil Nadu State of, India

STATUS: Active NOTICE DATE: May 1974 START DATE: 1973

ACKNOWLEDGMENT: International Road Federation (IRF 5a(82))

2R 104619

ACCEPTANCE SAMPLING AND TESTING OF CONSTRUCTION MATERIALS

STATISTICALLY BASED ACCEPTANCE SAMPLING PLANS ARE BEING DEVELOPED FOR FOUR CONSTRUCTION MATERIALS: STEEL REINFORCING BARS, STRUCTURAL PAINTS, JOINT SEALERS, AND CEMENT. THE NECESSARY INFORMATION WILL BE GATHERED FROM HISTORICAL RECORDS OR FROM SPECIALLY DESIGNED EXPERIMENTS. REPORT ISSUED: ACCEPTANCE SAMPLING OF STEEL REINFORCING BARS, JOHN B. DI COCCO, RESEARCH REPORT 18, ENG R&D BUREAU, NYS DOT, NOV. 1973.

PERFORMING AGENCY: New York State Department of Transportation, Engineering Research and Development Bureau, Study No 062-1

INVESTIGATOR: Law, D Anania, GA
 SPONSORING AGENCY: New York State Department of Transportation; Federal Highway Administration, Department of Transportation
 RESPONSIBLE INDIVIDUAL: Granley

HP&R 062-1

STATUS: Active NOTICE DATE: Sept. 1974 START DATE: Aug. 1971 TOTAL FUNDS: \$112,000

ACKNOWLEDGMENT: New York State Department of Transportation, Federal Highway Administration (222011356)

2R 104652

RAPID ROAD CONSTRUCTION FOR ARMY OPERATIONS

THE PURPOSE HERE IS TO DEVELOP CRITERIA AND PROVIDE GUIDANCE FOR A NEW RAPID METHOD OF BUILDING ARMY ROADWAY LINES OF COMMUNICATION IN THE THEATER OF OPERATION. THIS METHOD IS DESIGNED TO ELIMINATE THE REQUIREMENTS FOR HIGH QUALITY BASE COURSES AND MANY PAVEMENT SURFACES BY SUBSTITUTING FOR THESE A MECHANICALLY STABILIZED LAYER OF NATURAL SUBGRADE SOIL WHICH IS ENCAPSULATED IN AN INEXPENSIVE, LLIGHTWEIGHT, WATERTIGHT, TRAFFICKABLE MEMBRANE. KEY FACTORS BEING CONSIDERED IN THE BUILDING OF THIS CAPSULE AREA-(1) PREVENTION OF INFLUX OF WATER-(2) PROPER CONSTRUCTION AND BONDING PROCEDURES FOR ALL MATERIALS (3) PROVIDING BASE AND SIDE MEMBRANES CAPABLE OF WITHSTANDING CONSTRUCTION OPERATIONS-(4) PROVIDING A SURFACE MEMBRANE CAPABLE OF WITHSTANDING CONTINUOUS TRAFFICKING FOR ONE YEAR-AND (5) REDUCTION OF CONSTRUCTION COSTS. TIME AND PERSONNEL BY 50 PERCENT AS COMPARED WITH CURRENT STANDARD METHODS. ALL SYSTEMS INVESTIGATED WILL BE MADE FROM STANDARD SOFTWARE PRODUCTS AND BE CAPABLE OF BEING CONSTRUCTED BY EQUIPMENT ORGANIC TO ENGINEER UNITS.

PERFORMING AGENCY: Waterways Experiment Station
 INVESTIGATOR: Jackson, RD Joseph, AH
 SPONSORING AGENCY: Department of Defense

STATUS: Active NOTICE DATE: Apr. 1974 START DATE: July 1972

ACKNOWLEDGMENT: Science Information Exchange

2R 104672

EVALUATION AND INTRODUCTION OF NEW CONSTRUCTION MATERIALS AND TECHNIQUES

MATERIALS FOR USE IN NEW CONSTRUCTION AND IN REHABILITATION OF EXISTING FACILITIES ARE CONTINUALLY BEING IMPROVED OR NEWLY DEVELOPED THROUGH THE R&D EFFORT OF INDUSTRY. NEW MATERIALS WHICH CAN SATISFY THE REQUIREMENTS OF MILITARY CONSTRUCTION AT LOWER COST THAN EXISTING MATERIALS MUST BE IDENTIFIED AND ALLOWED TO BE USED IN MILITARY CONSTRUCTION AS QUICKLY AS POSSIBLE. THE TECHNICAL OBJECTIVE IS THE EVALUATION OF NEW MATERIALS AS POTENTIAL ALTERNATES TO EXISTING MATERIALS USED IN MILITARY CONSTRUCTION. NEW MATERIALS AND APPLICATIONS WILL BE SELECTED FOR EVALUATION BASED ON THE NEEDS OF OCE AND OF THE DISTRICTS. A GENERAL EVALUATION

PROCEDURE IS DEVELOPED FOR EACH APPLICATION BASED ON FUNCTIONAL REQUIREMENTS, LIFE CYCLE COSTS, QUALITY CONTROL AND SAFETY ASPECTS OF THE CONSTRUCTION PHASE, ETC. THE PROCEDURE IS THEN USED TO EVALUATE SPECIFIC MATERIALS PROPOSED FOR THE APPLICATION BASED ON MATERIAL PROPERTIES, FIELD CONSTRUCTION PROCEDURES, AND PERFORMANCE OF EXISTING INSTALLATIONS. PROMISING MATERIALS WILL BE RECOMMENDED AS POTENTIAL ALTERNATES TO EXISTING MATERIALS. GUIDANCE FOR SPECIFICATIONS AND MANUAL PREPARATION OR REVISION WILL BE FURNISHED AFTER OCE REVIEW AND IF REQUESTED.

PERFORMING AGENCY: Army Construction Engineering Research Laboratory
 INVESTIGATOR: Aufmuth, RE Kanarowski, SM
 SPONSORING AGENCY: Department of Defense; Department of the Army, Department of Defense

STATUS: Active NOTICE DATE: Oct. 1974 START DATE: July 1973 COMPLETION DATE: June 1975

ACKNOWLEDGMENT: Army Construction Engineering Research Laboratory

2R 105106

EPOXY RESINS FOR USE ON CIVIL WORKS PROJECTS (ES 628)

THE PURPOSE OF THE STUDY IS TO DEVELOP INFORMATION ON THE APPLICATIONS THAT CAN BE MADE OF EPOXY RESIN SYSTEMS IN CONNECTION WITH CONCRETE CONSTRUCTION AND MAINTENANCE SO THAT THE MOST ADVANTAGEOUS SYSTEMS MAY BE SELECTED FOR THE ACCOMPLISHMENT OF SPECIFIC RESULTS. THE PLAN IS TO OBTAIN, CORRELATE, SUMMARIZE, AND EVALUATE AVAILABLE DATA ON POTENTIAL APPLICATIONS OF EPOXY RESINS IN CIVIL WORKS CONSTRUCTION. EPOXY RESIN SYSTEMS WILL BE TESTED FOR SPECIFIC NEEDS SUCH AS DURABILITY UNDER VARIOUS CONDITIONS, BONDING CHARACTERISTICS, PROTECTION, ETC. THE PROGRESS TO DATE INCLUDES: (1) SURVEY OF THE USE OF EPOXY-RESIN SYSTEMS IN CIVIL WORKS PROJECTS; (2) STUDY OF THE EFFECTS OF WATER ON CURED EPOXY-RESIN SYSTEMS; (3) COOPERATION IN TESTING WITH ASTM; (4) IDENTIFICATION OF NEW MATERIALS; (5) CAVITATION TESTS; (6) RATE OF CURE AND AGING FACTORS OF EPOXY RESIN SYSTEMS; AND (7) PULL-OUT TESTS.

PERFORMING AGENCY: Department of the Army, /Concrete Div
 INVESTIGATOR: Mather, B
 SPONSORING AGENCY: Department of Defense, /Corp Eng

STATUS: Active NOTICE DATE: Apr. 1974 START DATE: July 1972

ACKNOWLEDGMENT: Science Information Exchange

2R 105113

TECHNOLOGY FOR USE OF SULPHATE WASTE IN ROAD CONSTRUCTION

This study is developing the technology required for using waste sulfate and fly ash as binder and aggregate in road construction. The effect of the following variables on strength development are being evaluated: type of hydrated lime, form of pure calcium sulfate or sulfite, source and composition of fly ash, consistency of mixtures, curing temperature, replacement of lime by portland cement, admixtures and impurities expected in waste sulfates. Chemical and microstructural changes that take place within selected mixtures will be investigated to relate them to mechanical properties. Actual waste sulfates will be incorporated. Strength-compositional relationships will be evaluated, based on previous experimental results. Mixtures which show particular promise in highway applications will be evaluated for durability, permeability and leachability. Aggregate will be prepared and its suitability for portland cement concrete and asphaltic concrete will be determined. Finally, based on the knowledge and performance characteristics gained during this work, use criteria will be recommended.

PERFORMING AGENCY: Gillette Research Institute
 INVESTIGATOR: Kawam, A Smith, L
 SPONSORING AGENCY: Federal Highway Administration, Department of Transportation
 RESPONSIBLE INDIVIDUAL: Ormsby

Contract DOT-FH-11-8122 (CPFF)

STATUS: Active NOTICE DATE: Dec. 1974 COMPLETION DATE: June 1975 TOTAL FUNDS: \$193,000

ACKNOWLEDGMENT: Federal Highway Administration (204023351), Gillette Research Institute

2R 105116

LIME TREATMENT OF INCINERATOR RESIDUES FOR BASE COURSE CONSTRUCTION

TREATED INCINERATOR RESIDUE AS THE BASE COURSE OF A PARKING LOT TO BE CONSTRUCTED BY THE CITY OF CHICAGO AT ITS SOUTHWEST INCINERATOR AT 39TH AND IRON STREETS. /FHWA/

PERFORMING AGENCY: Soil Testing Services, Incorporated
 INVESTIGATOR: Gnaedinger, JP Zimmerman, RE
 SPONSORING AGENCY: Federal Highway Administration, Department of Transportation
 RESPONSIBLE INDIVIDUAL: Ormsby

Contract DOT-FH-11-8128 (CPFF)

STATUS: Active NOTICE DATE: Mar. 1975 START DATE: Aug. 1973 COMPLETION DATE: Aug. 1975 TOTAL FUNDS: \$19,000

ACKNOWLEDGMENT: Federal Highway Administration (204103351)

2R 105226

BENEFICIATION OF UNSUITABLE MATERIALS FOR BASE AND SUB-BASES

DYNAMIC LABORATORY TESTING IS BEING CARRIED OUT IN A CIRCULAR TEST TRACK AND IN A SPECIALLY CONSTRUCTED FACILITY WHICH APPLIES CYCLING COMPRESSION TO SOIL CUBES (6'X6'X6') THROUGH CONVENTIONAL 10.00-20 DUAL TIRES. THE PERFORMANCE OF VARIOUS MULTILAYER STRUCTURES CONSTRUCTED WITH BENEFICIATED MATERIALS IS TO BE EVALUATED IN ORDER TO FIND SUPPLEMENTS OR REPLACEMENTS FOR TRADITIONAL GRANULAR BASES AND SUB-BASES. /IRF/

PERFORMING AGENCY: Autonomous National University of Mexico, Engineering Faculty, Engineering Institute, 869
 INVESTIGATOR: Corro-Caballero, S Prado, G Rangel, F
 SPONSORING AGENCY: Ministry of Public Works, Mexico

STATUS: Active NOTICE DATE: May 1974 START DATE: Aug. 1973

ACKNOWLEDGMENT: International Road Federation (IRF 1a(99))

2R 105317

DEVELOPMENT AND VALIDATION OF TEST METHODS FOR ASSESSING THE QUALITY OF SANDS FOR BITUMINOUS ROAD CONSTRUCTION

WHILE TEST METHODS HAVE BEEN DEVELOPED FOR CERTAIN CRITERIA FOR CHIPPINGS, NO SPECIFIC QUALITY REQUIREMENTS HAVE BEEN LAID DOWN FOR CRUSHED AND NATURAL SANDS. IN TVBIT THERE ARE NO DATA CONCERNING THE PERMISSIBLE PROPORTION OF WEATHERING PRODUCTS IN SANDS OR TEST METHODS FOR THEIR DETERMINATION. IN THE PRESENT WORK, A TEST METHOD WILL BE DEVELOPED. EARLIER INVESTIGATIONS INTO THE CAUSES OF PREMATURE WEARING OF ROAD PAVINGS BROUGHT TO LIGHT AMONG OTHER THINGS INADEQUATE COHESION OF ONLY A HIGH PROPORTION PRODUCTS, CAPABLE OF SWELLING, IN THE SANDS USED. THE INSTITUTE HAS AVAILABLE A VIBRATORY ABRASION TESTING MACHINE AND AN IMPACT ABRASION TESTING MACHINE. IN THESE, SAND-ASPHALT SPECIMENS WILL BE TESTED UNDER STRESSES WHICH SIMULATE THOSE ENCOUNTERED IN THE PAVING. FIRST, THESE MACHINES WILL BE SYSTEMATICALLY

TESTED FOR THEIR STABILITY. FIVE SANDS WITH DIFFERENT PROPORTIONS OF WEATHERING PRODUCTS AND FIVE WITH DIFFERENT COHESION WILL BE STUDIED. THE TESTS WILL BE EXTENDED TO COVER SPECIMENS PREPARED IN A DIFFERENT WAY, TO DIFFERENT TEST TEMPERATURES, AND CHANGES IN THE TEST CONDITIONS IN THE MACHINES. EVALUATION OF THE RESULTS OF THESE TESTS SHOULD ENABLE PROPOSALS TO BE DRAWN UP FOR CERTAIN DEFINITE METHODS OF ASSESSING THE QUALITY OF SANDS. WHEN THE TEST CONDITIONS HAVE BEEN ESTABLISHED FOR THE VIBRATORY AND IMPACT ABRASION TESTS, 30 DIFFERENT SPECIALLY SELECTED SANDS WILL BE TESTED. THE INVESTIGATION WILL COVER MAINLY THOSE TYPES OF CRUSHED SAND WHICH IN RECENT YEARS HAVE BEEN USED WITH VARYING SUCCESS IN ROAD CONSTRUCTION. EARLIER INVESTIGATIONS BY THE INSTITUTE WILL ALSO BE REFERRED TO. /IRRD/IRF/

PERFORMING AGENCY: Technical University of Munich, West Germany, Institute of Bituminous Materials, VIII.27

SPONSORING AGENCY: Federal Ministry of Transport, West Germany

STATUS: Active NOTICE DATE: May 1974 START DATE: 1969

ACKNOWLEDGMENT: International Road Research Documentation, OECD (IRRD-R701014), International Road Federation (IRF 28a(14))

2R 105319

THE FROST-RESISTING PROPERTIES OF MIXTURES OF SAND, CHIPPINGS AND BALLAST (MINERAL CONCRETE)

MANY STUDIES HAVE BEEN CARRIED OUT INTO FROST HEAVING OF NATURALLY-OCCURRING SOILS. THERE IS HOWEVER NO ADEQUATE INFORMATION AVAILABLE ON THE SUSCEPTIBILITY TO FROST OF PREPARED ROAD MATERIALS. ROAD CONSTRUCTION MATERIALS ARE MADE UP ON THE PRINCIPLE OF MINIMUM PORE CONTENT, SO THAT IT IS POSSIBLE FOR QUITE SMALL AMOUNTS OF PLASTIC COMPONENTS CONTAINED IN THE PORES TO CAUSE FROST HEAVING OF THE WHOLE MASS AS A RESULT OF THE FORMATION OF OVAL INCLUSIONS. TO CLEAR UP THIS PROBLEM, IT IS INTENDED TO CARRY OUT A PROGRAM OF FROST HEAVE AND TRIAXIAL COMPRESSION TESTS. USING A MATERIAL WHICH IS SUSCEPTIBLE TO FROST HEAVING, A PRELIMINARY SERIES OF TESTS WILL BE USED TO ESTABLISH A TEMPERATURE-TIME PROGRAM, WHICH WILL AS CLEARLY AS POSSIBLE INDICATE THE DEGREE OF FROST RISK. IN THE MAIN PROGRAM, TESTS WILL BE CARRIED OUT TO DETERMINE THE INFLUENCE OF PARTICLE SIZE DISTRIBUTION OF CRUSHED SHELLY LIMESTONE WITH ADDED SAND ON THE FROST RISK. TESTS WILL ALSO BE CARRIED OUT TO DETERMINE THE DEFORMATION MODULI AND FRICTION ANGLES WHICH OCCUR. IN THESE TESTS THE COMPACTNESS WILL BE VARIED. FOR THE MEASUREMENT OF FROST RISK, CYLINDRICAL TEST SPECIMENS 25 CM. LONG AND 25.2CM. IN DIAMETER WILL BE PREPARED. THE SPECIMENS WILL BE PLACED IN FREEZING CELLS, THE UPPER PART OF WHICH CONSISTS OF RINGS WHICH SEPARATE WHEN FROST HEAVING OCCURS. THE FROST HEAVING WILL BE MEASURED BY MEANS OF DIAL GAUGES. BY SUITABLE DESIGN OF THE FREEZING CELLS IT IS POSSIBLE TO MEASURE THE DEPTH OF FROST PENETRATION, THE FROST HEAVING AND THE WATER ABSORPTION OR PARTIAL VACUUM DUE TO INCLUSIONS IN THE PORES OF THE UNBOUND MATERIAL. /IRRD/IRF/

PERFORMING AGENCY: Stuttgart University, West Germany, Official Research & Materials Testing Inst for Construction, VIII.30

INVESTIGATOR: Henke, KF

SPONSORING AGENCY: Federal Ministry of Transport, West Germany; Road Research Society, West Germany

STATUS: Active NOTICE DATE: May 1974 START DATE: 1969 TOTAL FUNDS: \$26,310

ACKNOWLEDGMENT: International Road Research Documentation, OECD (IRRD-R701049), International Road Federation (IRF 33c(v)(10))

2R 109353

THE POSSIBILITY OF USING HEAT INSULATING COURSES IN ROAD CONSTRUCTION

SUBSTANTIAL MEASURES HAVE TO BE TAKEN IN CONSTRUCTION, E.G. EXCAVATION OF SOIL WHICH IS SENSITIVE TO FROST, THE INCLUSION OF A FROST-PROTECTING LAYER OF GRAVEL 40 TO 60 CM THICK, TO PREVENT FROST DAMAGE TO ROADS. IN MANY PARTS OF GERMANY, THE GRAVEL USED FOR THIS PURPOSE IS VERY SCARCE AND HAS TO BE TRANSPORTED BY RAIL OR ROAD, SOMETIMES FOR A DISTANCE OF MORE THAN 100 KM., INVOLVING A CONSIDERABLE INCREASE IN COST. THE GOAL IS TO ASCERTAIN WHETHER THE INSULATING COURSE WILL ENABLE THE ANTI-FROST COURSE TO BE REDUCED OR OMITTED ENTIRELY. VERY LITTLE KNOWLEDGE IS AVAILABLE ON THE USE OF HEAT INSULATING COURSES IN ROAD CONSTRUCTION. IN VIEW OF THE ADVANTAGES AND THE COST SAVING OFFERED BY THE USE OF THESE COURSES, A DETAILED STUDY AND VERIFICATION OF THE ADVANTAGES AND DISADVANTAGES SHOULD BE CARRIED OUT BY AN OFFICIAL BODY. CONTINUOUS FROST AND LOADING TESTS WILL BE CARRIED OUT ON THE LARGE EXPERIMENTAL SITE TO DETERMINE THE DIMENSIONING OF THE HEAT INSULATING COURSES ACCORDING TO THE TYPE OF MATERIAL, DURATION OF FROST AND THE DEPTH OF INSTALLATION. IN PARALLEL WITH THESE TESTS, TEMPERATURE MEASUREMENTS AND MECHANICAL TESTS ARE CARRIED OUT ON EXPERIMENTAL SECTIONS. THESE SHOULD PROVIDE INFORMATION ON THE BEHAVIOR OF HEAT INSULATING COURSES AFTER A LONG PERIOD IN DAMP SOILS. THE TESTS WILL COVER: (1) THE TESTING OF HEAT INSULATING MATERIALS, IN RESPECT OF THEIR TECHNICAL AND THERMODYNAMIC PROPERTIES FOR ROAD CONSTRUCTION PURPOSES, (2) THE INFLUENCE OF THE COURSES ON THE HEAT BALANCE AND THE BEARING PROPERTIES OF ROADS, (3) THE DETERMINATION OF THE THICKNESSES OF THE COURSES, AND (4) OBSERVATION OF EXPERIMENTAL ROAD SECTIONS AND HEAT INSULATING COURSES UNDER TRAFFIC LOADING. /IRRD/IRF/

PERFORMING AGENCY: Federal Institute of Road Research, West Germany, 6.204 (242)

INVESTIGATOR: Behr, H

SPONSORING AGENCY: Federal Ministry of Transport, West Germany

STATUS: Active NOTICE DATE: May 1974

ACKNOWLEDGMENT: International Road Research Documentation, OECD (IRRD-R700422), International Road Federation (IRF 1(52))

2R 109373

ACCELERATED METHODS OF TESTING FOR LIME STABILIZED PAVEMENT MATERIALS

THE USE OF ELEVATED TEMPERATURE IS INVESTIGATED FOR CURING LIME STABILIZED SOIL, AND TESTING FOR UNCONFINED COMPRESSIVE STRENGTH AND C.B.R. IN ORDER TO DETERMINE THE ACCELERATED CURING CONDITIONS, THAT WOULD BE EQUIVALENT TO THE SEVEN DAYS CURING UNDER NORMAL TEMPERATURE PLUS A FURTHER FOUR DAYS IMMERSION IN WATER ACCORDING TO STANDARD PRACTICE. /IRF/

PERFORMING AGENCY: Ceylon Dept. of Highways

INVESTIGATOR: Goonewardene, AK

SPONSORING AGENCY: Road Research Lab /Ceylon/, /Research & Development Div

STATUS: Active

ACKNOWLEDGMENT: International Road Federation

2R 109531

LIME FLYASH AGGREGATE MIXTURES

BASIC RESEARCH IS BEING CONDUCTED ON PROPERTIES OF LIME-FLYASH-AGGREGATE MIXTURES AND THE FACTORS WHICH INFLUENCE THESE PROPERTIES. PARTICULAR EMPHASIS IS BEING PLACED ON USE OF ADDITIVES AND CON-

STRUCTION PRACTICES TO ACCELERATE CURING FOR LATE-SEASON CONSTRUCTION WITH THE HOPE THAT THE TERMINAL DATA FOR CONSTRUCTION CAN BE MOVED BACK SEVERAL WEEKS TO A MONTH. FIELD AND LABORATORY STUDIES ARE BEING CONDUCTED TO EVALUATE THE DURABILITY OF THESE MIXTURES AT AN EARLY AGE AND TO FIND METHODS OF IMPROVING DURABILITY.

PERFORMING AGENCY: Illinois University, Urbana, Department of Civil Engineering

INVESTIGATOR: Barenberg, EJ

SPONSORING AGENCY: Pozzolan Products Company

STATUS: Active NOTICE DATE: Mar. 1975 START DATE: July 1972

ACKNOWLEDGMENT: Illinois University, Urbana

2R 109545

STABILIZED LAYERS FOR PAVEMENTS

THE OBJECTIVE IS TO DETERMINE THE STRUCTURAL BENEFITS PROVIDED TO PAVEMENT SYSTEMS BY USE OF STABILIZED SOIL LAYERS AND TO DEVELOP THEREFROM SUITABLE CRITERIA FOR THE DESIGN AND CONSTRUCTION OF SUCH PAVEMENT SYSTEMS. THIS INVESTIGATION PROVIDED SUPPORT TO A LARGE SCALE FIELD TEST INVOLVING BOTH RIGID AND FLEXIBLE PAVEMENTS INCORPORATING A RANGE OF SOIL TYPES AND STABILIZING AGENTS. THE TEST PAVEMENTS WERE SUBJECTED TO TRAFFIC WITH HEAVY AIRCRAFT GEAR LOADS. /AUTHOR/

PERFORMING AGENCY: Waterways Experiment Station

INVESTIGATOR: Burns, CD Roney, CL

SPONSORING AGENCY: Waterways Experiment Station, /Office, Chief of Engineers

STATUS: Active NOTICE DATE: Feb. 1974 START DATE: Mar. 1972 COMPLETION DATE: June 1974 TOTAL FUNDS: \$200,000

ACKNOWLEDGMENT: Waterways Experiment Station

2R 115262

STABILITY OF SHIRASU (A VOLCANIC ASH SOIL) SLOPE

"Shirasu" is a kind of volcanic ash soil very susceptible to erosion. It is so widely distributed in Southern Kyushu that it is an indispensable material for road construction in that region. This research aims at clarifying the distribution and the physical characteristics of Shirasu, finding the factors causing failures of Shirasu slope, and studying the method of stabilizing Shirasu slope. /IRRD-IRF/

REFERENCES:

TECHNICAL INSTRUCTIONS IN PLANNING AND CONSTRUCTION OF ROAD EARTHWORK, Shima, T. Business Memoir of Kyushu Technical Office, 1973

PERFORMING AGENCY: Kyushu Regional Construction Office, Japan, Ministry of Construction

INVESTIGATOR: Shima, T Horita, T Tanimoto, S

SPONSORING AGENCY: Ministry of Construction, Japan

In-House

STATUS: Active NOTICE DATE: Sept. 1974 START DATE: 1965 COMPLETION DATE: 1975 TOTAL FUNDS: \$130,000

ACKNOWLEDGMENT: International Road Federation (IRF 11(1)). International Road Research Documentation, OECD

2R 115323

UNDERWATER CONCRETING METHODS [Suichu Konkurito Sekoho]

The authors studies preplaced aggregate concrete and tremie concrete methods for the past ten years and have executed many concrete structures under water using these methods. But in these procedures, it was apparent that these methods have substantial, unavoidable defects. So, a new type tremie method called the KDT tremie method was developed and studied. This new tremie method was found to have many advantages in comparison with the conventional tremie method. The study has been continued to obtain detailed data at the job site. An experimental application of the method to an underwater reinforced concrete slab is now under study. /IRRD-IRF/

PERFORMING AGENCY: Kajima Institute of Construction Technology, Japan

INVESTIGATOR: Nakahara, Y Ohtomo, T Yokota, S

SPONSORING AGENCY: Kajima Corporation

STATUS: Active NOTICE DATE: Sept. 1974 START DATE: Dec. 1970 COMPLETION DATE: May 1975

ACKNOWLEDGMENT: International Road Federation (IRF 37(29)), International Road Research Documentation, OECD

2R 115509

LABORATORY TEST TRACK

This project will predict the stress and displacement behavior of pavement materials into the plastic range and assess the value of non-standard pavement materials. /IRF/

PERFORMING AGENCY: Sydney University, Australia, School of Civil Engineering

INVESTIGATOR: Davis, EH

SPONSORING AGENCY: Australian Road Research Board

STATUS: Active NOTICE DATE: Oct. 1974

ACKNOWLEDGMENT: International Road Federation (IRF 11A(26))

2R 115668

OPERATIONAL RESEARCH IN PRODUCTION AND TRANSPORT OF ASPHALT

The purpose of this project is to improve the organization of the highway construction plant. /IRF/

PERFORMING AGENCY: Croatian Civil Engineering Institute, Yugoslavia

INVESTIGATOR: Milkic, N Eres, M Galjanica, S

SPONSORING AGENCY: Croatian Civil Engineering Institute, Yugoslavia

STATUS: Active NOTICE DATE: Oct. 1974 START DATE: 1974 COMPLETION DATE: 1976 TOTAL FUNDS: \$9,700

ACKNOWLEDGMENT: International Road Federation (IRF 3(26))

2R 115693

STUDY OF ASPHALT MIXTURES FOR ROAD BASE

Bituminous mixtures used in construction of road bases are studied, especially those containing coarse aggregates as well as those made using calcareous aggregates-"tosca"- abundant material found at the southern part of Buenos Aires Province and at La Pampa, for which characteristics and behavior are not yet determined. /IRF/

PERFORMING AGENCY: National University of the South, Argentina

INVESTIGATOR: Zalazar, LM Gonzalez, GA Sclavi, AH Heindl, JJ

SPONSORING AGENCY: National University of the South, Argentina

START DATE: Sept. 1972 COMPLETION DATE: Oct. 1975 TOTAL FUNDS: \$52,400,000

ACKNOWLEDGMENT: International Road Federation (IRF 9(5))

2R 115733

STABILIZATION BY MEANS OF GRADING, AND LIME STABILIZATION [Stabilizzazione Granulometrica Stabilizzazione con Calce]

The purpose of this project is to investigate for the purpose of road construction new applications of soil stabilization methods, namely by grading correction (without the admixture of other materials), and the addition of lime. /IRF/

PERFORMING AGENCY: Palermo University, Italy, Institute of Road Construction, Department of Engr

INVESTIGATOR: Tesoriere, G Barresi, G Boscaino, G

STATUS: Active NOTICE DATE: Oct. 1974

ACKNOWLEDGMENT: International Road Federation (IRF 13B(9))

2R 115813

STEEL BRIDGE CONSTRUCTION

The object of this research is the improvement of steel bridge constructions and their planning methods. /IRF/

CONSTRUCTION MATERIALS

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PERFORMING AGENCY: Highway Transportation Research Institute, Hungary, Department of Bridges, Road Construction and Materials
INVESTIGATOR: Gallik, I

STATUS: Active NOTICE DATE: Nov. 1974

ACKNOWLEDGMENT: International Road Federation (IRF 1E(35))

2R 125933

GROUTS AND ANCHORING SYSTEMS

Special grouts for tunnel applications, for machinery support, and for crane

rails are being developed. Work includes ground consolidation material, development of resin anchoring systems for stricter control: rock bolting, and fixings in concrete. /IRRD/IRF/

PERFORMING AGENCY: Chemical Building Products, Limited
INVESTIGATOR: McCurrick, LH

STATUS: Active NOTICE DATE: May 1974

ACKNOWLEDGMENT: International Road Research Documentation, OECD (IRRD-R602373), International Road Federation (IRF 78(3))

3R 020022**SETTLEMENT OF BRIDGE APPROACHES AND EMBANKMENTS**

THE CAUSES OF SETTLEMENT OF BRIDGE APPROACHES ARE BEING DETERMINED AND METHODS OF DESIGN AND CONSTRUCTION ARE BEING DEVELOPED WHEREBY SETTLEMENT MAY BE PREVENTED. LONG TERM DATA ARE BEING COLLECTED FROM SETTLEMENT PLATFORMS, MERCURY-FILLED SETTLEMENT GAGES, PROFILE MEASUREMENTS AND SLOPE INDICATORS AT SOME TEN BRIDGE SITES. BASED ON A PRELIMINARY ANALYSIS OF DATA OBTAINED TO DATA ALONG WITH DATA OBTAINED FROM TWO GENERAL SURVEYS OF MANY APPROACHES, THE MAJOR CAUSES OF POST-CONSTRUCTION SETTLEMENT OF MANY BRIDGE APPROACHES APPEARS TO BE (1) SLOPE INSTABILITY DUE TO PROGRESSIVE FAILURE AND (2) SECONDARY COMPRESSION OF APPROACH EMBANKMENT FOUNDATIONS. CONFIRMATION OF THESE OBSERVATIONS IS IN PROGRESS.

REFERENCES:

Mercury-Filled Settlement Gauge Hopkins, TC; Deen, RC, Kentucky Bureau of Highways, Research Division, HRB Record, Dec. 1972

Bluegrass Parkway Bridges over Chaplin River Hopkins, TC, Kentucky Bureau of Highways, Research Division, Feb. 1973

Slope Stability Analysis: Computerized Solution of Bishop's Simplified Method of Slices, Yoder, SM; Hopkins, TC, Kentucky Bureau of Highways, Research Division, Feb. 1973

Remedial Stability Analysis of Unstable Eastern Approach Embankment, Bluegrass Parkway over Chaplin River, Hopkins, TC; Yoder, SM, Kentucky Bureau of Highways, Research Division, May 1973

PERFORMING AGENCY: Kentucky Department of Transportation, Bureau of Highways, Research Division, Study No KYHPR-64-17

INVESTIGATOR: Havens, JH Deen, RC Hopkins, TC

SPONSORING AGENCY: Kentucky Department of Transportation, Bureau of Highways; Federal Highway Administration, Department of Transportation

RESPONSIBLE INDIVIDUAL: Sallberg

HP&R 64-17

STATUS: Active **NOTICE DATE:** Feb. 1975 **START DATE:** Jan. 1964 **COMPLETION DATE:** Jan. 1978 **TOTAL FUNDS:** \$336,000

ACKNOWLEDGMENT: Kentucky Department of Transportation, Federal Highway Administration (003168353)

3R 020415**DESIGN AND PERFORMANCE OF EMBANKMENTS IN ORGANIC SOIL**

THE METHODS CURRENTLY USED IN EXPLORATION AND DESIGN OF ROADWAY EMBANKMENTS IN ORGANIC SOILS OR LARGE MUCK LAYERS WHICH ARE TOO DEEP AND EXTENSIVE TO ECONOMICALLY REMOVE AND REPLACE WITH SUITABLE MATERIALS ARE EVALUATED. THE PROGRAM ENCOMPASSES FIELD INVESTIGATION METHODS, DATA INTERPRETATION EMBANKMENT DESIGN, CONSTRUCTION METHODS AND PERFORMANCE MONITORING. A FINAL REPORT IS UNDER PREPARATION. REPORTS ISSUED: DESIGN AND PERFORMANCE OF EMBANKMENTS ON ORGANIC SOILS, BELLE GLADE TEST EMBANKMENTS-TESTING AND ANALYSIS, C.F. CHEN & L.C. NOTTINGHAM, MAY 1973.

PERFORMING AGENCY: Florida Department of Transportation, Office of Materials and Research

INVESTIGATOR: Smith, LL Ho, KH

SPONSORING AGENCY: Florida Department of Transportation, Office of Materials and Research; Federal Highway Administration, Department of Transportation

RESPONSIBLE INDIVIDUAL: Sallberg

HP&R S-5-71

STATUS: Active **NOTICE DATE:** Dec. 1974 **START DATE:** July 1971 **COMPLETION DATE:** June 1975 **TOTAL FUNDS:** \$45,600

ACKNOWLEDGMENT: Florida Department of Transportation, Federal Highway Administration (162343353)

3R 020584**EARTHQUAKE INDUCED EMBANKMENT DISTRESS**

THE OBJECTIVES ARE TO SURVEY AND CATALOG THE EARTHWORK DAMAGE, DETERMINE THE MECHANISMS INVOLVED IN CAUSING THE DAMAGE, AND TO MAKE RECOMMENDATIONS FOR MINIMIZING EARTHQUAKE DAMAGE ON FUTURE PROJECTS. GROUND BREAKAGE WILL BE MAPPED, EARTHWORK DAMAGE WILL BE RELATED TO GEOLOGIC FEATURES, DESIGN, AND CONSTRUCTION METHODS. REPORTS ISSUED: THE SAN FERNANDO EARTHQUAKE-SOILS AND GEOLOGIC INVESTIGATIONS IN RELATION TO HIGHWAY DAMAGE, R.H. PRY SOCK, J.P. E. GAN, JR., SEPTEMBER 1971.

PERFORMING AGENCY: California Department of Transportation, Division of Highways, Transportation Laboratory Branch, Study No. 19-632119

INVESTIGATOR: Forsyth, RA Hannon, JB Jackura, KA

SPONSORING AGENCY: California Department of Transportation, Division of Highways; Federal Highway Administration, Department of Transportation

RESPONSIBLE INDIVIDUAL: Sallberg

HP&R D-5-43

STATUS: Active **NOTICE DATE:** Mar. 1975 **START DATE:** Feb. 1971 **COMPLETION DATE:** Dec. 1974 **TOTAL FUNDS:** \$95,100

ACKNOWLEDGMENT: California Department of Transportation, Federal Highway Administration (173101353)HRIS 63 022737, 2R63220117

3R 020875**EVALUATION OF COMPACTION OF CEMENT TREATED BASES**

MORE EFFICIENT METHODS WILL BE SOUGHT FOR PLACING AND TRIMMING CEMENT TREATED AGGREGATES TO SECURE STRONGER AND MORE DURABLE BASES. FIELD INVESTIGATIONS WILL BE MADE ON SEVERAL CONSTRUCTION PROJECTS AND SPECIFICATIONS WILL BE RECOMMENDED TO INSURE THAT THE MOST EFFICIENT CONSTRUCTION METHODS ARE USED.

PERFORMING AGENCY: California Department of Transportation, Division of Highways, Transportation Laboratory Branch, Study No. 19-63382

INVESTIGATOR: Skog, JB Smith, RE Murray, BD

SPONSORING AGENCY: California Department of Transportation, Division of Highways; Federal Highway Administration, Department of Transportation

HP&R D-2-16

STATUS: Active **NOTICE DATE:** Oct. 1974 **START DATE:** July 1967 **COMPLETION DATE:** Dec. 1974 **TOTAL FUNDS:** \$38,000

ACKNOWLEDGMENT: California Department of Transportation

3R 021196**STATEWIDE FLEXIBLE PAVEMENT PERFORMANCE AND DEFLECTION STUDY**

THIS DEFLECTION STUDY PLANS TO /1/ ESTABLISH THE RELATIONSHIP BETWEEN TOLERABLE DEFLECTION LEVEL, STRUCTURAL SECTION, AND TRAFFIC VOLUME, /2/ DETERMINE THE DEFLECTION ATTENUATION PROPERTIES OF VARIOUS ROADWAY MATERIALS, AND /3/ DETERMINE THOSE QUALITY CHARACTERISTICS OF VARIOUS ROADWAY MATERIALS, CONSTRUCTION PRACTICES OR DESIGN CRITERIA WHICH HAVE THE GREATEST EFFECT ON FLEXIBLE PAVEMENT PERFORMANCE AND /4/ EVALUATE THE PERFORMANCE OF BITUMINOUS OVERLAY SYSTEMS DESIGNED TO MINIMIZE REFLECTION CRACKING. REPORTS ISSUED: OVERLAY DESIGN USING DEFLECTIONS, G. B. SHERMAN, J. B. HANNON, WESTERN SUMMER MEETING HRB, AUGUST 1970. STRUCTURAL OVERLAYS FOR PAVEMENT REHABILITATION, R.W. BUSHEY, K.L. BAUMEISTER, J.A. MATTHEWS, G.B. SHERMAN, INTERIM REPORT, NOVEMBER 1974.

PERFORMING AGENCY: California Department of Transportation, Division of Highways, Transportation Laboratory Branch, Study No. 19-633128

INVESTIGATOR: Skog, JB Matthews, JA Bushey, RW

SPONSORING AGENCY: California Department of Transportation, Division of Highways; Federal Highway Administration, Department of Transportation

CONSTRUCTION EQUIPMENT AND METHODS

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RESPONSIBLE INDIVIDUAL: McComb

HP&R D-5-05

STATUS: Active NOTICE DATE: Oct. 1974 START DATE: Mar. 1962 COMPLETION DATE: June 1976 TOTAL FUNDS: \$458,300

ACKNOWLEDGMENT: California Department of Transportation, Federal Highway Administration (295210353)

3R 021201

LIME TREATED ROADWAYS

PERFORMANCE OF LIME TREATED ROADS IN CALIFORNIA IS BEING EVALUATED. THIS STUDY WILL BE CARRIED OUT BY ON SITE INSPECTION, CORING, DEFLECTION MEASUREMENTS, LABORATORY TESTS AND STUDY OF PROJECT RECORDS.

PERFORMING AGENCY: California Department of Transportation, Division of Highways, Transportation Laboratory Branch, Study No. 19-633324
INVESTIGATOR: Skog, JB Smith, RE Alexander, ML

SPONSORING AGENCY: California Department of Transportation, Division of Highways; Federal Highway Administration, Department of Transportation

RESPONSIBLE INDIVIDUAL: Fohs

HP&R D-2-14

STATUS: Active NOTICE DATE: Oct. 1974 START DATE: Aug. 1967 COMPLETION DATE: June 1975 TOTAL FUNDS: \$55,500

ACKNOWLEDGMENT: California Department of Transportation, Federal Highway Administration (292023351)

3R 021389

LONG SPAN BRIDGE DEFLECTION STUDY

FIELD DEFLECTION DATA ARE BEING ACCUMULATED ON SEVERAL SELECTED LONG SPAN BRIDGES. REDUCTION OF DATA AND STATISTICAL ANALYSIS WILL BE MADE AND CHARTS OR GRAPHS WILL BE PREPARED WHICH WILL AID BRIDGE DESIGNERS IN PREDICTING SHORT AND LONG TERM DEFLECTIONS AS INFLUENCED BY CONSTRUCTION METHODS, SEQUENCE OF CONSTRUCTION, AND CONSTRUCTION MATERIALS.

PERFORMING AGENCY: California Department of Transportation, Division of Highways, Office of Structures, Study No. 14-624122

INVESTIGATOR: Bezouska, TJ Mancarti, GD Nelson, BH

SPONSORING AGENCY: California Department of Transportation, Division of Highways; Federal Highway Administration, Department of Transportation

RESPONSIBLE INDIVIDUAL: Ballinger

HP&R D-4-043

STATUS: Active NOTICE DATE: Oct. 1974 START DATE: 1970 COMPLETION DATE: June 1978 TOTAL FUNDS: \$70,000

ACKNOWLEDGMENT: California Department of Transportation, Federal Highway Administration (324520353)

3R 045960

TUNNEL LINING

The contractor shall perform and report on the following: Task 1. The prior work of the Principal Investigator shall be specialized for the specific case of the tunnel lining of circular cross-section. Task 2. The prior work of the Principal Investigator shall be extended to include the case of the tunnel lining of horseshoe shaped cross section. Task 3. The system of a linkage of prefabricated structural elements forming a tunnel lining shall be studied. Task 4. An in-situ test of a tunnel structure under construction shall be conducted.

PERFORMING AGENCY: California State University, Sacramento

SPONSORING AGENCY: Office of Systems Development and Technology, Department of Transportation

RESPONSIBLE INDIVIDUAL: McFarland, RK (Tel 202-426-9638)

Contract DOT-OS-40016 (CS)

STATUS: Active NOTICE DATE: Feb. 1976 START DATE: Jan. 1974 TOTAL FUNDS: \$76,698

ACKNOWLEDGMENT: TRAIS (PR # PUR-2-40569)

3R 043984

EARTH REINFORCEMENT AND UNDERPINNING TECHNIQUES FOR USE IN CUT-AND-COVER TUNNELING

This project will attempt to improve methods for protecting adjacent building foundations during cut-and-cover and soft-ground tunneling. This will require the following: (1) Development of a comprehensive, in-depth synthesis of current methods of earth reinforcement and underpinning, in the broadest sense of the term, including manuals for design and for construction planning and execution; (2) Development of innovative concepts for improved earth reinforcement and underpinning methods for the broad range of site conditions encountered; and (3) Recommendations for testing and evaluating the innovative designs and for further needed research to achieve the ultimate objective. /FHWA/

PERFORMING AGENCY: Goldberg-Zoino and Associates, Incorporated

INVESTIGATOR: Goldberg

SPONSORING AGENCY: Federal Highway Administration, Department of Transportation, RFP-238 PR # 41-10-032

RESPONSIBLE INDIVIDUAL: Gale, HG (Tel 202-426-0743)

Contract DOT-FH-11-8499 (CPFF)

STATUS: Active NOTICE DATE: Oct. 1975 START DATE: June 1974 TOTAL FUNDS: \$98,000

ACKNOWLEDGMENT: Federal Highway Administration (179314353)

3R 082051

TIME TO CORROSION OF REINFORCING STEEL VERSUS VARIOUS PARAMETERS AND DESIGN CONSTRUCTION

The purpose of this project is to determine the relative time to corrosion of reinforcing steel embedded in concrete slabs fabricated from various mix designs and construction procedures, when the slabs are subject to periodic wetting with a 3 percent sodium chloride solution. The effect of coating breaks on the effectiveness of electrostatically-applied, powdered, epoxy resin rebar coatings will be determined.

PERFORMING AGENCY: Federal Highway Administration, Department of Transportation

INVESTIGATOR: Clear

SPONSORING AGENCY: Federal Highway Administration, Department of Transportation

RESPONSIBLE INDIVIDUAL: Clear

In-House

STATUS: Active NOTICE DATE: Dec. 1974 COMPLETION DATE: Dec. 1975 TOTAL FUNDS: \$87,000

ACKNOWLEDGMENT: Federal Highway Administration (024022351)

3R 082110

A COMPUTER BASED INFORMATION SYSTEM FOR COUNTY EQUIPMENT COST RECORDS

The objective of this project is to provide a uniform system in all counties for gathering, storing, processing, and using data and information pertaining to costs of county highway equipment.

PERFORMING AGENCY: Iowa University, HR-173

INVESTIGATOR: Poyzer, JD Liittschwager, JM

SPONSORING AGENCY: Iowa State Highway Commission

STATUS: Active NOTICE DATE: Nov. 1974 START DATE: Nov. 1974 COMPLETION DATE: July 1975 TOTAL FUNDS: \$23,699

ACKNOWLEDGMENT: Iowa State Highway Commission

3R 082277

DEVELOPMENT OF METHODOLOGY FOR DESIGN AND CONSTRUCTION OF COMPACTED SHALE EMBANKMENTS

The purpose is to identify factors responsible for rapid deterioration of shales and develop (1) techniques to evaluate the stability of existing embankments; (2) remedial treatments for existing distressed embankments and (3) design criteria and construction control techniques for compacted shale embankments.

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CONSTRUCTION EQUIPMENT AND METHODS

PERFORMING AGENCY: Waterways Experiment Station, Army Corps of Engineers
INVESTIGATOR: Strohm
SPONSORING AGENCY: Federal Highway Administration, Department of Transportation
RESPONSIBLE INDIVIDUAL: Fohs

IA PO-4-1-0196

STATUS: Active NOTICE DATE: Dec. 1974 COMPLETION DATE: June 1978 TOTAL FUNDS: \$800,000

ACKNOWLEDGMENT: Federal Highway Administration (234014351)

3R 082299

SURFACE COATING OF CONCRETE STRUCTURES

A "user manual" will be prepared which describes the advantages, cost and construction techniques used in applying surface coatings to concrete structures used in highway construction.

PERFORMING AGENCY: Nevada Department of Highways
INVESTIGATOR: Taylor
SPONSORING AGENCY: Federal Highway Administration, Department of Transportation
RESPONSIBLE INDIVIDUAL: Olsen

Contract DOT-FH-11-8173-1 (CPFF)

STATUS: Active NOTICE DATE: Dec. 1974 TOTAL FUNDS: \$8,000

ACKNOWLEDGMENT: Federal Highway Administration (318103356)

3R 082381

EFFECTS OF PAVEMENT TEXTURE ON SKID RESISTANCE

The objectives of this study are: to determine wear factors on asphalt and PCC pavements; to investigate the effect of mix design, material properties, and construction techniques on skid resistance; to determine skid resistance speed gradients and the relationship between locked wheel and peak friction coefficients.

PERFORMING AGENCY: Ohio Department of Transportation
INVESTIGATOR: Behn
SPONSORING AGENCY: Ohio Department of Transportation; Federal Highway Administration, Department of Transportation
RESPONSIBLE INDIVIDUAL: Smith, R

HP&R 14276

STATUS: Active NOTICE DATE: Dec. 1974 COMPLETION DATE: June 1975 TOTAL FUNDS: \$30,000

ACKNOWLEDGMENT: Federal Highway Administration (193014351)

3R 082498

MODIFIED AGGREGATE-LIME-POZZOLAN BASE COURSE

The purpose is to evaluate the ability of a modified blend of aggregate-lime-pozzolan base material to provide improved stability and increased development of strength, particularly in late season-low temperature construction environments.

PERFORMING AGENCY: Pennsylvania Department of Transportation, 74-14
INVESTIGATOR: Brunner, RJ

STATUS: Active NOTICE DATE: Oct. 1974 START DATE: Sept. 1974 COMPLETION DATE: June 1978

ACKNOWLEDGMENT: Pennsylvania Department of Transportation

3R 082559

THE EFFECT OF CONSTRUCTION PROCEDURE, SOIL CHARACTERISTICS AND DURATION OF LOADING ON THE BEHAVIOR OF DRILLED SHAFTS

The capacity of drilled shafts in different soils and placed by different methods, and the effect of time on capacity will be determined by field measurements on full scale piles.

PERFORMING AGENCY: Texas University, Austin
INVESTIGATOR: Reese
SPONSORING AGENCY: Texas State Department of Highways & Public Transp; Federal Highway Administration, Department of Transportation
RESPONSIBLE INDIVIDUAL: Sallberg

HP&R 176

STATUS: Active NOTICE DATE: Dec. 1974 COMPLETION DATE: Aug. 1975 TOTAL FUNDS: \$195,000

ACKNOWLEDGMENT: Federal Highway Administration (188301353)

3R 082570

CAMBER IN PRESTRESSED CONCRETE BEAMS

Objectives of the Study are: (1) Determine the cause or causes of differential camber in pretensioned prestressed concrete bridge beams that are designed and fabricated to be identical, within specified tolerances and construction standards. (2) To recommend changes in design and/or fabrication techniques that will eliminate the cause of differential camber. (3) To test and verify the changes or modification of item 2.

PERFORMING AGENCY: Texas Transportation Institute, Texas A&M University, Study No 2-5-75-193

INVESTIGATOR: Furr, HL Jones, HL
SPONSORING AGENCY: Texas State Department of Highways & Public Transp; Federal Highway Administration, Department of Transportation

HP&R

STATUS: Active NOTICE DATE: Jan. 1975 START DATE: Sept. 1974 COMPLETION DATE: Aug. 1976 TOTAL FUNDS: \$53,400

ACKNOWLEDGMENT: Texas Transportation Institute

3R 082572

BITUMINOUS TREATED BASES

The purpose here is to provide technology for more economical asphalt treated base courses by investigation new construction techniques and more realistic criteria for material selection and design which will provide the desired performance in a given environment.

PERFORMING AGENCY: Texas Transportation Institute, Texas A&M University, Study No 2-6-74-41

INVESTIGATOR: Epps, JA Gallaway, BM
SPONSORING AGENCY: Texas State Department of Highways & Public Transp; Federal Highway Administration, Department of Transportation
RESPONSIBLE INDIVIDUAL: Spellman

HP&R 041

STATUS: Active NOTICE DATE: Jan. 1975 START DATE: Sept. 1973 COMPLETION DATE: Aug. 1975 TOTAL FUNDS: \$75,000

ACKNOWLEDGMENT: Texas Transportation Institute (240023351), Federal Highway Administration

3R 082638

EVALUATION OF UTAH'S QUALITY CONTROL PROCEDURES RELATED TO CONSTRUCTION

The objectives are to establish an overall plan to improve Utah's quality control system. Also those areas of quality control that can be immediately changed or improved will be implemented through this study; those areas requiring a more extensive change-over will be identified for later implementation. Information will be gathered from various individuals throughout Utah related to construction to help identify problem areas and possible solutions. This information will be compared to a literature search or questionnaire aimed at the same problem areas to detect existing problems and their solutions and where these solutions will help improve quality construction and control in Utah.

PERFORMING AGENCY: Utah State Department of Transportation, Materials and Tests Division, Study No. 500-927

INVESTIGATOR: Leatham, J Peterson, GE Peterson, DE
SPONSORING AGENCY: Utah State Department of Transportation; Federal Highway Administration, Department of Transportation

HP&R

STATUS: Active NOTICE DATE: Oct. 1974 START DATE: July 1974 COMPLETION DATE: June 1975 TOTAL FUNDS: \$12,000

ACKNOWLEDGMENT: Utah State Department of Transportation

3R 083019

REDUCING THE SEASONALITY OF HOT PLANT-MIX BITUMINOUS PAVING

The relative merit of construction methods which reduce the seasonality of constructing bituminous concrete pavements will be determined.

PERFORMING AGENCY: Montana Department of Highways
 INVESTIGATOR: Mackey
 SPONSORING AGENCY: Montana Department of Highways; Federal Highway Administration, Department of Transportation
 RESPONSIBLE INDIVIDUAL: Olsen

HP&R 7927

STATUS: Active NOTICE DATE: Dec. 1974 COMPLETION DATE: June 1975 TOTAL FUNDS: \$2,000

ACKNOWLEDGMENT: Federal Highway Administration (057013356)

3R 085336

STRUCTURAL ANALYSIS OF STEEL-CONCRETE COMPOSITE MATERIAL CONSTRUCTION

At civil engineering constructions consisting of such composite materials as steel-concrete sandwich, reinforced concrete and steel fiber reinforced concrete, investigation of the fundamental material and structural mechanism for composite action of the composite materials is urgently required. Theoretical and numerical analysis for the above purpose will be carried out through electronic computations on the following subjects: (1) Two-dimensional elastic deformation analysis? (2) Extension of the above program to material non-linear problems including plasticity and creep? (3) Three-dimensional elastic and inelastic anisotropic problems? and (4) In addition, crack problems in terms of initiation and propagation and boundary layer problems between different materials will be treated as applied problems.

PERFORMING AGENCY: Osaka University, France
 INVESTIGATOR: Maeda, Y Matsui, S
 SPONSORING AGENCY: Ministry of Education, Japan

STATUS: Active NOTICE DATE: May 1975 START DATE: Apr. 1975 COMPLETION DATE: Mar. 1977 TOTAL FUNDS: \$7,000

ACKNOWLEDGMENT: International Road Research Documentation, OECD, International Road Federation (IRF 22a(52))

3R 085407

MECHANIZATION OF EXCAVATION FOR OPEN CAISSONS

This study is intended to develop a single machine that will make it possible to excavate either a circular or elliptical space corresponding to the respective shapes of the open caissons to be laid. Such equipment is designed to perform excavation with an underground excavating unit mounted at the tip of a special revolving shaft that gives 3 types of revolving motion, up and down and reciprocation, properly combined. Excavated material is to be removed continuously by means of sand pumps or air lift, and a complete system combining removal mechanism is being developed. /IRRD/IRF/

PERFORMING AGENCY: Hazama-Gumi, Ltd, Engineering Research Center
 INVESTIGATOR: Matsugaki, K Ebisu, T
 SPONSORING AGENCY: Hazama-Gumi, Ltd, Engineering Research Center

STATUS: Programmed NOTICE DATE: May 1975 START DATE: June 1975

ACKNOWLEDGMENT: International Road Research Documentation, OECD, International Road Federation (IRF 82(5))

3R 085590

NON-DESTRUCTIVE TEST METHODS IN CONSTRUCTION CONTROL

This project involves evaluating non-destructive apparatus and methods used in or available for construction practice, for precision, reliability and durability, and developing non-destructive methods for quality control, based on probabilistic principles. /IRF/

REFERENCES:

- Precision and Reliability of a Nuclear Meter for Soil and Bituminous Mix Density Determination, Rule, B, Internal Report, Feb. 1975
- Assessment of Capacitance Method for Bituminous Materials Density Determination, Rule, B, Internal Report, Nov. 1974
- Development of Test Method for Density/Moisture Determination of

Earthen Materials, Rule, B, Apr. 1975

PERFORMING AGENCY: Queensland Main Roads Department, Australia
 INVESTIGATOR: Spies, R Rule, B
 SPONSORING AGENCY: Queensland Main Roads Department, Australia

STATUS: Active NOTICE DATE: May 1975 START DATE: 1974 COMPLETION DATE: 1976 TOTAL FUNDS: \$18,900

ACKNOWLEDGMENT: International Road Federation (IRF 6(49))

3R 085647

THE INFLUENCE OF LAYOUT AND MANAGEMENT POLICIES ON THE PRODUCTIVITY OF MATERIAL FLOW PROCESSES ON CONSTRUCTION SITES

The objective of the study is to establish current practice at the planning levels and to develop improved practical techniques suitable for both head office and field agents. This will be achieved by site visits to dams, major road construction, tunnels, high rise buildings and other sites. /IRF/

PERFORMING AGENCY: New South Wales University, Australia, School of Civil Engineering, Dept of Engr Constr & Managemnt
 INVESTIGATOR: Woodhead, RW Birdsall, GC
 SPONSORING AGENCY: Australian Government

STATUS: Active NOTICE DATE: May 1975 START DATE: Feb. 1975 COMPLETION DATE: 1978

ACKNOWLEDGMENT: International Road Federation (IRF 10f(19))

3R 085782

ARID AREA CONSTRUCTION TECHNIQUES

Techniques are to be developed for compacting materials in their dry state and the properties of materials which have been compacted in this condition are to be studied. The work is in the planning phase. /IRRD/IRF/

PERFORMING AGENCY: Transport and Road Research Laboratory, Department of the Environment
 INVESTIGATOR: Bofinger, HE Russell, RB Buchan, EB
 SPONSORING AGENCY: Transport and Road Research Laboratory, Department of the Environment

STATUS: Programmed NOTICE DATE: Apr. 1975 START DATE: 1975 COMPLETION DATE: 1978

ACKNOWLEDGMENT: International Road Research Documentation, OECD (IRRD-603085), International Road Federation (IRF 1a(445))

3R 085787

LOADING AND PERFORMANCE OF FALSEWORK IN BRIDGE CONSTRUCTION

Loads on falsework used for building bridges are being determined to improve safety during construction. The methods used are based on site measurements, backed by laboratory tests and theoretical analysis. Measurements have just been made on falsework used on successive spans of a motorway viaduct. Results are being analysed. /IRRD/IRF/

PERFORMING AGENCY: Transport and Road Research Laboratory, Department of the Environment
 INVESTIGATOR: Price, WI Taylor, ME Price, AR
 SPONSORING AGENCY: Department of the Environment, England

STATUS: Active NOTICE DATE: Apr. 1975 START DATE: Jan. 1974 COMPLETION DATE: 1980

ACKNOWLEDGMENT: International Road Research Documentation, OECD (IRRD-603092), International Road Federation (IRF 1a(450))

3R 086273

COMPUTER ASSISTANCE IN PRODUCTION PLANNING FOR ROAD CONSTRUCTION

This project consists of coordinating existing computer programs and developing new ones that will be helpful in production planning for road construction. The computer programs are meant to include planning of costs, scheduling of time (pert), planning of needs for resources (machinery) and planning of costs/time. /IRRD/IRF/

PERFORMING AGENCY: Norwegian Institute of Technology, Foundation of Scientific and Industrial Research
 INVESTIGATOR: Berger, A
 SPONSORING AGENCY: Public Roads Administration, Norway

STATUS: Active NOTICE DATE: June 1975 START DATE: 1975 TOTAL FUNDS: \$21,200

ACKNOWLEDGMENT: International Road Research Documentation, OECD (IRRD-603498), International Road Federation (IRF 5b(6))

3R 087022**SURFACE TYPES OF THIN PAVEMENTS**

This project will attempt to evaluate performance of various surface types on thin or staged pavement structures. Two test sections with various widths of cold-mix, single and double sand seals, and shoulder treatments will be evaluated from maintenance records and visual observations. This project was turned over to Research in early 1975 while still under construction. /RTAC/

PERFORMING AGENCY: Saskatchewan Department of Highways & Transp, Can
 INVESTIGATOR: Culley, RW
 SPONSORING AGENCY: Saskatchewan Department of Highways & Transp, Can

STATUS: Active NOTICE DATE: Oct. 1975 START DATE: Aug. 1974 COMPLETION DATE: Dec. 1977

3R 100785**EXPEDIENT MEMBRANE-ENVELOPED-SOIL-LAYERS (MESL) ROADS IN A WINTER ENVIRONMENT**

THE OBJECTIVE IS TO DEVELOP ENGINEERING CRITERIA AND CONSTRUCTION TECHNIQUES FOR CONSTRUCTING SUCH ROADS IN A WINTER ENVIRONMENT. LABORATORY FREEZE-THAW TESTING WILL BE CONDUCTED ON VARIOUS FINE-GRAINED SOIL TYPES TO DETERMINE THE APPROPRIATE MOISTURE CONTENTS TO PREVENT MOISTURE MIGRATION AND LENSING DURING FREEZING. LABORATORY CBR (CALIFORNIA BEARING RATIO) TESTS WILL ALSO BE CONDUCTED ON THAWING SAMPLES TO DETERMINE STRENGTH LOSSES DUE TO FREEZING. FIELD TESTS WILL PROVIDE TRAFFIC RESPONSE DATA.

PERFORMING AGENCY: Cold Regions Research and Engineering Laboratory, Department of the Army, AT31-03-002
 INVESTIGATOR: Smith, N Eaton, R
 SPONSORING AGENCY: Army Corps of Engineers, Department of the Army

STATUS: Active NOTICE DATE: Nov. 1974 START DATE: July 1973 COMPLETION DATE: June 1976 TOTAL FUNDS: \$410,000

ACKNOWLEDGMENT: Cold Regions Research and Engineering Laboratory

3R 101335**THE STRUCTURAL DESIGN, DESIGN MIXTURES AND CONSTRUCTION METHOD OF ASPHALT PAVEMENTS**

FULL SCALE TEST PAVEMENTS WHICH HAVE MANY TYPES OF ASPHALT MIXTURES WERE CONSTRUCTED. PLASTIC FLOW AND SKIDDING RESISTANCE OF THE MIXTURES ARE BEING MEASURED. THE PERFORMANCE OF ACTUAL LOW COST PAVEMENT ARE BEING SURVEYED. THE PERFORMANCE TESTS OF ASPHALT PLANTS WERE CONDUCTED. /IRRD/IRF/ REFERENCES.

Resistance to Plastic Flow of Asphalt Mixtures and Their Composition, Matsuno, S; Tanimoto, S, Public Works Research Institute, Mar. 1971

Stripping of Asphalt Mixtures and Its Preventive Measures Nagumo, S, Public Works Research Institute, (In Japanese)

PERFORMING AGENCY: Public Works Research Institute, Japan, Ministry of Construction, Chiba Branch
 INVESTIGATOR: Nagumo, S Anzaki, Y Kojima, I
 SPONSORING AGENCY: Ministry of Construction, Japan

STATUS: Active NOTICE DATE: June 1974 START DATE: Apr. 1961 COMPLETION DATE: 1974 TOTAL FUNDS: \$266,000

ACKNOWLEDGMENT: International Road Research Documentation, OECD (IRRD-R51102), International Road Federation (IRF 1b(69))

3R 101486**UPDATE PAVEMENT CONSTRUCTION METHODS AND EQUIPMENT**

THE OBJECTIVE HERE IS TO CONDUCT TESTS, DEVELOP CRITERIA, AND INVESTIGATE NEW PAVEMENT CONSTRUCTION METHODS AND EQUIPMENT TO ASSURE OPTIMUM UTILIZATION OF THE MOST ADVANCED AND PRODUCTIVE CAPABILITIES FOR THE DESIGN AND CONSTRUCTION OF HEAVY-LOAD AIRFIELD PAVEMENTS. NEW AND INNOVATIVE CONSTRUCTION METHODS AND EQUIPMENT ARE BEING STUDIED TO DETERMINE COMPARIBILITY BETWEEN HEAVY-LOAD AIRFIELD PAVEMENT DESIGN REQUIREMENTS AND CONSTRUCTION PRACTICES. INFORMATION IS GATHERED THROUGH TESTS AND ANALYSIS OF TECHNOLOGY ADVANCES IN CONSTRUCTION EQUIPMENT AND HEAVY CONSTRUCTION PRACTICES, INSPECTION OF PAVEMENT CONSTRUCTION PROJECTS, AND THROUGH DISCUSSIONS WITH CONTRACTORS AND EQUIPMENT MANUFACTURERS. THIS INFORMATION WILL BE EVALUATED TO DETERMINE APPLICABILITY TO MILITARY CONSTRUCTION IN ORDER TO ACHIEVE DESIGN REQUIREMENTS OR TO TAILOR SAID REQUIREMENTS TO BE COMPATIBLE WITH CURRENT CONSTRUCTION PRACTICES AND TO SATISFY USER REQUIREMENTS. DATA AND INFORMATION COLLECTED WILL BE ANALYZED FOR ENGINEERING AND ECONOMIC (COST) IMPACT ON MILITARY AIRFIELD PAVEMENT DESIGN AND CONSTRUCTION. CRITERIA AND METHODS DEVELOPED WILL BE USED IN FORMULATING SPECIFICATIONS AND WILL BE INCORPORATED INTO GUIDE SPECIFICATIONS AND TECHNICAL MANUALS. AREAS UNDER INVESTIGATION INCLUDE: VIBRATORY ROLLERS, HOT-MIX RETENTION BINS, DRYER-DRUM MIXING PLANTS, FULL-WIDTH PAVING UNITS, SLIP-FORM CONCRETE PAVING PLACEMENT EQUIPMENT, DEEP-LIFT LAYDOWN OF ASPHALTIC CONCRETE, AND MODIFICATION OF MIXING-TIME REQUIREMENTS IN BOTH PCC AND ASPHALTIC CONCRETE PRODUCTION.

PERFORMING AGENCY: Waterways Experiment Station, Army Corps of Engineers

INVESTIGATOR: White, TD Malison, KD

SPONSORING AGENCY: Waterways Experiment Station, Army Corps of Engineers

STATUS: Active NOTICE DATE: Apr. 1975 START DATE: Apr. 1972 TOTAL FUNDS: \$150,000

ACKNOWLEDGMENT: Science Information Exchange (ZQA248156)

3R 101631**THE REACTION OF HIGHWAY PAVEMENTS TO DYNAMIC LOADING. PART C: STUDIES OF THE EXPERIMENTAL SUBGRADE, B 288**

THIS IS PART OF A CONTINUING PROGRAM IN WHICH 22 SECTIONS OF AN EXPERIMENTAL ROAD HAVE BEEN SUBJECTED TO HEAVY TRAFFIC SINCE 1959. THE B 288 SECTION, WHICH SUCCEEDS THE B 36 AND B 29 SECTIONS FOR THE STUDY OF ROAD BASES WITH VERY DIFFERENT STRUCTURES, EMPLOYS CONSTRUCTION METHODS THAT FROM EXPERIENCE ON OTHER EXPERIMENTAL SITES AND NEW ROADS APPEAR TO BE ESPECIALLY PROMISING FOR THE DEVELOPMENT OF STANDARD TYPES. THE STUDIES EMBRACE THE VARIOUS CONSTRUCTIONAL ELEMENTS AND THEIR MINIMUM THICKNESSES. /IRRD/IRF/

PERFORMING AGENCY: Federal Institute of Road Research, West Germany, 6.61

INVESTIGATOR: Buseck, H

SPONSORING AGENCY: Federal Ministry of Transport, West Germany

STATUS: Active NOTICE DATE: May 1974 START DATE: 1964

ACKNOWLEDGMENT: International Road Research Documentation, OECD (IRRD-R700405), International Road Federation (IRF 1(12))

3R 101730

RELATIONS BETWEEN THE STRUCTURE, DURABILITY AND SKID RESISTANCE OF EXCEPTIONALLY GOOD OR BAD FLEXIBLE PAVEMENTS

TESTS ARE BEING CARRIED OUT ON 85 SECTIONS OF ROAD TO SEE WHETHER THE SKIDDING RESISTANCE IS DUE TO THE STRUCTURE OF THE ROAD AND TO ESTABLISH THE RELATIONS WHICH EXIST BETWEEN ROAD STRUCTURE AND SKIDDING RESISTANCE. THE AGE OF AND THE TRAFFIC VOLUME CARRIED BY THE SURFACINGS IS ALSO BEING TAKEN INTO ACCOUNT. THE MEASUREMENTS OF SKIDDING RESISTANCE ARE BEING TAKEN ANNUALLY OVER A PERIOD OF 5 YEARS WITH THE STUTTGART FRICTION METER (LOCKED TRAILER WHEEL), AND THE ROAD STRUCTURE IS BEING ESTABLISHED BY MEANS OF CORES. THE AIM IS TO ESTABLISH REASONS FOR SKIDDING RESISTANCE SO THAT APPROPRIATE RECOMMENDATIONS CAN BE MADE WITH REGARD TO ROAD CONSTRUCTION. THE BAVARIAN ROAD AUTHORITIES WILL REPORT ON ROADS WHICH ARE KNOWN TO HAVE GOOD OR BAD NON-SKID PROPERTIES. OF THESE, 100 WILL BE SELECTED, TAKING THEIR AGE AND TRAFFIC LOADING INTO ACCOUNT. AFTER MEASUREMENT OF SLIPPERINESS AND WATER PENETRATION AND ANALYSIS OF THE CORES, THE RESULTS WILL BE COMPARED AND A RELATIONSHIP BETWEEN CONSTRUCTION, DURABILITY AND SLIPPERINESS WILL BE SOUGHT. /IRRD/IRF/

PERFORMING AGENCY: Federal Institute of Road Research, Inzel, W Ger, 7.38

INVESTIGATOR: Schmitz, H

SPONSORING AGENCY: Federal Ministry of Transport, West Germany

STATUS: Active NOTICE DATE: May 1974 TOTAL FUNDS \$22,500

ACKNOWLEDGMENT: International Road Research Documentation, OECD (IRRD-R700747), International Road Federation (IRF 5(18))

3R 101808

STUDY OF DARMSTADT-HEIDELBERG CONCRETE TEST SECTION

IN 1968, A CONCRETE PAVING WITHOUT EXPANSION JOINTS AND WITHOUT REINFORCEMENT, DEPARTING FROM THE CONVENTIONAL METHOD OF CONSTRUCTION, WAS LAID. WITH A VIEW TO THE USE OF THIS METHOD OF CONSTRUCTION, FOUR VARIANTS OF BASECOURSE AND TWO THICKNESSES OF PAVING WERE USED. INFORMATION IS TO BE OBTAINED AS TO THE PERFORMANCE OF THE CONCRETE PAVING, BOTH IN GENERAL AND UNDER TRAFFIC. DURING 1968 THE MAIN WORK WAS THE INSTALLATION OF THE NECESSARY MEASURING APPARATUS, BUT IN THE COMING YEARS SYSTEMATIC MEASUREMENTS WILL BE MADE ON SELECTED 120 M. LONG SECTIONS, FOR EACH TYPE OF PAVING. THE WORK WILL INCLUDE: MEASUREMENT OF AXLE LOADS, OBSERVATION OF CRACKS AND MEASUREMENT OF THE RUNNABILITY INDEX, MEASUREMENT OF TEMPERATURES, CAMBER DISTORTION AND HORIZONTAL PRESSURE STRESSES IN THE PAVING, MEASUREMENT OF THE OPENING UP AND CLOSING OF JOINTS, OF EARTH PRESSURE STRESSES, EXPANSION AND BENDING OF THE CONCRETE UNDER LOAD. THE REASON IS TO FIND A METHOD WHICH, COMPARED WITH THE CONVENTIONAL METHODS, WILL BE SIMPLER AND HENCE MORE ECONOMIC. THE SIMPLIFICATION CONSISTS ESSENTIALLY IN THE DISPENSING WITH EXPANSION JOINTS AND REINFORCEMENT, AND THE ECONOMY IN THE SAVING OF THE COSTS OF CONSTRUCTION. THE CONSTRUCTION WILL BE TESTED WITH A VIEW TO STANDARDIZATION. IN ADDITION, A COMPARISON WILL BE MADE BETWEEN THE MEASURED VALUES AND THOSE OBTAINED THEORETICALLY. /IRRD/IRF/

PERFORMING AGENCY: Federal Institute of Road Research, West Germany; State Road Office Hesse, West Germany

INVESTIGATOR: Schuster, FO Baum, G Buseck, H Keller, H Lenz, KH Meyer, H Eichberg, J Horner, HJ

SPONSORING AGENCY: Federal Ministry of Transport, West Germany

STATUS: Active NOTICE DATE: May 1974 START DATE: 1967 TOTAL FUNDS: \$750,000

ACKNOWLEDGMENT: International Road Research Documentation, OECD (IRRD-R700421), International Road Federation (IRF 1(50))

3R 102017

ENVIRONMENTAL DETERIORATION OF PAVEMENT

THE OBJECTIVES ARE TO PROVIDE USABLE AND ECONOMIC METHODS OF IMPROVING REMEDIAL MAINTENANCE AND PAVEMENT DESIGN AND REDUCING COSTS OF CONSTRUCTION AND MAINTENANCE BY (A) IDENTIFYING THE CAUSES OF PAVEMENT CRACKING IN WEST TEXAS, AND (B) TESTING THE EFFICIENCY OF SELECTED REMEDIES FOR THE PROBLEM. THE STUDY WILL PROVIDE A BASIS FOR EVALUATING THE CAUSES OF NON-TRAFFIC LOAD ASSOCIATED CRACKING. ONCE THE CAUSES ARE DETERMINED, REMEDIAL MAINTENANCE, FUTURE DESIGN AND CONSTRUCTION METHODS, AND MATERIALS SPECIFICATIONS CAN BE EXAMINED AND ALTERED, AS APPROPRIATE TO ESTABLISH THE NECESSARY CHANGES TO REDUCE OR ELIMINATE THIS TYPE OF DISTRESS. PAVEMENT OVERLAY SYSTEMS WILL BE SUGGESTED WHICH WILL BE AIMED AT PROVIDING A RELATIVELY MAINTENANCE-FREE SURFACING.

PERFORMING AGENCY: Texas Transportation Institute, Texas A&M University, Study No 2-8-73-18

INVESTIGATOR: Lytton, RL Epps, JA

SPONSORING AGENCY: Texas State Department of Highways & Public Transp; Federal Highway Administration, Department of Transportation

RESPONSIBLE INDIVIDUAL: McComb

HP&R 018

STATUS: Active NOTICE DATE: Jan. 1975 START DATE: Sept. 1972 COMPLETION DATE: Aug. 1976 TOTAL FUNDS \$140,000

ACKNOWLEDGMENT: Texas Transportation Institute, Federal Highway Administration (237402353)

3R 102045

IMPROVE PORTLAND CEMENT CONCRETE WEARING SURFACES

THIS STUDY WAS UNDERTAKEN TO DETERMINE THROUGH FIELD EXPERIMENTATION AND OBSERVATION THE EFFECTS THAT CONSTRUCTION TECHNIQUES AND MATERIALS HAVE ON THE PRODUCTION OF DURABLE TEXTURED CONCRETE SURFACES WHICH RESULT IN ENDURING SKID RESISTANCE. CHANGES IN CONTRACT CONTROLS AND CONSTRUCTION PROCEDURES ACCORDINGLY ARE RECOMMENDED.

PERFORMING AGENCY: California Department of Transportation, Division of Highways, Transportation Laboratory Branch, Study No. 19-635293

INVESTIGATOR: Spellman, DL Bailey, SN Woodstrom, JH Spickelmire, LS

SPONSORING AGENCY: California Department of Transportation, Division of Highways; Federal Highway Administration, Department of Transportation

RESPONSIBLE INDIVIDUAL: Smith, R

HP&R D-3-49

STATUS: Active NOTICE DATE: Oct. 1974 START DATE: Mar. 1973 COMPLETION DATE: June 1977 TOTAL FUNDS: \$201,800

ACKNOWLEDGMENT: California Department Transportation, Federal Highway Administration (256022351)

3R 102810

BRIDGE DECKS SPECIALLY CONSTRUCTED FOR INCREASED DURABILITY

CONVENTIONAL DESIGN AND CONSTRUCTION PRACTICES FOR SEVERAL BRIDGES HAVE BEEN MODIFIED AND CONSTRUCTION AND PERFORMANCES WILL BE MONITORED TO ASCERTAIN WHETHER THE MODIFICATIONS MAY PRACTICALLY AND ECONOMICALLY YIELD INCREASED DURABILITY FOR DECKS. CONSTRUCTION HAS BEEN CLOSELY MONITORED & PERIODIC PERFORMANCE SURVEYS WILL BE

CONDUCTED FOR AT LEAST FOUR YEARS OR UNTIL SUCH A TIME AS DEFINITE CONCLUSIONS MAY BE FORTHCOMING. CONSTRUCTION OF BRIDGES CONTAINING GALVANIZED STEEL WILL BE MONITORED AND THEIR MAINTENANCE RECORDS WILL BE COMPARED TO CONVENTIONAL STEEL BRIDGES TO DETERMINING THE POTENTIAL ECONOMY OF USING GALVANIZED STEEL. DECKS CONTAINING MODULAR EXPANSION SYSTEMS WILL BE STUDIED.

PERFORMING AGENCY: Kentucky Department of Transportation, Bureau of Highways, Research Division, KYP-71-25

INVESTIGATOR: Havens, JH Hughes, RD Rahal, A

SPONSORING AGENCY: Kentucky Department of Transportation, Bureau of Highways

STATUS: Active NOTICE DATE: Feb. 1975 START DATE: 1971

ACKNOWLEDGMENT: Kentucky Department of Transportation

3R 102869

COMPUTERIZED DESIGN PROCEDURES FOR PREDICTING, EVALUATING, AND OPTIMIZING TIME-DEPENDENT EFFECTS IN REINFORCED, PARTIALLY PRESTRESSED AND FULLY PRESTRESSED NONCOMPOSITE CONCRETE STRUCTURES

INVESTIGATOR: Branson, DE

SPONSORING AGENCY: Iowa State Highway Commission; Iowa University, Iowa City

STATUS: Active NOTICE DATE: Mar. 1972 START DATE: Sept. 1970

ACKNOWLEDGMENT: American Concrete Institute

3R 103090

SHEAR CONNECTORS FOR PRECAST COMPOSITE CONSTRUCTION

AN ATTEMPT IS BEING MADE TO DEVELOP CONSTRUCTION TECHNIQUES AND DESIGN CRITERIA FOR CERTAIN TYPES OF SHEAR CONNECTORS. /IRF/

PERFORMING AGENCY: Queensland University, Australia, Department of Civil Engineering

INVESTIGATOR: Koretsky, AV

SPONSORING AGENCY: Australian Road Research Board

STATUS: Active NOTICE DATE: June 1974 START DATE: 1968

ACKNOWLEDGMENT: International Road Federation (IRF 17a(20))

3R 103770

DETERIORATION OF CONCRETE BRIDGE DECKS

THIS PROJECT IS BEING CONDUCTED TO STUDY AND DETERMINE THE RESULTS OF SURVEYS OF THE DETERIORATION OF IN-SERVICE BRIDGE DECKS, THE EFFECT OF CONSTRUCTION PROCEDURE AND PRACTICES UPON THE DETERIORATION OF CONCRETE IN BRIDGE DECKS, THE ASSOCIATION BETWEEN FRACTURE PLANE OCCURRENCE AND RUSTING OR DEPTH OF REINFORCING, THE PHYSICAL DIFFERENCE BETWEEN CONCRETE IN DETERIORATED AND NON-DETERIORATED AREAS OF A BRIDGE DECK, THE MERIT OF INSULATING THE UNDERSIDE OF A CONCRETE BRIDGE DECK, THE CHLORINE CONTENT IN THE TOP 2 INCHES OF A CONCRETE BRIDGE DECK, THE SERVICE PERFORMANCE OF A BRIDGE DECK TREATED WITH AN EPOXY RESIN SEAL COAT, THE SERVICE OF BRIDGE DECK CONCRETE WHEREIN DOW CORNING 777 WAS USED AS AN ADMIXTURE, AND THE EFFECTIVENESS OF WATERPROOFING MEMBRANES IN PROTECTING A BRIDGE DECK. REPORTS ISSUED:

PERFORMING AGENCY: Missouri State Highway Commission, Division of Materials and Research, Study No. 62-1

SPONSORING AGENCY: Missouri State Highway Commission; Federal Highway Administration, Department of Transportation

RESPONSIBLE INDIVIDUAL: Clear

HP&R 62-1

STATUS: Active NOTICE DATE: Oct. 1974 START DATE: Aug. 1961 TOTAL FUNDS: \$125,000

ACKNOWLEDGMENT: Missouri State Highway Commission, Federal Highway Administration (296300351)1P27020107, 1P27020226, 2R32012534

3R 103894

LEAN CEMENT CONCRETE FOR ROADBASES

THE RHEOLOGY, COMPACTION AND OTHER CONSTRUCTION TECHNIQUES, ECONOMICS, LOAD-CARRYING CAPACITY AND PERFORMANCE OF LEAN CEMENT CONCRETE ARE STUDIED AS MATERIAL FOR BONDED UNDERLAY AND ROADBASES. /IRF/

PERFORMING AGENCY: Central Road Research Institute, India, Council for Scientific and Industrial Research

INVESTIGATOR: Ghosh, RK Garg, AK Malhotra, JN

SPONSORING AGENCY: Council for Scientific & Industrial Res, India

STATUS: Active NOTICE DATE: May 1974 START DATE: 1965

ACKNOWLEDGMENT: International Road Federation (IRF 1a(38))

3R 103895

POZZOLAN CEMENT CONCRETE, LIME-POZZOLAN CONCRETE AND LIME-POZZOLAN MIXTURE-BOUND MACADAM IN PAVEMENTS

THE RHEOLOGY, CONSTRUCTION TECHNIQUES, ECONOMICS, LOAD-CARRYING CAPACITY AND PERFORMANCE OF POZZOLAN CEMENT CONCRETE, LIME-POZZOLAN CONCRETE AND LIME-POZZOLAN MIXTURE- MACADAM ARE BEING STUDIED AS PAVEMENT MATERIAL IN SURFACINGS, COMPOSITE CONSTRUCTION AND ROADBASE, WITH A VIEW TO PROVIDING ALTERNATIVE AND ECONOMIC MATERIALS FOR PAVEMENT CONSTRUCTION. /IRF/

PERFORMING AGENCY: Central Road Research Institute, India, Council for Scientific and Industrial Research

INVESTIGATOR: Ghosh, RK Sethi, KI

SPONSORING AGENCY: Council for Scientific & Industrial Res, India

STATUS: Active NOTICE DATE: May 1974 START DATE: 1965

ACKNOWLEDGMENT: International Road Federation (IRF 1a(39))

3R 104330

SUMMARY REPORTS: CONCRETE-POLYMER TECHNOLOGY

THESE REPORTS WILL SUMMARIZE VALUABLE INFORMATION FROM PREVIOUSLY PUBLISHED TOPICAL REPORTS COVERING YEARLY PROGRESS OF JOINT RESEARCH ON CONCRETE-POLYMER MATERIALS. FIVE REPORTS ON INDIVIDUAL AREAS OF TECHNOLOGY ARE PLANNED; (1) OVER-ALL CONCRETE-POLYMER STUDIES, (2) MONOMER AND COMPOSITE EXPERIMENTS, (3) PROCESS TECHNOLOGY, (4) STRUCTURAL PROPERTIES, AND (5) APPLICATION DEVELOPMENTS. THE REPORTS WILL SUMMARIZE IN A READILY USABLE FORM INFORMATION AND EXPERIENCE GATHERED OVER SEVERAL YEARS OF RESEARCH IN THIS FIELD.

PERFORMING AGENCY: Bureau of Reclamation, DR-370

INVESTIGATOR: Selander, CE

SPONSORING AGENCY: Bureau of Reclamation

STATUS: Active NOTICE DATE: Feb. 1974 START DATE: Jan. 1973 COMPLETION DATE: Jan. 1974

ACKNOWLEDGMENT: Bureau of Reclamation

3R 104332

POLYMER-IMPREGNATED CONCRETE (PIC) PIPE

BEFORE A SYSTEM OF PIC PIPE CAN BE SPECIFIED FOR USAGE, A THOROUGH DESIGN KNOWLEDGE MUST BE OBTAINED AND THE SERVICE REQUIREMENT STANDARDS MUST BE INVESTIGATED. THE PROGRAM IS DESIGNED TO COMPARE UNREINFORCED PRECAST PIC PIPE WITH REINFORCED PRECAST CONCRETE PIPE. GOALS OF THE PROGRAM ARE TO YIELD COMPLETE DESIGN INFORMATION, SERVICE REQUIREMENTS, MANUFACTURING TECHNIQUES, AND AN EVALUATION OF THE ECONOMIC BENEFITS. IF THE OUTCOME OF THE ECONOMIC STUDY OF PIC PIPE IN FY74 IS FAVORABLE, IT IS

PROPOSED TO INVESTIGATE THE MANUFACTURING AND CONSTRUCTION TECHNIQUES OF THIS PIPE AS FOLLOWS: (A) CORRELATE INFORMATION FROM OTHER CONCRETE-POLYMER MATERIALS PROGRAMS TO DETERMINE THAT WHICH APPLIED TO THE PIPE PROGRAM, (B) APPLICATION OF POLYMER IMPREGNATION TO PRESTRESSED CONCRETE PIPE (C) METHODS OF REPAIR, AND (D) SURFACE IMPREGNATION BY SPRAYING AND/OR BRUSHING.

PERFORMING AGENCY: Bureau of Reclamation, DR-344
 INVESTIGATOR: Riffle, HC
 SPONSORING AGENCY: Bureau of Reclamation, *; American Concrete Pipe Association

STATUS: Active NOTICE DATE: Feb. 1974 START DATE: May 1971 COMPLETION DATE: May 1974

ACKNOWLEDGMENT: Bureau of Reclamation

3R 104588

LONG-TERM SETTLEMENT STUDY OF BRIDGE APPROACHES
 CONSTRUCTION PROCEDURES WILL BE DEVELOPED TO DECREASE THE CORRECTIVE WORK TO REDUCE BUMPS AT STRUCTURE APPROACHES AFTER FREEWAYS ARE OPENED TO PUBLIC TRAFFIC. ANY HYPOTHESIS DEVELOPED DURING THE STUDY WILL LATER BE SUBJECT TO VERIFICATION BY OTHER FULL SCALE EXPERIMENTAL TEST SECTIONS.

PERFORMING AGENCY: California Department of Transportation, Division of Highways, Transportation Laboratory Branch, Study No. 19-632400
 INVESTIGATOR: Forsyth, RA Hirsch, AD Yee, WS
 SPONSORING AGENCY: California Department of Transportation, Division of Highways; Federal Highway Administration, Department of Transportation
 RESPONSIBLE INDIVIDUAL: Krylowski

HP&R D-4-035

STATUS: Active NOTICE DATE: Oct. 1974 START DATE: Aug. 1965 COMPLETION DATE: Dec. 1974 TOTAL FUNDS: \$80,800

ACKNOWLEDGMENT: California Department of Transportation, Federal Highway Administration (059423353)

3R 104601

COLD WEATHER CONSTRUCTION
 PROCEDURES WILL BE DEVELOPED WHICH WILL ALLOW CONSTRUCTION TO BE EFFECTIVELY AND ECONOMICALLY PERFORMED UNDER COLD WEATHER CONDITIONS. LABORATORY AND FIELD TESTS WILL BE CONDUCTED TO EVALUATE AND COMPARE DESIGN AND CONSTRUCTION METHODS UTILIZING WINTERTIME CONSTRUCTION PROCEDURES. REPORTS ISSUED: USA CRREL SPECIAL REPORT 172, LITERATURE SURVEY OF COLD WEATHER CONSTRUCTION PRACTICES, J.A. HAVERS & R.M. MORGAN, MAY 1972. USA CRREL SPECIAL REPORT 204, BIBLIOGRAPHY ON WINTER CONSTRUCTION, 1967-1971, C.W. KAPLER, APRIL 1974. USA CRREL SPECIAL REPORT 74-288, TEMPORARY ENCLOSURES AND HEATING DURING CONSTRUCTION, L. BENNETT. (DRAFT IN PROCESS OF PUBLICATION). USA CRREL SPECIAL REPORT 74-29, INCREASING THE EFFECTIVENESS OF SOIL COMPACTION AT BELOW FREEZING TEMPERATURES, W. HAAS, B. ALKIRE AND T. KADERABEK. (DRAFT IN PROCESS OF PUBLICATION).

PERFORMING AGENCY: Cold Regions Research and Engineering Laboratory, Department of the Army, AM-1-01-004
 INVESTIGATOR: Sayles, F
 SPONSORING AGENCY: Army Corps of Engineers, Department of the Army

STATUS: Active NOTICE DATE: Nov. 1974 START DATE: July 1968 COMPLETION DATE: June 1975 TOTAL FUNDS: \$313,000

ACKNOWLEDGMENT: Cold Regions Research and Engineering Laboratory

3R 104699

METHODS FOR SAMPLING AND CONTROL OF ROAD CONSTRUCTION

THE NIRR IS AIMING AT INTRODUCING ITS SCHEME FOR QUALITY CONTROL INTO GENERAL ROAD PRACTICE IN SOUTH AFRICA. THE FEASIBILITY OF USING THE SCHEME IN PRACTICAL ROAD CONSTRUCTION WILL BE TESTED. ASSISTANCE IS BEING OFFERED TO ROAD AUTHORITIES IN THE DRAFTING OF SPECIFICATIONS IN ACCORDANCE WITH THE SCHEME. DATA WILL BE COLLECTED ON COSTS AND ON THE VARIABILITY OF PARAMETER, WHICH CAN BE USED TO IMPROVE THE EFFECTIVENESS OF THE PRACTICAL USE OF THIS QUALITY CONTROL SCHEME. /IRF/

PERFORMING AGENCY: Nat Inst Road Research /S Africa/, 9431/4541; Cncl Scient & Indus Res /S Africa/
 INVESTIGATOR: Kuhn, SH Walker, RN
 SPONSORING AGENCY: Nat Inst Road Research /S Africa/, 9431/4541

STATUS: Active NOTICE DATE: Jan. 1974 START DATE: 1970 COMPLETION DATE: 1975

ACKNOWLEDGMENT: International Road Federation IRF 1A(66), 2R33600799

3R 105052

CORROSION OF STEEL PILES

THE EFFECT OF THE SAN FRANCISCO BAY ENVIRONMENT ON STEEL "H" PILES, METHODS OF ARRESTING CORROSION OF EXISTING STEEL PILES, AND PROPOSED CONSTRUCTION METHODS THAT MIGHT PREVENT EXCESSIVE CORROSION WILL BE INVESTIGATED.

PERFORMING AGENCY: California Department of Transportation, Toll Bridge Administration, Study No 15-627137
 INVESTIGATOR: Spellman, DL Stratfull, RF Balala, B
 SPONSORING AGENCY: California Department of Transportation, Division of Highways; Federal Highway Administration, Department of Transportation
 RESPONSIBLE INDIVIDUAL: Berman

HP&R D-3-50

STATUS: Active NOTICE DATE: Oct. 1974 START DATE: Apr. 1972 COMPLETION DATE: June 1975 TOTAL FUNDS: \$247,000

ACKNOWLEDGMENT: California Department of Transportation, Federal Highway Administration (152012351)

3R 105108

UNDERWATER WELDING

THIS PROGRAM WAS DESIGNED TO INVESTIGATE THE METALLURGICAL FACTORS OF SIGNIFICANCE IN THE UNDERWATER WELDING OF FERROUS MATERIALS. WHILE SOME DEGREE OF SUCCESS HAS BEEN REPORTED USING DEVICES WHICH EFFECTIVELY EXPEL THE WATER FROM THE ZONE OF WELDING, THESE METHODS SEVERELY LIMIT THE TYPE AND VERSATILITY OF WELDS WHICH MAY BE NECESSARY TO PRODUCE. WHETHER OR NOT THE WATER IS IN CONTACT WITH THE WELDING OPERATION, THE WELD METAL AND ASSOCIATED HEAT AFFECTED ZONE ARE SUBJECT TO EXTREMELY RAPID COOLING RATES RESULTING IN WELDS OF HIGH HARDNESS AND RESULTANT HIGH CRACK SENSITIVITY. WHEN THE WELD IS PRODUCED IN CONTACT WITH WATER, THE WELD METAL IS FURTHER SUBJECT TO POROSITY. ACCORDINGLY, THE CONTRIBUTIONS TO THESE PROBLEMS OF THE ALLOYING ELEMENTS PRESENT IN STEELS TO BE WELDED, AND THE WELD METAL ITSELF, MUST BE DETERMINED IN ORDER TO ESTABLISH THE LIMITING CONDITIONS FOR UNDERWATER WELDING. FURTHER STUDY SHOULD ALSO BE GIVEN TO OTHER METALLURGICAL PARAMETERS SUCH AS RATE OF SOLIDIFICATION, MODEL MODE OF SOLIDIFICATION, RATE OF COOLING THROUGH THE CRITICAL TRANSFORMATION, RESPONSE TO COOLING RATE, ETC.

PERFORMING AGENCY: Wisconsin University, Madison
 INVESTIGATOR: Loper, C Miller, R
 SPONSORING AGENCY: Commonwealth Dept of Works /Australia/; Nat
 Oceanic & Atmospheric Admin, NOAA

STATUS: Active NOTICE DATE: Apr. 1974

ACKNOWLEDGMENT: Science Information Exchange

3R 105235

RELATIONSHIP BETWEEN THE PETROLOGICAL NATURE OF SHALES, WEATHERING TESTS, CONSTRUCTION TECHNIQUE AND SERVICE RECORD

TESTING PROCEDURES ARE BEING DEVELOPED TO INDICATE THE SUITABILITY OF SHALES AND SIMILAR FISSILE ROCKS FOR USE AS PAVEMENT MATERIALS. A METHOD SIMULATING BREAKDOWN UNDER COMPACTION EQUIPMENT BY REPETITIVE COMPACTION IN THE LABORATORY HAS BEEN ADOPTED TENTATIVELY. OTHER PROCEDURES RESULTING FROM WORK CARRIED OUT BY THE INSTITUTE OF HIGHWAY AND TRAFFIC RESEARCH (UNIVERSITY OF N.S.W.) FOR THE DEPARTMENT OF MAIN ROADS, ARE TO BE TRIED. /IRF/

REFERENCES:

The Testing of Barixitic Gravel for Road Base Construction West, NW; Denham, SC, Australian Road Research Board, Proceedings, Vol. 6, No. 5, pp 107-123, 1972

PERFORMING AGENCY: New South Wales Department of Main Roads-Australia

INVESTIGATOR: Davidson, WH

SPONSORING AGENCY: New South Wales Department of Main Roads-Australia

STATUS: Active NOTICE DATE: May 1974 START DATE: 1960

ACKNOWLEDGMENT: International Road Federation (IRF 5(5))

3R 105536

SUBAQUEOUS TUNNELS

STUDIES AND TESTS WILL BE CONDUCTED ON METHODS OF CONSTRUCTION FOR TRENCH TYPE TUNNELS AND METHODS OF TUNNEL EXCAVATION UNDER HIGH WATER PRESSURES IN CASE OF SUBAQUEOUS TUNNELS. /IRRD/IRF/

REFERENCES:

Stress Analysis on Six Lane Immersed Tunnel Tatushi, S; Mizutani, T, Civil Engineering Journal, Aug. 1970

A Test of Sand Jetting for Foundation on Immersed Tunnels Tateishi, S; Mizutani, T; Maruyama, Technical Memorandum of PWRI

PERFORMING AGENCY: Public Works Research Institute, Japan, Ministry of Construction, Chiba Branch

INVESTIGATOR: Konda, T Mizutani, T

SPONSORING AGENCY: Ministry of Construction, Japan

STATUS: Active NOTICE DATE: Apr. 1974 START DATE: Apr. 1966

ACKNOWLEDGMENT: International Road Research Documentation, OECD (IRRD-R51084), International Road Federation (IRF 16(51))

3R 105656

REPAIR OF ROADS AND AIRFIELDS IN A WINTER ENVIRONMENT

THE OBJECTIVE IS TO PROVIDE FIELD ENGINEERS WITH ENGINEERING CRITERIA AND CONSTRUCTION TECHNIQUES FOR RAPIDLY REPAIRING DAMAGED ROADS AND AIRFIELDS IN A WINTER ENVIRONMENT IN THE THEATER OF OPERATIONS. LABORATORY AND FIELD TESTS WILL BE CONDUCTED ON RAPID-SETTING CONCRETES AND SYNTHETIC MATERIALS IN COLD ENVIRONMENTS. NEW AND IMPROVED METHODS FOR USING INDIGENOUS MATERIALS, INCLUDING SNOW AND FROZEN SOIL, WILL BE STUDIED.

PERFORMING AGENCY: Cold Regions Research and Engineering Laboratory, Department of the Army, AT31-03-003

INVESTIGATOR: Smith, N

SPONSORING AGENCY: Army Corps of Engineers, Department of the Army

STATUS: Active NOTICE DATE: Nov. 1974 START DATE: July 1973 COMPLETION DATE: June 1976 TOTAL FUNDS: \$120,000

ACKNOWLEDGMENT: Cold Regions Research and Engineering Laboratory

3R 105658

SPECIAL TESTING FOR DUST ABATEMENT AND ROAD STABILIZATION

THE OBJECTIVES ARE: (1) ACQUAINT ENGINEERS WITH METHODS, PRODUCTS AND EQUIPMENT AVAILABLE FOR ROADWAY DUST CONTROL AND STABILIZATION; (2) DETERMINE THROUGH PROPER CONSTRUCTION METHODS FOLLOWED BY LONG-TERM EVALUATION, WHAT METHODS AND MATERIALS ARE EFFECTIVE AND ECONOMICAL FOR USE ON, OR WITHIN, UNIMPROVED SECONDARY ROADS; AND (3) INTRODUCE ENGINEERS TO METHODS OF RECLAIMING AND/OR UPGRADING EXISTING SECONDARY ROADS THAT ARE FAILING UNDER TRAFFIC AND/OR ENVIRONMENTAL CONDITIONS.

This is a cooperative research project in affiliation with: Allis-Chalmers Construction Machinery Division; American Admixtures; American Can Company; Armak Highway Chemicals Department; Bitucote Products Company; CIBA-Geigy; Del Chemical Corporation; Dow Chemical U.S.A.; Emulsified Asphalts, Inc.; Flambeau Paper Company; ITT Rayonier, Inc.; Linwood Stone Products Company, Inc.; National Ash Association; National Chemical Stabilization Association; National Lime Association; Salt Institute; Sandar Inc.; Saunders Petroleum Company; and Scott Paper Company.

Stabilization-Holding The Roads I.S.U. Film Production Unit Koehring Rd Div, Educational Film, 1973

PERFORMING AGENCY: Engineering Research Institute, Iowa State University, 1049-S

INVESTIGATOR: Hoover, JM Handy, RL

SPONSORING AGENCY: Koehring Company; Engineering Research Institute, Iowa State University

STATUS: Active NOTICE DATE: Mar. 1975 START DATE: June 1973 COMPLETION DATE: June 1976 TOTAL FUNDS: \$14,500

ACKNOWLEDGMENT: Iowa State University, Ames

3R 109011

NEGATIVE SKIN FRICTION ON PILES IN CLAY SOILS

A CLAY SOIL CONSOLIDATING AROUND A PILE FOUNDATION IMPARTS TO IT AN ADDITIONAL VERTICAL LOAD DUE TO SKIN FRICTION FORCES DEVELOPED AS THE CLAY MOVES DOWNWARD RELATIVE TO THE PILE. TO STUDY THE NATURE AND MAGNITUDE OF SKIN FRICTION IN LEDA CLAY SOILS, TWO STEEL-CONCRETE COMPOSITE PILES, 39 INCHES IN DIAMETER BY 300 FEET LONG, WERE DRIVEN TO BEDROCK TO SUPPORT AN OVERPASS ON THE NORTH SHORE AUTOROUTE IN QUEBEC. AT THE SAME SITE A FLOATING 12 INCH DIAMETER BY 160 FOOT LONG HOLLOW STEEL FRICTION TEST PILE WAS INSTRUMENTED TO STUDY THE NATURE AND MAGNITUDE OF BOTH NEGATIVE AND POSITIVE SKIN FRICTION LOADS GENERATED ON IT. AT ANOTHER SITE, NEAR OTTAWA, ONTARIO, A 16 INCH DIAMETER HOLLOW STEEL END BEARING PILE IS INSTRUMENTED. THE CLAY SOIL AROUND IT WAS SURCHARGED WITH A CIRCULAR FILL. INSTRUMENTATION OF THESE PILES CONSISTED OF MECHANICAL DEFORMATION GAUGES TO MEASURE THE DEFORMATION IN THE PILES, ELECTRICAL STRAIN METERS, VERTICAL SETTLEMENT GAUGES TO MEASURE THE SETTLEMENT IN THE SURROUNDING SOIL AND PIEZOMETERS. LABORATORY TESTS ARE UNDERWAY TO MEASURE THE COEFFICIENT OF FRICTION BETWEEN THE PILE & THE SOIL. /RTAC/ REPORTS ISSUED: FIELD OBSERVATIONS OF NEGATIVE SKIN FRICTION LOADS ON LONG PILES IN MARINE CLAY, M. BOZOZUK, LEHIGH CONFERENCE PROCEEDINGS ON DESIGN AND INSTALLATION OF PILE FOUNDATIONS AND CELLULAR STRUCTURES, ENVO PUBLISHING CO., APR 70, PP 273-80. DOWNDRAG MEASUREMENTS ON A 160 FT FLOATING TEST PILE IN MARINE CLAY, M. BOZOZUK, CANADIAN GEOTECHNICAL JOURNAL, VOL. 9, NO 2, P 127, MAY 72.

PERFORMING AGENCY: National Research Council of Canada, Division of Building Research, K6,K9
 INVESTIGATOR: Bozozuk, M Eden, WJ
 SPONSORING AGENCY: National Research Council of Canada

STATUS: Active NOTICE DATE: Oct. 1975 START DATE: 1966

ACKNOWLEDGMENT: National Research Council of Canada, Div Bldg Res, Roads and Transportation Association of Canada

3R 109478

DESIGN CRITERIA FOR FOUNDATIONS IN COLD REGIONS
 CRITERIA FOR ADEQUATE AND ECONOMICAL DESIGN AND CONSTRUCTION AND MAINTENANCE OF FOUNDATIONS IN PERMAFROST AREAS UNDER VARIOUS CONDITIONS OF LOADING WILL BE DEVELOPED. THEORETICAL STUDIES AND DESIGN PROCEDURES WILL BE CONSOLIDATED. PERFORMANCE SURVEYS WILL BE MADE OF EXISTING FOUNDATIONS. LABORATORY AND FIELD OBSERVATIONAL PROGRAMS WILL BE CONDUCTED. REPORTS ISSUED: INSTALLATION OF DRIVEN TEST PILES IN PERMAFROST AT BETHEL AIR FORCE STATION, ALASKA, F.E. CRORY, USACRREL TECHNICAL REPORT 139, 1973.

PERFORMING AGENCY: Cold Regions Research and Engineering Laboratory, Department of the Army, AT06-04-001
 INVESTIGATOR: Crory, F Blouin, S Sayles, F
 SPONSORING AGENCY: Army Corps of Engineers, Department of the Army

STATUS: Active NOTICE DATE: Nov. 1974 START DATE: July 1969 COMPLETION DATE: June 1978 TOTAL FUNDS: \$756,000

ACKNOWLEDGMENT: Cold Regions Research and Engineering Laboratory

3R 109915

METHODS OF ROAD CONSTRUCTION FOR LANDSLIDE AREAS
 THE BEHAVIOR OF LANDSLIDES IN THE EXPERIMENTAL AREA IS BEING OBSERVED. ROAD CONSTRUCTION METHODS IN LANDSLIDE AREAS ARE BEING STUDIED. /IRRD/IRF/
 REFERENCES:

Method of Road Construction for Landslide Areas Yamashita, H; Sakai, A. Public Works Research Institute, Annual Report, 1963

PERFORMING AGENCY: Public Works Research Institute, Japan, Niigata Experimental Laboratory
 INVESTIGATOR: Sakai, A
 SPONSORING AGENCY: Ministry of Construction, Japan

STATUS: Active NOTICE DATE: May 1974 START DATE: 1963 COMPLETION DATE: 1975

ACKNOWLEDGMENT: International Road Research Documentation, OECD (IRRD-R51147), International Road Federation (IRF 16(114))

3R 110088

BEHAVIOR OF TUNNELS AND OPEN CUTS IN THE WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY BASIC SUBWAY SYSTEM
 A THREE YEAR STUDY OF THE CONSTRUCTION PERFORMANCE OF BRACED CUTS AND TUNNELS IS UNDERWAY IN WASHINGTON. CONSTRUCTION METHODS AND SOIL AND ROCK CONDITIONS WILL BE OBSERVED; AND SOIL AND ROCK DISPLACEMENTS, SUPPORT LOADS, BLASTING VIBRATIONS, AND WATER LEVELS WILL BE MEASURED. INFORMATION COLLECTED WILL BE USED TO MONITOR STABILITY DURING CONSTRUCTION AND TO IMPROVE DESIGN PROCEDURES FOR FUTURE CONSTRUCTION. /UI/

PERFORMING AGENCY: Illinois University, Urbana
 INVESTIGATOR: Hansmire Mahar Jones Cording, EJ
 SPONSORING AGENCY: Washington Metropolitan Area Transit Authority

STATUS: Active NOTICE DATE: Mar. 1975 START DATE: Mar. 1970 TOTAL FUNDS: \$354,000

ACKNOWLEDGMENT: Illinois University, Urbana

3R 110412

STRESS ON COMPARABLE FROST-RESISTANT ROAD STRUCTURES

APART FROM THE STANDARD BITUMINOUS PAVEMENTS AND CONCRETE PAVEMENTS IN ACCORDANCE WITH THE SPECIFICATION TV-BETON 72. RECENTLY THERE HAVE BEEN NEW DEVELOPMENTS IN THE FORM OF FULL-DEPTH ASPHALT PAVEMENTS AND CONSTRUCTION METHODS EMPLOYING HEAT INSULATING COURSES. THE WORKING COMMITTEE ON FROST HAS DECIDED TO STUDY THE EQUIVALENT OF THESE CONSTRUCTION METHODS. IT IS NOT SUFFICIENT TO COMPARE THE DIFFERENT ROAD STRUCTURES SOLELY IN RESPECT TO POSSIBLE FROST PENETRATION; AT THE SAME TIME THE STRESSING OF THESE STRUCTURES BY TRAFFIC LOADS, PARTICULARLY DURING THE CRITICAL PERIOD OF THAW, NEEDS TO BE CONSIDERED. FIRST A SELECTION OF EIGHT POSSIBLE FROST-RESISTANT METHODS OF CONSTRUCTION WAS MADE. THESE ARE TO BE EXAMINED TO DETERMINE THE STRESS CAUSED BY TRAFFIC. FOR THIS, CALCULATION BY MEANS OF MULTI-LAYERED THEORY OF THE STRESSES AND DEFORMATIONS WHICH OCCUR IN THE INDIVIDUAL LAYERS OF THE STRUCTURE IN RELATION TO DIFFERENT PERIODS OF THE YEAR (TEMPERATURE, SUBSOIL BEARING CAPACITY) IS NECESSARY. THE STRESSES AND DEFORMATIONS WHICH OCCUR HAVE TO BE COMPARED WITH PERMITTED VALUES. IN ASSOCIATION WITH THE RESULTS OF THE HEAT FLOW CALCULATION (FROST PENETRATION) FOR THESE METHODS, A STATEMENT CAN BE MADE ABOUT THEIR EQUIVALENCE. /IRRD/IRF/

PERFORMING AGENCY: Technical University of Munich, West Germany. Institute for Construction of Land Transport Routes
 SPONSORING AGENCY: Federal Ministry of Transport, West Germany

STATUS: Active NOTICE DATE: May 1974 START DATE: 1973

ACKNOWLEDGMENT: International Road Research Documentation, OECD (IRRD-R700166), International Road Federation (IRF 28j(6))

3R 111369

SNOW AND ICE PREDICTION IN WINTER ENVIRONMENTS
 THE PURPOSE OF THIS RESEARCH IS TO PROVIDE A DESCRIPTION OF THE SNOW AND ICE CONDITIONS ON EARTH AND ESTABLISH TECHNIQUES TO PREDICT THIS ASPECT OF THE WINTER ENVIRONMENT USING CERTAIN CLIMATIC AND METEOROLOGICAL INPUTS. THESE OBJECTIVES ARE ACCOMPLISHED THROUGH THE ANALYSIS OF WEATHER DATA AND FIELD OBSERVATIONS ON THE DEPTH AND PHYSICAL PROPERTIES OF THE SNOW COVER ON THE FORMATION, GROWTH & DECAY OF SURFACE ICE, & ON THE FREQUENCY-DURATION OCCURRENCES OF VARIOUS FORMS OF FROZEN PRECIPITATION. SUCH INFORMATION IS USEFUL IN VEHICULAR MOBILITY AND SAFETY IN WINTER CONSTRUCTION OF AIRFIELDS, ROADS AND BUILDINGS AND IN OTHER DISCIPLINES SUCH AS COMMUNICATIONS AND HIGHWAY MAINTENANCE. IN COOPERATION WITH OTHER U.S. AND CANADIAN AGENCIES, USACRREL SUPPORTS AND MAINTAINS SEVERAL SNOW AND ICE OBSERVING NETWORKS THROUGHOUT NORTH AMERICA. AN ESTABLISHED SYSTEM OF QUALITY CONTROL, COLLECTION AND TABULATION CONTINUES, AND REPORTS FROM THE INFORMATION PROVIDE NEW KNOWLEDGE AND TECHNIQUES TO PREDICT REGIONAL AND SEASONAL VARIATIONS IN SNOW, ICE AND CLIMATE.

REFERENCES:
 Climatic Conditions in Winter at Some Selected Urban Sites in the U.S., Bilello, M, Cold Regions Research and Engineering Laboratory, Internal Report No. 234
 Snow, Ice and Winter Temperatures in the Libby Dam, Montana Drainage Basin, Bilello, M, Cold Regions Research and Engineering Laboratory, Technical Note, May 1974

PERFORMING AGENCY: Cold Regions Research and Engineering Laboratory, Department of the Army, AT31-03-004
 INVESTIGATOR: Bilello, MA
 SPONSORING AGENCY: Army Corps of Engineers, Department of the Army

STATUS: Active NOTICE DATE: Nov. 1974 START DATE: July 1973 TOTAL FUNDS \$140,000

ACKNOWLEDGMENT: Cold Regions Research and Engineering Laboratory

3R 115254

PLANNING AND CONTROL OF CONSTRUCTION PROCESS

Based on many observations and studies for operations and circumstances in some constructions, a planning and controlling system of the project with a computer model that simulates the construction process, is developed. This system gives the optimum decision in planning and controlling of the construction process. /IRRD-IRF/

PERFORMING AGENCY: Public Works Research Institute, Japan, Ministry of Construction, Chiba Branch

INVESTIGATOR: Chida, S. Kumagai, K. Aida, M.

SPONSORING AGENCY: Ministry of Construction, Japan

IA

STATUS: Active NOTICE DATE: Sept. 1974 START DATE: Apr. 1972 COMPLETION DATE: Mar. 1977

ACKNOWLEDGMENT: International Road Federation (IRF 1B(155)), International Road Research Documentation, OECD

3R 115257

SAFETY IN CONSTRUCTION MACHINERY

The purpose of this study is to investigate the security of construction machineries. Operator-protecting equipments are being evaluated in field tests of different construction machines. /IRRD-IRF/

PERFORMING AGENCY: Public Works Research Institute, Japan, Ministry of Construction, Chiba Branch

INVESTIGATOR: Serizawa, T. Nakano, S.

SPONSORING AGENCY: Ministry of Construction, Japan

IA

STATUS: Active NOTICE DATE: Sept. 1974 START DATE: Apr. 1974 COMPLETION DATE: Mar. 1977 TOTAL FUNDS: \$65,000

ACKNOWLEDGMENT: International Road Federation (IRF 1B(158)), International Road Research Documentation, OECD

3R 115323

UNDERWATER CONCRETING METHODS [Suichu Konkurito Sekoho]

The authors studies preplaced aggregate concrete and tremie concrete methods for the past ten years and have executed many concrete structures under water using these methods. But in these procedures, it was apparent that these methods have substantial, unavoidable defects. So, a new type tremie method called the KDT tremie method was developed and studied. This new tremie method was found to have many advantages in comparison with the conventional tremie method. The study has been continued to obtain detailed data at the job site. An experimental application of the method to an underwater reinforced concrete slab is now under study. /IRRD-IRF/

PERFORMING AGENCY: Kajima Institute of Construction Technology, Japan

INVESTIGATOR: Nakahara, Y. Ohtomo, T. Yokota, S.

SPONSORING AGENCY: Kajima Corporation

STATUS: Active NOTICE DATE: Sept. 1974 START DATE: Dec. 1970 COMPLETION DATE: May 1975

ACKNOWLEDGMENT: International Road Federation (IRF 37(29)), International Road Research Documentation, OECD

3R 115400

OBSERVATION OF THE PERFORMANCE OF OPERATION PAVEMENTS

The study of the behaviour of full-scale pavements as a check on design, analysis and construction procedures is undertaken. /IRF/

PERFORMING AGENCY: Commonwealth Scientific & Ind Res Organ, Australia, Melbourne Division of Applied Geomechanics

INVESTIGATOR: Richards, BG. Poppin, JW

SPONSORING AGENCY: Commonwealth Scientific & Ind Res Organ, Aus-

tralia

STATUS: Active NOTICE DATE: Sept. 1974

ACKNOWLEDGMENT: International Road Federation (IRF 3A(33))

3R 115510

REDUCTION OF CRACKING IN CONCRETE

This project will examine and collate as much available information as possible on the control and reduction of cracking in concrete by design and construction procedures. /IRF/

PERFORMING AGENCY: Sydney University, Australia, School of Civil Engineering

INVESTIGATOR: Campbell-Allen, D.

SPONSORING AGENCY: Australian Road Research Board

STATUS: Active NOTICE DATE: Oct. 1974

ACKNOWLEDGMENT: International Road Federation (IRF 11A(27))

3R 115797

VEHICLE ROAD SYSTEMS ON SNOW AND ICE

THIS PROJECT IS DEVELOPMENT AND TECHNIQUES FOR CONSTRUCTING AND MAINTAINING YEAR-ROUND ROADS ON PERENNIAL SNOWFIELDS, ICE AND GLACIER ICE SUITABLE FOR PASSENGER VEHICLES, PICKUPS, VANS, TRUCKS, AND TRUCK-TRACTOR-TRAILER COMBINATIONS OF GROSS COMBINATION WEIGHTS UP TO 75,000 POUNDS OPERATING IN POLAR REGIONS. A REVIEW OF THE REQUIREMENTS FOR ROADS ON SNOW AND ICE FOR VEHICLES WITH FLOTATION TIRES WEIGHING UP TO 75,000 POUNDS SHOWED THE NEED TO DEVELOP: (1) ROADS SUITABLE FOR VEHICLES WITH SINGLE FRONT AXLE LOADS UP TO 13,000 POUNDS, SINGLE REAR AXLE LOADS UP TO 18,000 POUNDS, AND REAR AXLE LOADS UP TO 32,000 POUNDS AT TRAVEL SPEEDS UP TO 45 MPH; (2) ENGINEERING CRITERIA FOR DESIGNING AND MAINTAINING HEAVY-DUTY, HIGH-SPEED VEHICLE ROADS ON SNOW AND ICE; (3) ROAD-BUILDING EQUIPMENT OF OPTIMUM DESIGN FOR RAPID CONSTRUCTION USING TWO VEHICLES UP TO SIZE SIX SNOW TRACTORS; (4) ROAD MAINTENANCE EQUIPMENT OF OPTIMUM DESIGN FOR HIGH-SPEED SURFACE GRADING WITH WHEELED EQUIPMENT; (5) CONSTRUCTION AND MAINTENANCE TECHNIQUES; (6) HIGH STRENGTH WEARING SURFACES FOR AREAS SUBJECT TO SEVERE USAGE DETERIORATION AND ABLATION; (7) MARKING AND GUIDANCE CONTROL; AND (8) CONSTRUCTION AND MAINTENANCE MANUALS FOR CONTROL; AND (8) CONSTRUCTION AND MAINTENANCE MANUALS FOR BUILDING AND MAINTAINING SNOW ROADS. /SIE/

PERFORMING AGENCY: Department of the Navy, Civil Engineering Laboratory

INVESTIGATOR: Beard, WH

SPONSORING AGENCY: Naval Facilities Engineering Command, Navy, DN744029

STATUS: Active NOTICE DATE: Apr. 1974 START DATE: July 1973 COMPLETION DATE: June 1974

ACKNOWLEDGMENT: Science Information Exchange (ZQN744029 7)2R40240915

3R 115848

DIAPHRAM WALLING

This project is attempting to develop simpler techniques of constructing diaphragm walls and to apply these techniques in the field and evaluate their performance and economy. /IRF/

PERFORMING AGENCY: Central Road REsearch Institute, India, Council for Scientific and Industrial Research

INVESTIGATOR: Mohan, D. Jain, GRS. Makol, RL

SPONSORING AGENCY: Central Road Research Institute, India, Council for Scientific and Industrial Research

STATUS: Active NOTICE DATE: Nov. 1974 COMPLETION DATE: 1975

ACKNOWLEDGMENT: International Road Federation (IRF 1B(17))

3R 115860

PROVIDING HARD SHOULDERS FOR PAVEMENTS: DESIGN AND MATERIALS

This project is making an analysis of the design requirements for unpaved and paved shoulders and the influence of such shoulders on the methods used in the construction of the highway. /IRF/

PERFORMING AGENCY: Tamil Nadu Highways & Rural Works Dept, India, Highways Research Station

SPONSORING AGENCY: Tamil Nadu Highways & Rural Works Dept, India, Highways Research Station

STATUS: Active NOTICE DATE: Nov. 1974 COMPLETION DATE: 1978

ACKNOWLEDGMENT: International Road Federation (IRF 5A(104))

3R 128911

DESIGN AND CONSTRUCTION METHODS FOR CONCRETE PAVEMENT

The purpose of the project is to investigate the daily and annual change of temperature, abrasive properties and cracking of cement concrete pavement to obtain a design and construction method. /IRRD/IRF/

PERFORMING AGENCY: Hokkaido Development Bureau, Japan, Civil Engineering Research Institute

INVESTIGATOR: Kubo, H

SPONSORING AGENCY: Hokkaido Development Bureau, Japan

5700

STATUS: Active NOTICE DATE: Apr. 1974 START DATE: 1973 COMPLETION DATE: 1982

ACKNOWLEDGMENT: International Road Research Documentation, OECD (IRRD-603334), International Road Federation (IRF 8a(45))

SOURCE INDEX

The source index lists funding and performing agencies in alphabetical order. The research project summaries identify each agency as the performing research agency or the funding agency or as both the performing and the funding agency. The index gives the name of the agency as it appears on the HRIS research project summary (names have been altered in some cases to conform to the constraints of the system design). The mailing address of the agency is given following the name. Subject area and TRIS accession numbers of re-

search summaries associated with each agency are then listed in ascending numerical order. For example, the research project summary identified by TRIS accession number 101481 and assigned subject area 1R, System Construction, Management, and Quality Control, appears under Georgia Department of Transportation. Some organizations are listed more than one time in this index because various units within the agency are associated with research projects.

A

ADHESIVE ENGINEERING COMPANY San Carlos, California, 94070
2R 055848

AMERICAN CONCRETE PIPE ASSOCIATION
3R 104332

AMERICAN IRON AND STEEL INSTITUTE 150 East 42nd Street; New York, New York, 10017
2R 102787

ARIZONA DEPARTMENT OF TRANSPORTATION Highway Division; 206 South 17th Avenue MU-
2R 082119

ARKANSAS STATE HIGHWAY DEPARTMENT P.O. Box 2261; Little Rock, Arkansas, 72203
2R 102043

ARMY CONSTRUCTION ENGINEERING RESEARCH LABORATORY P.O. Box 4005; Champaign, Illinois, 61820
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2R 083093, 2R 083104, 3R 100785, 3R 104601, 3R 105656, 3R 109478, 3R 111369

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C

CALIFORNIA DEPARTMENT OF TRANSPORTATION Division of Highways; P.O. Box 1499; Sacramento, California, 95807
1R 020877, 1R 021188, 1R 105748, 1R 109504, 2R 021389, 2R 048913, 3R 020584, 3R 020875, 3R 021196, 3R 021201, 3R 102045, 3R 104588, 3R 105052

CALIFORNIA DEPARTMENT OF TRANSPORTATION Division of Highways, Office of Structures; P.O. Box 1499; Sacramento, California, 95807
2R 021389

CALIFORNIA DEPARTMENT OF TRANSPORTATION Division of Highways, Transportation Laboratory Branch; P.O. Box 1499; Sacramento, California, 95807
1R 020877, 1R 021188, 1R 105748, 1R 109504, 3R 020584, 3R 020875, 3R 021196, 3R 021201, 3R 102045, 3R 104588

CALIFORNIA DEPARTMENT OF TRANSPORTATION Toll Bridge Administration; P.O. Box 1499; Sacramento, California, 95807
3R 105052

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3R 045960

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2R 086637

CENTRAL ROAD RESEARCH INSTITUTE, INDIA Council for Scientific and Industrial Research; Roorkee, Uttar Pradesh, India
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CEYLON DEPT. OF HIGHWAYS
2R 109373

CHEMICAL BUILDING PRODUCTS, LIMITED Cleveland Road, HP2 7DL; Hemel Hempstead, Hertfordshire, England
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COLD REGIONS RESEARCH AND ENGINEERING LABORATORY Department of the Army; P.O. Box 282; Hanover, New Hampshire, 03755
3R 100785, 3R 104601, 3R 105656, 3R 109478, 3R 111369

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3R 105108

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3R 115400

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COMMONWEALTH SCIENTIFIC & IND RES ORGAN, AUSTRALIA 314
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D

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2R 104652

DEPARTMENT OF DEFENSE /Corp Eng

2R 105106

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Division; 2nd Street, Port Area; Manila, Philippines

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DEPARTMENT OF THE ARMY /Concrete Div

2R 105106

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F

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3R 020022, 3R 102810

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PURDUE AND INDIANA STATE HIGHWAY COMMISSION JHRP Joint Highway Research Project; Civil Engineering Building, Purdue University; West Lafayette, Indiana, 47907
1R 109551, 2R 082196, 2R 102032

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Q

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R

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2R 082554, 3R 082570, 3R 082572, 3R 102017

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INVESTIGATOR INDEX

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The retrieval term index lists the terms that have been assigned to the summaries in this issue. A term may consist of one or more words, and a number of terms are followed by qualifying words set off by slashes.

The terms are arranged alphabetically. Under each term are listed the two-digit subject area number and the six-digit TRIS accession number for those summaries in this part that have been assigned to the term.

Coordinating two or more terms is often useful in the search for summaries. Someone who is interested in research projects pertaining to settlement of bridge approaches, for example, should look up summaries under each of the terms

BRIDGE APPROACHES and SETTLEMENTS. The answer in this case is the summary identified by TRIS accession number 020022 listed in subject area 3R, Construction Equipment and Methods. The coordination process can be extended to more than two terms and to the other indexes. Computer retrieval will often be more convenient to use for complicated coordinations.

Certain terms are not useful retrieval terms unless coupled or coordinated with other terms, for example, DESIGN or EVALUATION. Summaries listed under both DESIGN and STRAIN GAGES are likely of a different nature from summaries listed under both EVALUATION and STRAIN GAGES.

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ABSTRACTS OF PUBLISHED TECHNICAL PAPERS, JOURNAL ARTICLES, AND RESEARCH REPORTS

1A 039272

TUNNELING COST ANALYSIS

The report provides the Office of High Speed Ground Transportation with a review and analysis of tunnel construction costs. The data for all cost analyses in the report were obtained from historical records of tunnel owners, contractors, and equipment and material manufacturers throughout the United States. The report proper includes discussions regarding the data gathering process, the methods of analysis employed, and the tunneling cost estimating relationships. Also, included is a brief review of the cost impact of differences in tunnel design and construction policies. (Author)

Spittel, LA Willyard, JC
RMC, Incorporated Final Rpt RMC-UR-151, Mar. 1971, 160 pp

Contract DOT-FR-0-0040

ACKNOWLEDGMENT: NTIS (PB-201363)

PURCHASE FROM: NTIS Repr PC, Microfiche

PB-201363, DOTL NTIS

1A 051065

INSTITUTIONAL IMPLICATIONS OF U. S. DEEPWATER PORT DEVELOPMENT FOR CRUDE OIL IMPORTS

The report provides an overall appraisal of the institutional problems associated with the planning, construction, and operation of deep draft port facilities in the U. S. and adjacent waters for the reception and transshipment of imported crude petroleum. It defines the public interest in such ports, the characteristics which distinguish such ports from conventional ports, problems of legal jurisdiction at international, federal, state, and local levels, the political setting, problems of finance, ownership, and economics, and regulation of deepwater ports and related land-side developments. It makes recommendations for legislation and organization. (Modified author abstract)

Brant, MR Gladieux, BL Knight, HG Ulin, JC Brown, RE
Nathan (Robert R) Associates Incorporated Final Rpt June 1973, 184 pp

Contract DACW31-73-C-0016

ACKNOWLEDGMENT: NTIS (AD-766285/1)

PURCHASE FROM: NTIS Repr PC, Microfiche

AD-766285/1

1A 080387

QUALITY CONTROL IN HIGHWAY CONSTRUCTION

This paper outlines an integrated quality-control system for use in highway engineering and describes certain aspects in detail. As far as the judgement of quality is concerned, the system is equally applicable to acceptance control, where decisions must be taken whether to accept or reject an end product, and to process control, where decisions may have to be taken to modify a product to ensure its compliance with specifications.

Kuehn, SH (National Institute for Road Research, South Africa) *First International Conference Proceedings* Conf Paper 1972, pp 287-312, 6 Fig., 7 Tab., 8 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 206211)

1A 080544

EXPERIENCE WITH RELATIVE DENSITY AS A CONSTRUCTION CONTROL CRITERION

LIMITATIONS OF SEVERAL, SHALLOW AND DEEP, DIRECT AND INDIRECT METHODS TO OBTAIN RELATIVE DENSITIES ARE DISCUSSED, AND OPINIONS ARE GIVEN CONCERNING THE USE OF THESE METHODS FOR CONSTRUCTION CONTROL PURPOSES. EXPERIENCE FROM TWO EARTHWORK PROJECTS ARE GIVEN FOR: (1) DIRECT METHODS-CONVENTIONAL SAND CONE AND WATER BALLOON, CUTTING CYLINDER, MANUALLY EXCAVATED PIT, AND DENISON SAMPLER; AND (2) INDIRECT METHODS-NUCLEAR, STANDARD PLATE LOAD TEST, STANDARD PENETRATION TEST, AND STATIC CONE PENETRATION TEST. SOME OF THESE METHODS PROVED SATISFACTORY AS A MEANS OF OBTAINING RELATIVE DENSITIES, OTHERS DID NOT. THE WATER-BALLOON METHOD WAS FOUND MORE SUITABLE THAN THE SAND-CONE METHOD. REFERENCE CURVES WERE EFFECTIVE IN SOME CASES. USE OF 6-IN. DIAMETER CUTTING CYLINDERS TO OBTAIN FIELD DRY UNIT WEIGHTS WAS FOUND UNSATISFACTORY FOR SAND CONTAINING GRAVEL. RELATIVE DENSITIES OBTAINED FROM MEASUREMENTS OF INDIVIDUAL LAYERS FROM A MANUALLY EXCAVATED PIT WERE FOUND TO BE GREATER THAN THOSE OBTAINED FROM THE WATER-BALLOON METHOD. DRY UNIT WEIGHTS OBTAINED FROM DENISON SAMPLES GAVE REASONABLE RELATIVE DENSITY VALUES. RELATIVE DENSITIES FROM NUCLEAR METHODS ARE ONLY APPROXIMATE. USE OF THE STANDARD PLATE LOAD TEST TO OBTAIN RELATIVE DENSITIES WAS NOT SUCCESSFUL. HIGH STANDARD PENETRATION RESISTANCES RESULTING FROM RESIDUAL LATERAL STRESSES WERE OBTAINED IN SAND FILL COMPACTED IN LAYERS BY VIBRATORY COMPACTORS AND LEAD TO VERY HIGH INFERRED RELATIVE DENSITIES. STATIC CONE PENETRATION RESISTANCES GIVE QUALITATIVE MEASURES OF RELATIVE DENSITY OF COMPLETED EARTHWORK AND ARE USEFUL IN EVALUATING UNIFORMITY OF COMPACTION. /AUTHOR/

Presented at the 75th Annual Meeting, Los Angeles, June 25-30, 1972.

Leary, DJ Woodward, RJ (Woodward-Moorhouse and Associates, Incorporated) *ASTM Special Technical Publications* Conf Paper No. 523, July 1973, pp 387-401, 11 Fig., 6 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 210350)

1A 080574

MATERIAL TESTS FOR ROAD CONSTRUCTION WORK AND THEIR INFLUENCE ON THE QUALITY OF CONSTRUCTION ATTAINED [Materialpruefungen bei Strassenbauarbeiten und ihr Einfluss auf die Erreichte Ausfuehrungsqualitaet]

APART FROM INTENSIVE SUPERVISION BY THE CONTRACTOR AS PART OF QUALITY TESTING, CONTINUOUS CONTROL EXAMINATIONS ARE CONSIDERED NECESSARY SO THAT DIRECT INFLUENCE ON THE QUALITY OF THE CONSTRUCTION CAN BE ATTAINED. THE EXTENSIVE CONTROL TEST RESULTS AVAILABLE AT THE MUNICH MATERIALS TESTING CENTRE WERE EVALUATED STATISTICALLY. TWO IMPORTANT CHAR-

1A SYSTEM CONSTRUCTION, MANAGEMENT & QUALITY CONTROL

CHARACTERISTIC FEATURES WERE TAKEN FROM THE PRESENT PROGRAMME OF DETERMINING QUALITY CHARACTERISTICS, AND THE CHANGES IN THE FEATURES DURING THE LAST FOUR YEARS ARE ILLUSTRATED GRAPHICALLY. FROM THIS, SOME INTERESTING CONCLUSIONS CAN BE DRAWN: IT WAS FOR EXAMPLE ESTABLISHED THAT THE CHIPPINGS CONTENT OF GUSSASPHALT FOR URBAN ROAD CONSTRUCTION COULD BE REGARDED AS BEING OPTIMUM AT 47 PERCENT OF WEIGHT, BECAUSE OF PROCESSING. MOREOVER IT WAS REGULAR CHECKS. SIGNIFICANTLY DURING THE CONSTRUCTION PERIOD AS A RESULT OF [German]

Spaeth, M *Strasse und Autobahn* Vol. 23 No. 8, Aug. 1972, pp 415-417, 2 Fig., 1 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 300691)

1A 080708

PROBLEMS ASSOCIATED WITH THE CENTRALIZED ADMINISTRATION OF THE CONSTRUCTION OF RIGID PAVEMENTS ON FEDERAL MOTORWAYS [Probleme der Zentralverwaltung beim Betondeckenbau auf Bundesautobahnen]

After a brief reference to the construction of motorways in Czechoslovakia and the increasing use of rigid pavements, the author describes problems associated with the letting of contracts for the construction of concrete pavements on Austrian motorways. The question of one or two-stage construction and the alternating of surfacings on continuous sections is discussed. [German]

Matl, F *Zement und Beton* pp 27-30, 2 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 301120)

1A 080799

STAGING INTER URBAN HIGHWAY CONSTRUCTION BY DYNAMIC PROGRAMMING

This paper presents a method of scheduling highway network construction which can maximize the long-term advantages of such an undertaking. The approach taken is spatial-analytic, and thus somewhat unrealistic from economic or planning points of view. Rather, a simple accessibility function is used to explore the implications of alternate staging policies. The model could easily be adapted to more realistic or satisfying goals, however. The model presented does not require a typical dynamic programming tableau of the benefits of advancing from one network state to each other, but calculates these values only as they are required. An heuristic modification of the struct dynamic model allows the treatment of problems of realistic size. The model is applied to scheduling a highway network for a set of Ontario and Quebec cities. The dynamic strategy appears to be only marginally more beneficial than a myopic one, suggesting that it might be better to persue a policy of building highway networks to meet present needs.

Hodgson, MJ *Annals of Regional Science* Vol. 8 No. 3, Oct. 1974, pp 123-136

1A 081395

SUMMARY OF SYMPOSIUM ON PAVEMENT DESIGN AND MANAGEMENT SYSTEMS

The trend toward pavement management systems to incorporate design methods with construction, maintenance and research is discussed. Brief summaries of the 6 papers are given. Haas describes pavement systems methodology; Lewis reports on an operational pavement management system in Texas; Peterson describes the incorporation of pavement evaluation methods with planning, programming and budgeting, and the information system which handles the data. Phang explains how pavement design methodologies are being codified into a pavement management system. The improved structural analysis subsystem being developed by the Federal Highway Administration is detailed by McMahan, and Lytton reports on the implementation of the Systems Analysis Method for Pavements (SAMP).

Hudson, WR (Texas University, Austin) *Transportation Research Record* No. 512, 1974, pp 1-2

PURCHASE FROM: TRB Publications Off Orig. PC

1A 081396

GENERAL CONCEPTS OF SYSTEMS ANALYSIS AS APPLIED TO PAVEMENTS

A pavement management system can incorporate a large number of activities in planning, design, construction, maintenance, evaluation, and research. Its principal purpose is to achieve the best possible use of available funds, consistent with providing safe and smooth pavements. Systems analysis methods can provide a means for the comprehensive and efficient handling of the various activities and for achieving the desired end result. This paper demonstrates that such systems methodology can be used to provide a framework for the pavement management activities as well as provide the techniques for developing actual working management systems. It describes the general nature and applicability of the systems methodology, and it defines the basic structure of a pavement management system. The various levels of management are indicated. Design, one of the major subsystems, is selected as an example of the more in-depth use that might be made of systems analysis methods. Particular consideration is given to the input information needs of the designer, the generation of alternative design strategies, the nature of the outputs, and the economic evaluation of the outputs for selecting an optimal strategy.

Haas, R (Waterloo University, Canada); Friez, TL (Science Applications, Incorporated); Zueback, JM *Transportation Research Record* No. 512, 1974, pp 3-16, 5 Fig., 32 Ref.

PURCHASE FROM: TRB Publications Off Orig. PC

1A 081474

FULL-DEPTH CONSTRUCTION METHOD-THE NEW METHOD BUILDING FLEXIBLE PAVEMENTS [Full-Depth-Bauweise-Die Neue Baumethode im Asphaltstrassenbau]

The author explains the importance of correct pavement design. He gives details of the conventional design in accordance with the three-layer system and calculates soil pressure stresses for conventional road pavements. Problems involved in the construction of forst blankets are also described. Possible replacement of the conventional forst blanket by an asphalt pavement are discussed in detail. In this case theoretical design is simpler as it can be carried out in accordance with the two-layer system. This thickness of the asphalt pavement is selected in such a way that the soil pressure stresses reach, at a maximum, the values which occur during the incorporation of a normal forst blanket. Experiments with full-depth asphalt pavements and specifications for their construction in various countries are discussed. The article concludes with an explanation of the advantages of the full-depth asphalt method from an economic and heat engineering point of view. [German]

Nievelt, G

Forschungsgesellschaft fuer Strassenwesen Apr. 1972, 38 pp, Figs., Tabs., Refs.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 300870)

1A 081654

EXPERIMENTAL STRETCHES OF ROAD [Les Sections D'Essai De Chaussees.]

A number of experimental stretches of road, approximately thirty in all was built in all regions in France. This article describes the conditions under which the experimental programme was established, the various construction techniques represented in the experiment and the main results obtained. The necessity of having a thorough knowledge of the pavement before strengthening and of the manufacturing conditions for materials and in-situ operational conditions was shown to be a first requirement. Measurements were taken of deformability, and the deformation of longitudinal and transverse profiles; the light-weight vibrator was used together with core boring for evaluating the pavement structure and its evolution. The importance and effects of heavy traffic were studied. [French]

Sauterey, R Siffert, M *Bulletin de Liaison des Lab Des Ponts et Chaussees* No. 63, Jan. 1973, pp 83-91, 4 Fig., 1 Tab.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 101045)

SYSTEM CONSTRUCTION, MANAGEMENT & QUALITY CONTROL 1A

1A 081762

THE CONSTRUCTION OF DURBAN'S SOUTHERN FREEWAY

This paper is an account of a freeway constructed under difficult conditions. A deep strength asphalt design was adopted since the method of construction offered many advantages for design engineer and contractor alike and has been used extensively both in Europe and in the U.S.A. Details are given of the pavement and asphalt mix designs, the methods used for quality control at the plant and in the field, and the construction techniques employed. /IRRD/

Board, JR *Asphalt Pavements for So Africa Conference (1st) Proceeding* 1969, 14 pp, 5 Fig., 3 Tab., 2 Phot., 4 Ref.

1A 082810

THE USE OF BITUMEN EMULSIONS IN THE CONSTRUCTION AND MAINTENANCE OF ROADS

The types and grades of bitumen emulsion available to road authorities in South Africa and their properties are described. Recommendations are made on the correct handling and application of bitumen emulsion in road construction practice. This document gives details of the types of construction where bitumen emulsion was found to give satisfactory performance, together with some of the most common road construction and maintenance specifications. /Author/TRRL/

South African Council for Scientific & Indus Res Standard June 1972, 36 pp, 1 Fig., 10 Tab.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 205982)

1A 083611

STATISTICAL QUALITY CONTROL METHODS IN ROAD CONSTRUCTION

THE USE OF STATISTICAL QUALITY CONTROL METHODS IN ROAD CONSTRUCTION IS DISCUSSED. THE PRINCIPLES OF THESE METHODS ARE OUTLINED AND THE CONSEQUENCES OF THEIR USAGE SHOWN IN TERMS OF PROBABILITIES. THE BASIC CONCEPTS ARE EXPLAINED AND APPLIED TO AN EXAMPLE FROM WHICH SOME GENERAL CONCLUSIONS ARE DRAWN. /AUTHOR/

Salvik, MM (National Institute for Road Research, South Africa) *Civil Engineer in South Africa* Vol. 16 No. 8, Aug. 1974, pp 261-265, 1 Fig., 3 Tab., 3 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 211485)

1A 083780

BIG PROGRESS MADE IN EARTH WORKS FOR ROAD CONSTRUCTION

The topographical and climatic conditions and the problematic characteristics of road construction in Japan are reviewed, and features of road earth works are discussed. Soil investigation and quality control are described. A soil profile is usually prepared by means of simple soundings, and detailed investigations are conducted by mechanical boring and sampling. Some typical field measurement methods have been developed to determine the bearing capacity of the subgrade and subbases. Problems of earth works with cohesive soil of high water content (especially volcanic ash) are discussed. Effort has been made to reduce the contact pressure of machines by increasing the width of caterpillars etc., or decreasing the air pressure of tires. It has been observed that the sticky soil which was remolded during operation of works may have a considerable thixotropic regain and restoration of bearing capacity is considerable. It is accompanied by the effect of drying with the lapse of time. Counter measures for soft ground are considered. Several ways have been tried for the prevention of embankment settlement displacement of press-in compacted sand column for the soft soil after placing compacted sand pile on the foundation of embankment; forced consolidation; and concentration of the loads of embankment on the sand column. This compacted sand pile also serves for preventing slips of foundations of the embankment and other structures on the soft ground.

Construction Technique Vol. 4 No. 3, Feb. 1966, pp 70-73

1A 084213

COMPARISON OF CONSTRUCTION LABOR AGREEMENTS

Provisions of labor agreements negotiated by Associated General Contractors of America (AGC) chapters in St. Louis, Kansas City, and outstate Missouri, and various local carpenter, laborer, operating engineers, and teamster unions are examined. Differences in provisions covering wages, hours, and working conditions between crafts in a given area are noted as are differences in skill classifications and geographic jurisdiction. Provisions of labor agreements between various locals of the carpenters and several AGC chapters also are examined. Regional differences in provisions relating to wages, hours, and working conditions are examined. (Author)

Benjamin, NBH Young, AW *ASCE Journal of the Construction Division* Proc Paper Vol. 101 No. C01, ASCE 11180, Mar. 1975, pp183-200

1A 090683

CONSTRUCTION MANAGEMENT (A BIBLIOGRAPHY WITH ABSTRACTS)

The report includes management studies on the physical, social, and environmental factors of the construction industry. Cost and design studies are also included for military and civilian construction of buildings, houses, mobile homes, tunnel excavation, and roads. To aid the manager in planning and control, construction codes, data management, and contract administration research are also cited. (Contains 103 abstracts).

Supersedes COM-73-11798.

Grooms, DW

National Technical Information Service Bibliog Apr. 1975, 108 pp

ACKNOWLEDGMENT: NTIS

PURCHASE FROM: NTIS Repr. PC, Microfiche
NTIS/PS-75/253/5ST, DOTL/NTIS

1A 091372

CONSTRUCTION MONITORING OF SOFT GROUND RAPID TRANSIT TUNNELS. VOLUME I: A DEFINITION OF NEEDS AND POTENTIAL DEVELOPMENTS

The Urban Mass Transportation Administration (UMTA) Tunneling Program Concentrates its efforts on reducing tunneling costs, minimizing environmental impact and enhancing safety as it applies to the planning, organization, design, construction and maintenance cycles of rapid transit tunnels in the urban environment. This study investigates the area of construction monitoring of rapid transit tunnels in soft ground. Soft ground tunnel construction monitoring has the potential to reduce construction costs, safety hazards and environmental impacts. Monitoring can diagnose face stability and ground movement problems, and allow appropriate preventive or remedial action. Monitoring provides data for prediction of ground movements and allows the compilation of useful legal documentation. Such data are also required for improving design and prediction methods.

Prepared in cooperation with Soil and Rock Instrumentation, Inc., Newton Upper Falls, Mass. Paper copy also available in set of 2 reports as PB-241 535-SET, PC\$11.00.

Schmidt, B Dunicliff, CJ

Parsons, Brinckerhoff, Quade and Douglas, Inc, Transportation Systems Center, Soil and Rock Instrumentation, Incorporated Final Rpt., 3-V1 DOT-TSC-UMTA-75-9-V1, UMTA-MA-06-0025-74-1, Nov. 1974, 189p

Contract DOT/TSC-661

ACKNOWLEDGMENT: NTIS

PURCHASE FROM: NTIS Repr. PC, Microfiche
PB-241536/2ST, DOTL NTIS

1A 091373

CONSTRUCTION MONITORING OF SOFT GROUND RAPID TRANSIT TUNNELS. VOLUME II: APPENDIXES

The Urban Mass Transportation Administration (UMTA) Tunneling Program Concentrates its efforts on reducing tunneling costs, minimizing environmental impact and enhancing safety as it applies to the planning, organization, design, construction and maintenance cycles of rapid transit tunnels in the urban environment. This study investigates the area of construction monitoring of rapid transit tunnels in soft ground. Monitoring practices now in use do not usually allow full utilization of the data for the project from which they were gathered. Deficiencies in present practices are

1A SYSTEM CONSTRUCTION, MANAGEMENT & QUALITY CONTROL

pointed out, and a systematic approach to monitoring is presented. Information presented will aid owners, designers, specification writers and instrumentation engineers. A computer program for data storage, interpretation and retrieval is proposed. An interim quality control specification for instrumentation procurement is presented, and instrumentation hardware improvements are suggested.

Prepared in cooperation with Soil and Rock Instrumentation, Inc., Newton Upper Falls, Mass. Paper copy also available in set of 2 reports as PB-241 535-SET, PCS11.00.

Schmidt, B Dunicliff, CJ
Parsons, Brinckerhoff, Quade and Douglas, Inc. Transportation Systems Center, Soil and Rock Instrumentation, Incorporated Final Rpt., 3-V2 DOT-TSC-UMTA-75-9-V2, UMTA-MA-06-0025-74-1, Nov. 1974, 104p

Contract DOT/TSC-661

ACKNOWLEDGMENT: NTIS
PURCHASE FROM: NTIS Repr. PC, Microfiche
PB-241537/0ST, DOTL NTIS

1A 091495 FEDERALLY COORDINATED PROGRAM OF RESEARCH AND DEVELOPMENT IN HIGHWAY TRANSPORTATION. VOLUME 6. CONSTRUCTION, MAINTENANCE, IMPLEMENTATION, AND MANAGEMENT

The Federally Coordinated Program emphasizes the development and transfer of research results into practice; e.g., bridging the gap between research and operations. The objective of this category is to stimulate and expand the application and practical use of the products of highway research and development. To achieve this objective, the program will emphasize the development of an environment that is conducive to nationally coordinated and cooperative implementation efforts by the Federal Highway Administration, State highway agencies and other highway organizations. It will also emphasize systematic management and the assessment of the success of implementation including the benefits realized.

Paper copy also available in set of 7 reports as PB-242 057-SET, PCS42.00.

Federal Highway Administration FHWA/RD-FCP-007, July 1973, 58 pp

ACKNOWLEDGMENT: NTIS
PURCHASE FROM: NTIS Repr. PC, Microfiche
PB-242064/4ST

1A 091757 TUNNEL COST ESTIMATING UNDER CONDITIONS OF UNCERTAINTY

Of all areas of heavy construction, tunnel projects are subject to perhaps the greatest degree of uncertainty from the standpoint of predicting cost and progress. Sources of uncertainty include the unknown nature of geologic conditions along the tunnel alignment, and the difficulty of estimating the performance of men and equipment within the narrow confines of the tunnel. In this report a method is presented for explicitly reflecting these uncertainties in estimates of the time and cost of tunnel construction.

Also pub. as Tunnel Construction-5.

Wyatt, RD
Massachusetts Institute of Technology, National Science Foundation Tech. Rpt. R75-13, Sept. 1974, 211 pp

Grant NSF-GI-34029

ACKNOWLEDGMENT: NTIS
PURCHASE FROM: NTIS Repr. PC, Microfiche
PB-242428/1ST, DOTL NTIS

1A 091758 THE PROBABILISTIC ESTIMATION OF CONSTRUCTION PERFORMANCE IN HARD ROCK TUNNELS

This report concerns the development of a computer-based simulation model which can be used to evaluate costs and risks associated with hard rock tunneling. This report is the 4th in a series of reports dealing with this subject. The report examines conventional cost estimating procedures and concludes that there are two major inadequacies which exist: (1) the inability to account for the uncertainty in suspected geologic conditions at the tunnel

depth; and (2) the inability to quantify the effect of uncertain geology and the effect of the additional uncertainty in productivity of men and equipment on the performance of a construction strategy. The model employs techniques of probability and simulation to avoid these two shortcomings.

Also pub. as Tunnel Construction-4.

Minott, CH
Massachusetts Institute of Technology, National Science Foundation Tech. Rpt. R74-47, July 1974, 198 pp

Grant NSF-GI-34029

ACKNOWLEDGMENT: NTIS
PURCHASE FROM: NTIS Repr. PC, Microfiche
PB-242427/3ST, DOTL NTIS

1A 094294 FIELD TEST SECTIONS SAVE COST IN TUNNEL SUPPORT

This study summarizes 50 case histories where instrumented test sections were a key factor in realizing major savings from newer concepts in designing underground works. Savings were most often in the item of tunnel support, using field tests to validate newer approaches. Where the tests formed a coordinated program, savings have been spectacular. One example cited is Britain saving half the construction cost on recent London tunnels. In Sweden, cost of underground works has been reduced to equal or below that of surface alternatives for many facilities such as power plants, sewage and water treatment, oil storage, and parking. Despite growing objections to locating such facilities in the surface environment, high cost has deterred U.S. planners from considering the underground alternative. Major cost improvement could change this, allowing greater use of the underground to alleviate several U.S. problems: urban congestion, pollution and energy waste. The case record charts the road; wider trial of newer and less costly concepts (many developed abroad), using field tests to validate their applicability for U.S. conditions.

Lane, KS
American Society of Civil Engineers, New York., Underground Construction Research, Council.*National Science Foundation, Washington., D.C. Research Applied to National Needs. NSF/RA/T-75-035, Apr. 1975, 67p

Grant NSF-GI-41842

ACKNOWLEDGMENT: NTIS
PURCHASE FROM: NTIS NTIS Price, /MF\$2.25
PB-246982/3ST

1A 096034 AUTOMATIC SYSTEM FOR ESTABLISHING CONSTRUCTION WORK CONDITIONS [Notas sobre un Sistema Automatico de Certificaciones en Obra]

A brief description is given of the transistorised electronic equipment used for establishing construction budgets, state of the work, and cost analysis. This equipment is designed so that peripheral units for input and output data can be added to the main machine. /TRRL/ [Spanish]

Garciaez, JAA *Informes de la Construccion* No. 237, Nov. 1971, pp 63-67, 3 Fig.

ACKNOWLEDGMENT: Transportation & Soil Mechanics Laboratory, Spain, Laboratoire Central des Ponts et Chaussées, Transport and Road Research Laboratory (IRRD 100816)

1A 096291 REINFORCED EARTH ON M62 MOTORWAY

A new technique is outlined for reinforced earth structures (made up of soil, reinforcement and facing unit) in which the vertical reinforcing member is incorporated with the horizontal reinforcement and the facing is a non-structural unit. On the basis of economy, galvanized mild steel traps were chosen for the horizontal reinforcement. A block of 100 traps supporting a section near the middle of the wall was made of glass fiber roving impregnated with polyester resin-as an additional experiment. The facing unit was a hexagon based pyramid, 125 mm deep and measuring 600 mm across the flats. A glass reinforcement cement was used for the facing unit. Bunter sandstone from a borrow pit on site was used as the fill material. A discrete gap was formed between each facing unit. Details of construction

are briefly described. Construction was in layers with the facing keeping pace with the fill. The maximum area of wall completed including backfilling by 2 men in one day is 60 sq. m. Three general categories of problems have risen with the use of new construction techniques and materials. These problems are related to: the internal stability of the wall and the adequacy and relevance of the present design methods and assumptions, the problem of corrosion or damage of the materials forming the structure, and the general behaviour of the wall and its capacity to accommodate differential settlements and externally imposed stresses, and the internal strain movements of the wall. Comparisons are made of reinforced earth construction costs using the new method and the costs using the French method.

Presented at Seminar X (Road Design 1: General Topics) of the PTRC Summer Annual Meeting, Warwick University, England, 8-12 July 1974.

Jones, CJF (West Yorkshire Metropolitan County Council, Eng)
Planning and Transport Res and Computation Co Ltd PTRC/P/108,
July 1974, pp 246-255, 3 Fig., 8 Ref.

PURCHASE FROM: Planning and Transport Res and Computation Co Ltd
167 Oxford Street, London W1, England Orig. PC

1A 096986 CONSTRUCTION GUIDE FOR SOILS AND FOUNDATIONS

This book is intended to provide contractors and subcontractors with the practical aspects of foundation construction. It discusses soils, soil behaviour and the construction of foundations, emphasizing that the soil is as much a part of the overall structure as are the components of the superstructure. Potential problems in specifications, contracts, soils data, etc., are pointed out and some solutions offered. Special emphasis is given to: the importance of obtaining all available information on subsurface, rock, and groundwater conditions; the difficulties in the installation of specialized foundation elements such as piles, caissons and underpinning; and the necessity for the proper engineering of all temporary construction, excavation slopes, sheeting and bracing, and other measures to prevent property damage. /TRRL/

Fletcher, GA Smoots, VA
Wiley (John) and Sons, Limited Textbook 1974, 60 pp, Figs., Tabs.,
Photos., 60 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD
212258)

PURCHASE FROM: Wiley (John) and Sons, Incorporated 605 Third Avenue,
New York, New York, 10016 Repr.PC

1A 096995 THE NEW MONTREAL INTERNATIONAL AIRPORT

This paper describes the methods and procedures used by a project team established by the Canadian Federal government plan, design, and construct a large and complex project, the New Montreal International Airport at Mirabel. The project is being executed on the basis of Project Management with the help of a Consortium of consultants for design coordination and field construction management, using over 40 consulting firms for design and over 100 major contract packages for construction. The paper gives a general description of the project and outlines the organization, methods of design and construction management, the special design and construction management features, and the special problems encountered. Prominent phases of construction are shown by construction photographs.

Sebastyan, GY (Canadian Ministry of Transport) *ASCE Journal of the
Construction Division Proc Paper* Vol. 101 No. C02, ASCE 11346, June
1975, pp 317-334, 19 Fig.

1A 097488 BENEFICIAL USES OF SULPHUR IN SULPHUR-ASPHALT PAVEMENTS. VOLUME 3: TASK 3: PRELIMINARY DESIGN, CONSTRUCTION AND QUALITY CONTROL PROCEDURES

This effort which represents the third phase of a study to provide a preliminary comparison of the engineering characteristics of sand-asphalt sulphur (S-A-S) with conventional asphaltic concrete pavements, presents a users manual and sets forth some preliminary specifications and recommended procedures for selecting an optimum mix design and constructing highway pavements with S-A-S composites. The manual on "Recommended Practices" explains the engineering, economic and ecological basis of the specifications and offers recommendations for the accomplishment of these

requirements. Considerable information on sulphur is included, and details are presented on the preparation of paving mixtures, especially emphasizing tolerances and the effect of variations on the properties of the finished pavement. Paving equipment is reviewed. The manual on "Construction Specification" provides the basis for a contractual agreement between the constructor of the highway demonstration facility and the sponsor of the project. The "Quality Control" manual relates largely to the paving materials and to the sampling and testing of these materials and compositions therefrom. Raw materials, pavement mix design, and field sampling and testing are covered.

Sponsored by Bureau of Mines and the Sulphur Institute.

Galloway, BM Saylak, D
Texas Transportation Institute Final Rpt. Aug. 1974, 101 pp, 9 Fig., 8
Ref.

1A 099611 SIMPLE METHOD FOR OBSERVING THE OPERATION OF COMPACTORS [Methode simple pour suivre le fonctionnement des compacteurs]

Studies are being conducted to establish specifications regarding compaction. It is necessary to define practical methods of controlling the application of the specifications envisaged. One of the means considered is the control of the operation of compacting machines. With this aim in view it is proposed to observe visually the operation of the compactor(s) to see whether or not it conforms to the planned organization of the construction site as described by the engineering firm, and to determine the relation between the volume of materials laid during a given period of time and the surface covered by the compactor during the same period. This note describes how the latter arrangements were implemented on an earthworks site in the paris region. To assess the level of use to which the compactor was put, the compactor was supplied with a kilometer counter recording on disc the distance covered, speeds, operation and stop times. At the end of the day, data obtained were recorded together with the volume of materials laid, thus enabling the relation between the volume and surface covered to be calculated, the value of this relation being used to characterize total compaction effort. The quality of compaction operations and especially the thickness of the layers were also controlled. /TRRL/ [French]

Schaeffner, M Bauchard, M Dejoncheere, G *Bulletin de Liaison des Lab
des Ponts et Chaussees* No. 62, Nov. 1972, pp 22-26, 4 Fig., 2 Phot., 8 Ref.

ACKNOWLEDGMENT: Laboratoire Central des Ponts et Chaussees, Transport
and Road Research Laboratory (IRRD 100783)

PURCHASE FROM: Laboratoire Central des Ponts et Chaussees 58 Boulevard
Lefebvre, 75732 Paris Cedex 15, France Orig. PC

1A 099622 USE AND IMPORTANCE OF DEFLECTION MEASUREMENTS MADE ON ROADS IN FRENCH SPEAKING AFRICA AND IN MADAGASCAR [Utilisation et interet des mesures de deflexion sur chaussees en Afrique Francophone et a Madagascar]

The author recalls the extensive use of deflection measurements as a non-destructive means of testing pavements for the design of new pavements and control of application during construction. The measurements give highly representative results of the mechanical behaviour of the pavements. The technique is widely utilized in french speaking Africa and in madagascar. Details are given of the evolution of the technique and of some results obtained on flexible pavements. Precautions to take while carrying out measurements are mentioned. /TRRL/ [French]

Liautaud, GA *Revue Generale des Routes et des Aerodromes* Vol. 43 No.
484, Feb. 1973, pp 79-90, Figs., Tabs., Photos., Refs.

ACKNOWLEDGMENT: Laboratoire Central des Ponts et Chaussees, Transport
and Road Research Laboratory (IRRD 101055)

1A 099711 A GUIDE TO GOOD PRACTICE FOR ROAD EDGE DETAILS

This report classifies the various types of edge detail in current use and gives a guide to their design construction and maintenance and to the materials used. After setting out their functions the report gives descriptions of the types available and includes a comprehensive table showing the applications of the different types in various types of road. Edge details are next considered in relation to general requirements followed by a comprehensive

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chapter covering design practice which includes a table which considers the types available in relation to design requirements. The next chapter is concerned with the choice of form of construction and includes information on concrete and natural stone kerbs and channels, extruded edges, cast in situ edges and kerbs and channels cast integrally with the pavement. Maintenance is the subject of the next chapter, which is followed by information relating to relative costs of the various methods. The final chapter gives conclusions and comprehensive recommendations and an appendix gives drawings of 22 recommended details. /TRRL/

Cement and Concrete Association Tech. Rpt. No. 10, July 1974, 36 pp, Figs., 3 Tab., 18 Phot., 15 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 212155)

1A 099755

GOALS FOR BASIC RESEARCH IN CONSTRUCTION

This report and the workshop upon which it was based were designed to identify, set priorities for, and focus high-level attention on the need for basic research in construction engineering and management, especially in manpower and organizational development, management methodologies, innovations in construction methods, and construction industry dynamics. Closer working relationships were developed between the construction industry, private and government consumers of construction services, and university programs in construction engineering management. In the private sector, several participants suggested that an organization such as the Business Roundtable could provide leadership in establishing a coordinated program for funding basic research in construction.

Presented at a workshop sponsored by the Stanford Construction Institute.

Paulson, BC, Jr
Stanford University July 1975, 64 pp

1A 125290

EARTHWORKS AT THE PLANNING STAGE [El transporte de suelos en la ejecucion de la obra basica]

Various solutions are proposed to the problems of earthworks at the planning stage, taking account of possible adjustments having to be considered during construction. The initial earthwork plant must be flexible enough to allow for a number of contingencies; controls must be carried out and necessary modifications made in order to obtain minimum volumes to be transported over maximum distances. Finally a solution is put forward for the problem of measuring already completed earthworks, that, because of negligence, lack of foresight or material impossibility, were not recorded as construction progressed. The number of the covering abstract is IRRD Abstract No. 100834. /TRRL/ [Spanish]

Francesio, C *Decimo Concurso de Trabajos sobre Temas Viales* Conf Paper No. 84, Oct. 1968, pp 15-44, 18 Fig., 6 Tab.

ACKNOWLEDGMENT: Transportation & Soil Mechanics Laboratory, Spain, Laboratorio Central des Ponts et Chaussees, Transport and Road Research Laboratory (IRRD 100838)

1A 125294

SAFETY IN THE CONSTRUCTION OF BITUMINOUS SURFACINGS [Seguridad de la construccion de pavimentos asfalticos]

The construction of bituminous surfacings requires three types of safety measures: measures relating to the material used, to the plant, and to the equipment. Practical recommendations are proposed for the safety of different operations: transport, sampling, cleaning and maintenance of the equipment, operation of plants, etc. /TRRL/ [Spanish]

Perez, AS *Alemas* No. 61, Apr. 1972, pp 43-46

ACKNOWLEDGMENT: Transportation & Soil Mechanics Laboratory, Spain, Laboratorio Central des Ponts et Chaussees, Transport and Road Research Laboratory (IRRD 100979)

1A 125437

ARE CONSTRUCTION CONTRACTS FAIR?

Too often, specifications and contracts are written vaguely. The contractor has to deal with many unknowns and unpredictable factors. What can be done to ease this situation and reduce litigation? An attorney whose firm has

represented many contractors suggests ways to reduce litigation. For example, risks could be minimized and costly litigation avoided with more research before a contract is written, rather than the present reliance on "escape" clauses. A veteran contractor also gives his ideas, including his opinion that the design engineer should do more of the tasks now left to the contractor. For example, in tunneling, engineers should design the temporary support as well as the final lining.

Fox, GA (Grow Tunneling Corporation); Greenberg, ME *ASCE Civil Engineering* Vol. 45 No. 5, May 1975, pp 56-59

1A 126128

FIFTY-YEAR DEVELOPMENT CONSTRUCTION OF STEEL GIRDER BRIDGES

Steel girder bridge construction has evolved from standard to customized design with curved girders, box girders, and combinations thereof becoming more common. Refined designs require increased man-hours to maintain quality assurance and the safety with efficiency necessary to offset additional costs. Erection procedures basically remain the same with the trend toward erection in longer and heavier sections. Procedures are illustrated by representative structures. /ASCE/

Burroughs, EA (United States Steel Corporation) *ASCE Journal of the Construction Division* Proceeding Vol. 101 No. C03, ASCE #11549, Sept. 1975, pp 463-476, 19 Fig., 3 Ref.

PURCHASE FROM: ESL Repr. PC, Microfilm

1A 126833

JOINT EFFORT TO IMPLEMENT RESTRICTED PERFORMANCE SPECIFICATIONS IN PENNSYLVANIA

One of the key elements in the Pennsylvania Department of Transportation program for the implementation of statistically based restricted performance specifications for highway construction material is concerned with the necessary education of department and industry personnel. This paper discusses the experiences of Pennsylvania Department of Transportation and Pennsylvania State University in the past 2 years in their joint effort to provide the first phase of the training required. The background information for the series of training courses and for the development of a quality-control manual, the guidelines that were set up for the courses, and the objectives of each course session are discussed. The experiences and insight gained as a result of the first 5 courses in the series are discussed by relating some of the observations that participants made about the course itself and also about the proposed program of implementation that Pennsylvania Department of Transportation will follow. The objective of the paper is to share these experiences with other state departments of transportation that are at similar stages in the implementation of these types of specifications.

Willenbrock, JH (Pennsylvania State University, University Park) *Transportation Research Record* No. 529, 1975, pp 60-74, 2 Ref.

PURCHASE FROM: TRB Publications Off Orig. PC

1A 127336

QUALITY CONTROL OF BITUMINOUS PAVING FROM THE BEGINNING

The origin of modern controls and the resulting variability was studied in an effort to develop a better understanding of control systems. Practices with sheet asphalt in 1900 are mentioned and pavements built under patents issued to F.J. Warren are described; these include Bitulithic, Warrenite, Warrenite-Bitulithic, Topeka, and Black Bass. The quality control system used by Warren Brothers (illustrated by typical Bitulithic specification) controlled aggregate gradation, bitumen content, mixing coating, workability, overheating and compaction. Important requirements in which federal specifications differ from Warren specifications include the following: master ranges for aggregate gradation and asphalt content; job mix formula and tolerances, including mix temperature delivered to the job; temperature controls of bitumen aggregate, mixing, and mix at the plant; weather and limitations, detailed plant requirements; machine laydown; detailed roller and rolling requirements; and smoothness requirement. Variability by design is considered and variability in construction is discussed. Patented pavement, gradation and bitumen content, gradation, asphalt content and density of modern pavements are detailed. The limitation of variability is discussed. It is urged that controls should distinguish between satisfactory and unsatisfactory pavements. Satisfactory control can be maintained

without excluding good construction and unnecessarily increasing costs. Controls should be tailored to accommodate the characteristics of different mixtures, the requirements of the pavement, and the conditions encountered in construction. Either the conventional process control system or the newer end result specifications can be made to function satisfactorily for modern construction.

Proceedings of the meeting held in Houston, Texas, February 1973.

Tunncliff, DG (Warren Brothers Company) *Association of Asphalt Paving Technologists Proc* Vol. 42 1973, pp 440-481, 18 Fig., 5 Tab., 25 Ref.

1A 127337

ACTUAL APPLICATION OF END RESULT SPECIFICATIONS AND THE ROLE OF COMMERCIAL TESTING LABORATORIES IN APPLYING THEM

This report explains what an end result specification may consist of; how it can be applied; and what role commercial testing laboratories can play in applying it. The end result specification as applied on asphaltic concrete mixtures in Louisiana is outlined, and the duties and responsibilities of technicians is discussed. Sixteen projects were evaluated in the study of the effects of end result specifications. It was found that the standard deviation for the percentage of pay per project as based on 100 percent of contract unit price was 1.99 percent at a 95 percent confidence level. This indicates the contractor should receive at least 95 percent pay at least 95 percent of the time. The total tons of mix evaluated was 544,348 of which 7,223 tons of mix or 1.3 percent resulted in the contract unit price. Approximately 30,211 tons of mix or 5.5 percent resulted in the contractor receiving 95 percent of the contract unit price. There were no penalties at 50 percent or remove. There was total of 724 lots involved in all of the projects, of which 64 lots resulted in penalties. Approximately 93.7 percent of the failing lots were due to deficiencies in roadway density and only 6.3 percent due to deficiencies in Marshall Stability. End result specifications appear to be a satisfactory and workable means of defining the responsibilities of all the persons involved, as well as, ensuring a quality end product on asphaltic concrete projects.

Proceedings of the meeting held in Houston, Texas, February 1973.

Arena, PH, Jr (Delta Testing and Inspection, Incorporated) *Association of Asphalt Paving Technologists Proc* Vol. 42 1973, pp 482-498, 2 Fig., 3 Tab., 2 App.

1A 127797

THE USE OF WASTE AND LOW-GRADE MATERIALS IN ROAD CONSTRUCTION: 2 COLLIERY SHALE

The use of lower-grade and waste materials as alternatives to naturally occurring aggregates in the construction of roads helps to conserve the supplies of good quality aggregates and assists in problems arising from the disposal of unwanted materials. This report is one of a series that is aimed at bringing together the information that is available on each of the major waste products that have roadmaking potential. It deals with colliery shale and it considers the extent to which shale can be used in road construction. The report discusses the types and quantity of shale that are available, the purposes to which it can be put in the various stages of road construction and the tests needed to ensure that shales meet the required specifications. (A) /TRRL/

Sherwood, PT (TRRL)

Transport and Road Research Laboratory R&D Rept. LR 649, 1975, 18 pp, 3 Fig., 10 Tab., 16 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 214542)

PURCHASE FROM: Transport and Road Research Laboratory Department of the Environment, Crowthorne, Berkshire RG11 6AU, England Orig. PC

1A 127939

A DESIGNER'S VIEWS: FUNCTIONAL REQUIREMENTS AND LIMITATIONS

The standardization of tunnel equipment is discussed, the potential for saving based on actual and theoretical costs for two tunnels is briefly analyzed, and comments are made on the possibility of adapting a machine to different diameters, and the potential cost saving with regard to linings. It is desirable to standardize the components performing the various functions of the tunnel boring machines, so that they are interchangeable between systems. The effect of standard-size tunnels on projected tunnel design is discussed. Estimates indicate that there is no clear-cut economic

advantage in standardization of tunnel diameter. The possibility of adapting a machine to different diameters depends on whether it is a shield machine or a hard-rock machine. The design of tunnel linings will vary with the depth of the tunnel below ground surface and the quality of the ground. Depending on the purpose of the tunnel, similar design criteria may govern different tunnels and lead to standardization of design: metropolitan tunnels for transit systems; municipal tunnels for water supply and sewage disposal; tunnels shared by several utilities within the same conduit. In types of tunnel with no standardization potential with regard to size, economics could be effected by use of standard specifications for the operations involved in the procedure. Work schedule which ensured machinery movement in sequence from one tunnel to another would lead to savings; designers could ensure that station and ventilation shafts are scheduled. The development of a standardized tunnel lining system for the Bay Area Rapid Transit System is briefly described.

Report of a symposium conducted by Standing Subcommittee No 5, International Activities of the U.S. National Committee on Tunneling Technology, held on May 21-22, 1974 in Washington, D.C.

Thon, JG (Bechtel Corporation)

National Research Council 1975, pp 123-132

PURCHASE FROM: NTIS Repr. PC, Microfiche

1A 127968

CONSTRUCTION STAFFING MANAGEMENT STUDY

Research was planned to develop and test a project and multiple-project management system applicable to surveying, inspection, construction, supervision and documentation of rural freeway construction; and to make the research techniques, principal findings and management system available for use by state highway departments. A work plan is detailed which indicates the system approach being used to attain these objectives. Details are also given of a model construction management system for field construction employees which has been tested on three research laboratory projects. The basic elements of the system are: staffing, scheduling, reporting and controlling. The preliminary results are set forth. The implementation of the System will be completed in 3 phases: rural freeway implementation; system extension; and supporting systems.

Proceedings of the 1974 Sixtieth Annual Meeting, Detroit, Michigan, November 18-20, 1974.

Vander Meulen, RL (Michigan Department of State Highways & Transport) *American Assn of State Hwy & Transp Office Proc* Vol. 16 1974, pp 25-32

1A 128495

SPECIFICATION PREPARATION METHODS--STATE OF THE ART

This report presents the state of the art in construction specification preparation methods. Special emphasis is given to computerized preparation systems. The report: (1) explains the approach used to identify the current preparation methods; (2) discusses the response and analysis to a Construction Specifications Institute (CSI) membership state-of-the-art survey; (3) compares computerized preparation systems; (4) presents the results from a cost analysis study; (5) summarizes the results and conclusions and makes recommendations.

Neely, ES, Jr

Army Construction Engineering Research Laboratory, (4A0621-03A891-06-005) Final Rpt. CEBL-TR-P-46, Sept. 1975, 26 pp, 2 Fig., 12 Tab.

1A 128662

PAVEMENT SMOOTHNESS

The opinion is expressed that rough pavements are produced because the contractors attention to smoothness has been diverted by increased rates of production, OSHA and other factors, and also because designers and specification writers have imposed requirements for administrative and other reasons that detract from the contractors capability to produce a smooth pavement. The contractors' responsibilities are to provide equipment in good condition, provide competent operators, and direct management, supervisory and operating efforts to build smooth pavements. The responsibilities of the state or other agencies are listed. It is emphasized that both the contractor and the state and other agencies must think, plan and pave for smoothness.

1A SYSTEM CONSTRUCTION, MANAGEMENT & QUALITY CONTROL

Foster, CR *Paving Forum* Sept. 1975, p 18

1A 128800

DEMONSTRATION PROJECT NO. 34. CATHODIC PROTECTION

In an effort to acquaint field personnel with the theory of cathodic protection and assist in the design, construction and operation of a cathodic protection system, a demonstration project is being offered which will include an introductory slide presentation, assistance in development of a work plan and work schedule, assistance in locating material sources, assistance in the electronic circuitry and system design, and assistance during construction and post construction evaluation periods. Cathodic protection involves the external application of a direct current to the surface of the top mat of steel in sufficient amounts to overcome the internal current flow between the anode and cathode. A sacrificial anode is provided and allowed to corrode and the reinforcing steel becomes the cathode. Cathodic protection (CP), has been used for many years to control corrosion of buried pipe lines and structures in salt water environments, to protect piers, pilings and other underground installations. Promising results have been obtained in test installations of CP systems on bridge decks to control corrosion of the reinforcing steel.

Federal Highway Administration 2 pp

1A 129021

CONTRACTUAL RELATIONSHIPS IN CONSTRUCTION

The different types of contractual relationships prevalent in construction today are considered from the owner's, consultant's, contractor's, and legal viewpoints. The principal contractual relationships considered are general contractor, turnkey, construction manager, and independent prime contracts. /ASCE/

Presented at the April 9-13, 1973, ASCE National Structural Engineering Mtg, San Francisco, Calif.

Smith, SE (California Department of Water Resources); Wilson, WW (Metcalf and Eddy); Burns, WC (Morris and Knudsen Company);

Rubin, RA (Greenberg, Trayman, Harris, Cantor, Reiss & Blasky) *ASCE Journal of the Construction Division* Proceeding Vol. 101 No. C04, ASCE #11776, Dec. 1975, pp 907-921, 2 Fig., 2 Tab.

1A 129025

ROCK ANCHORS-STATE OF THE ART PART 2: CONSTRUCTION

Anchor construction techniques related to drilling, flushing, water testing, tendon preparation and installation, grouting and finally corrosion protection are discussed with emphasis on quality control and close on-site supervision. The drilling methods detailed include rotary drills and percussive drills. The choice of drilling method and drilling equipment are discussed. Drilling rates, flushing and alignment deviation are also reviewed. Water testing is described and recommendations are presented regarding waterproofing. The storage and handling of anchor tendons are discussed and recommendations are made regarding the avoidance of mechanical damage and corrosion. Comments are made with regard to the fabrication of anchors with multistrand or multiwire tendons, and the fixing and location of spacers and centralisers. Housing details are outlined.

Littlejohn, GS Bruce, JD (Aberdeen University, Scotland) *Ground Engineering* Vol. 8 No. 5, Sept. 1975, pp 34-45, 3 Fig., 6 Tab.

1A 129115

PLANNING UNDERGROUND CONSTRUCTION OPERATIONS

The modern under ground constructor faces economic and competitive conditions which demand exacting planning, logistics and scheduling; the most efficient operation methods and equipment known; and realistic, comprehensive; analytical risk evaluation with adequate contingencies or other protection. Planning can usually be separated into two phases: preconstruction and during construction. Preconstruction work includes a thorough review and familiarization with engineering and contract documents, site investigations, evaluating such local conditions as weather and labor supply, selection of construction methods and equipment, and preparation of detailed cost estimates. During construction, planning encompasses preparation of detailed work schedules, cost controls, and contingency plans.

Presented at the Rapid Excavation and Tunneling Conference, San Francisco, Calif., June 24-27, 1974.

Eberhardt, FC (Dravo Corporation)

American Inst of Mining, Metallurg & Petrol Engrs Proc Paper Vol. 1 1974, pp 143-151

ACKNOWLEDGMENT: EI

PURCHASE FROM: American Inst of Mining, Metallurg & Petrol Engrs Society of Mining Engineers, New York, New York, 10017 Repr. PC

1A 129453

ROAD CONSTRUCTION GUIDE [Guide de Construction Routiere]

This second edition of the Road Construction Guide offers the necessary requirements for road construction to enable it to adequately serve the road user during its design life. The fundamental principals and complete and well stated. This construction guide outlines the exact requisites in an understandable and usable fashion. It outlines the specification with respect to pavement, soils, materials and construction. /RTAC/ [French]

Tessier, GR

Quebec Ministry of Transport, Canada Text Book 1973, 218 pp, 42 Fig., Tabs., 24 Phot.

ACKNOWLEDGMENT: Roads and Transportation Association of Canada

PURCHASE FROM: Roads and Transportation Association of Canada 1765 St Laurent Boulevard, Ottawa, Ontario K1G 3V4, Canada Repr. PC

1A 200102

CPM IN CONSTRUCTION MANAGEMENT. SCHEDULING BY THE CRITICAL PATH METHOD

THE BASIC FUNDAMENTALS OF THE CRITICAL PATH METHOD /CPM/ AND PROGRAMME EVALUATION REVIEW TECHNIQUE /PERT/ SYSTEMS ARE PRESENTED. INCLUDING THE PREPARATION OF ARROW DIAGRAMS AND THE USE OF COMPUTER AND MANUAL CPM CALCULATION. PRACTICAL APPLICATIONS ARE DISCUSSED. /RRL/

Obrien, JJ

Megraw Hill Book Company 65

ACKNOWLEDGMENT: Road Research Laboratory /UK/

1A 200117

PREQUALIFICATION REQUIREMENTS

THE PREQUALIFICATION OF CONTRACTORS BY THE ONTARIO DEPARTMENT OF HIGHWAYS STARTED IN 1956. THIS PAPER ASSESSES THE RESULTS OF THE SYSTEM AND DESCRIBES THE REVISED PREQUALIFICATION FORMULA IN USE. PREQUALIFICATION PROVIDES A PROCEDURE WHICH ENABLES GOVERNMENT DEPARTMENTS TO MAKE AN IMPARTIAL AND OBJECTIVE DETERMINATION, AT THE TIME TENDERS ARE CALLED ON A PROJECT, OF THE CONTRACTORS FROM WHOM BIDS WILL BE ACCEPTED. IT ALSO PROVIDES AN EFFECTIVE INSTRUMENT OF CONTROL OVER THE PERFORMANCE OF SUCCESSFUL BIDDERS. THE SYSTEM REQUIRES THAT THE FINANCIAL RESOURCES, INITIAL EXPERIENCE AND TECHNICAL ABILITY AND THE DAY-TO-DAY DEMONSTRATED EXPERIENCE AND TECHNICAL ABILITY OF A CONTRACTOR CAN BE IMPARTIALLY AND OBJECTIVELY MEASURED IN TERMS THAT CAN BE RELATED TO THE ACCEPTABILITY OF A CONTRACTORS BID. THE ONTARIO ASSESSMENT PROCEDURES AND PENALTIES ARE DESCRIBED IN THE PAPER. /CGRA/

Crosbie, DA *Canadian Good Roads Association Proc* P318-323, Oct. 1964

1A 200302

OPTIMAL CONSTRUCTION STAGING BY DYNAMIC PROGRAMMING

THE TECHNIQUE OF DYNAMIC PROGRAMMING IS PRESENTED AS A METHOD OF OPTIMIZING THE STAGING SEQUENCE OF URBAN HIGHWAY IMPROVEMENTS. THE TECHNIQUE PROVIDES A METHOD OF DETERMINING THE OPTIMAL SEQUENCE OF HIGHWAY IMPROVEMENT FROM THE MANY SEQUENCES THAT ARE POSSIBLE. AN EXAMPLE URBAN FREEWAY SYSTEM IS USED TO DEMONSTRATE THE TECHNIQUE OF DYNAMIC PROGRAMMING. THE OPTIMAL SEQUENCE OF STAGING DECISIONS FOR TWO DECISION SETS ARE DETERMINED. /AUTHOR/

SYSTEM CONSTRUCTION, MANAGEMENT & QUALITY CONTROL 1A

Funk, ML Tillman, FA *Am Soc Civil Engr J Highway Div* Nov. 1968

1A 200399

FORMULATING HIGHWAY CONSTRUCTION PROGRAMS

CONTENTS: INTRODUCTORY REMARKS WELCOMING REMARKS, FRED BURGGRAF REMARKS OF DEPARTMENT CHAIRMAN, G. P. ST. CLAIR PURPOSE OF THE CONFERENCE, ROBLEY WINFREY OBJECTIVES AND APPROACH PROBLEMS IN FORMULATING HIGHWAY CONSTRUCTION PROGRAMS, JAMES W. MARTIN CONCEPTS OF AND APPROACHES TO CAPITAL BUDGETING, ROBLEY WINFREY INVESTMENT PLANNING SCHEDULING CAPITAL IMPROVEMENTS, DONALD R. LANG ROLE OF THE LEGISLATURE, EXECUTIVE BRANCH, AND OTHER AGENCIES IN HIGHWAY CONSTRUCTION PROGRAMMING, J. A. LEGARRA BASIC INFORMATION NEEDED FOR SOUND CAPITAL INVESTMENT PLANNING, PHILIP M. DONNELL ACCOUNTING AND BUDGETING REQUIREMENTS FOR ADVANCE CONSTRUCTION PROGRAMS, EUGENE C. HOLSHOUSER THE CASE FOR CAPITAL BUDGETING IN THE STATE HIGHWAY DEPARTMENTS, EUGENE C. HOLSHOUSER PRIORITY ANALYSES-PROJECT SELECTION PHYSICAL AND ECONOMIC RATING METHODS FOR PRIORITY CONSIDERATIONS, M. EARL CAMPBELL BALANCING OF PHYSICAL AND ECONOMIC RATINGS WITH OTHER CONSIDERATIONS TO ESTABLISH PROJECT PRIORITIES, ARTHUR C. ENGLAND SCHEDULING LETTING DATES FOR SPECIFIC PROJECTS COORDINATING THE HIGHWAY CONSTRUCTION SCHEDULE WITH ALL AGENCIES CONCERNED, JOHN A. SWANSON THE ROLE OF TIME AND MONEY AS RELATED TO CONSTRUCTION SCHEDULES, WILLIAM B. BIDELETT CONTROL AND ADJUSTMENTS OF CONSTRUCTION SCHEDULE, M. J. WALKER ADMINISTRATION AND MANAGEMENT HIGHWAY PROGRAMMING LAW, DAVID R. LEVIN ADMINISTRATIVE REQUIREMENTS FOR HIGHWAY CONSTRUCTION PROGRAMMING, W. F. BABCOCK PUBLIC RELATIONS ASPECTS OF HIGHWAY CONSTRUCTION PROGRAMMING, DONALD M. BROWN SUMMARY AND SYNTHESIS FORMULATING HIGHWAY CONSTRUCTION PROGRAMS, A CASE STUDY AND SUMMARY, CLINTON H. BURNES

Highway Research Board Special Reports 1961

1A 200420

STATISTICAL SPECIFICATIONS IN BITUMINOUS CONCRETE HIGHWAY CONSTRUCTION

THE NEED FOR STATISTICALLY ORIENTED ACCEPTANCE PLANS BY HIGHWAY DEPARTMENTS, AND FOR CONTROL PROCEDURES BY CONTRACTORS IS EVIDENT IN THE INCREASED DISCUSSION GIVEN THESE MATTERS IN HIGHWAY-ORIENTED MEETINGS FROM COAST TO COAST. ALTHOUGH SOME STATISTICAL SPECIFICATIONS ARE USED IN THE HIGHWAY INDUSTRY AT PRESENT, MANY MORE ARE NEEDED. THE DELAY IN ADOPTING THESE PROCEDURES HAS STEMMED FROM A RELUCTANCE ON THE PART OF HIGHWAY AGENCIES, BOTH FEDERAL AND STATE, TO PART WITH THEIR TRADITIONAL METHODS AND THE RELUCTANCE OF CONTRACTORS TO UNDERTAKE CONTROL OF THEIR OWN PROCESSES. THE STEPS BEING TAKEN BY MOST HIGHWAY AGENCIES IN IMPLEMENTING STATISTICAL SPECIFICATIONS AS WELL AS MOST OF THE IMPORTANT ITEMS IN ASPHALTIC CONCRETE SPECIFICATIONS ARE MENTIONED. /AUTHOR/

Hughes, CS *Materials Research and Standards* Oct. 1970

1A 200440

A NEW ROAD POLICY

A NEW HIGHWAY CONSTRUCTION POLICY HAS BEEN ADOPTED, ITS FIRST POINT OF EXECUTION BEING THE ANCHIETA-IMMIGRANTES SYSTEM CONNECTING SAN PAULO AND THE PORT OF SANTOS, THAT AIM AT A SYSTEMS APPROACH TO HIGHWAY CONSTRUCTION AND AT INTEGRATION OF HIGHWAY PLANNING AND CONSTRUCTION WITH ECONOMIC DEVELOPMENT OF THE STATE OF SAN PAULO. EMBODIMENT OF THE POLICY HAS OCCURRED IN CREATION OF A PRIVATE COMPANY WITH FULL AUTONOMY TO CON-

STRUCT, OPERATE, AND MAINTAIN THE ROADS CONNECTING THE TWO CITIES. THE COMPANY'S PRINCIPAL STOCKHOLDER IS THE STATE OF SAN PAULO. SATURATION OF THE VIA ANCIETA, THE EXISTING ROUTE BETWEEN THE TWO CITIES,- LED TO PLANNING FOR THE NEW VIA DOS IMIGRANTES, THE CONNECTORS BETWEEN THEM, LIMITED ACCESS DESIGN, A SIGNALLING SYSTEM TO PROMOTE A STEADY FLOW OF HIGH-SPEED TRAFFIC, AND RELATED SYSTEM FEATURES. IT IS ANTICIPATED THAT USER CHARGES WILL MEET OPERATING COSTS AND PAY OFF THE INITIAL INVESTMENT, WHICH WAS REALIZED FROM OWN CAPITAL AND FROM DOMESTIC AND FOREIGN LOANS. THE TOTAL COST IS ESTIMATED AT 780 MILLION CRUZEIROS FOR THE THREE STAGES OF CONSTRUCTION. WHEN COMPLETED, THE NEW HIGHWAY SYSTEM WILL BE AMONG THE MOST ADVANCED IN THE WORLD. /RRI/

Campiglia, AO
Road Research Institute /Brazil/ 1970

ACKNOWLEDGMENT: Road Research Institute /Brazil/

1A 200456

CONSTRUCTION BY CONTRACT AND BY DAY LABOR

THE RELATIVE ADVANTAGES AND DISADVANTAGES OF PUBLIC WORKS CONSTRUCTED BY DAY LABOR CONTRACT ARE DISCUSSED. AND DATA FROM TWO SURVEYS ARE PRESENTED. GENERALLY, CONTRACT WORK WAS FAVORED FOR HEAVY EXCAVATION, LARGE BRIDGES AND HIGH TYPE PAVING, WHICH TYPES OF WORK ARE RELATIVELY INFREQUENT IN COUNTY OPERATIONS. ADVANTAGES OF DAY LABOR APPEARED TO BE MOST APPARENT ON SMALL OPERATIONS. /AUTHOR/

Conner, CN *Highway Research Board Proceedings* 1943

1A 200681

A STUDY TO DEVELOP METHODS FOR IMPROVING THE TRAINING OF CONSTRUCTION AND MATERIALS INSPECTORS

THIS REPORT AND TRAINING MANUAL PROVIDE A COMPREHENSIVE TOOL FOR TRAINING AND DEVELOPING CONSTRUCTION AND MATERIALS INSPECTORS. THE REPORT WAS QUITE BRIEF BUT WAS SUPPLEMENTED BY THE COMPREHENSIVE TRAINING MANUAL. RECOMMENDATIONS WERE CONTAINED IN THE REPORT TEXT. THE TRAINING MANUAL INCLUDED SECTIONS ON SURFACE GEOLOGY, SOILS AND SOIL SOIL TESTING, COMPACTION, EARTHWORK, SUBBASES AND BASES, CONCRETE PAVEMENT, STRUCTURES AND BITUMINOUS PAVEMENTS. /BPR/

Mississippi State Highway Department 1966

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4824442 66)

1A 200686

TRAINING OF INSPECTORS AND SUPERVISORS FOR THE CONSTRUCTION INDUSTRY

THE GROWING NEED FOR TRAINED INSPECTORS AND SUPERVISORS FOR THE CONSTRUCTION INDUSTRY IS INDICATED. THE PAPER DESCRIBES THE ESTABLISHMENT OF COURSES IN THE PROVINCE OF ONTARIO TO TRAIN THESE MUCH NEEDED TECHNICIANS FOR THE CONSTRUCTION INDUSTRY. THE FULL-TIME COURSE IS GIVEN IN SECONDARY TECHNICAL SCHOOLS /GRADE 11/ AND IS DESIGNED TO TRAIN STUDENTS FOR POSITIONS AS CONCRETE INSPECTORS, STEEL INSPECTORS, SOIL AND GRADING INSPECTORS, INSTRUMENT MEN, RODMEN, ESTIMATORS, PURCHASING AGENTS, SALES TECHNICIANS, SPECIFICATION WRITERS OR EXPEDITORS. THE FORMULATION OF THE COURSE AND THE TEACHING METHODS ARE DESCRIBED. THE CLOSE WORKING RELATIONSHIP BETWEEN THE SCHOOL STUDENTS AND INDUSTRY INTERESTED IN EMPLOYING GRADUATES IS INDICATED. /CGRA/

Stanners, JE *Canadian Good Roads Association Proc* Oct. 1964

1A SYSTEM CONSTRUCTION, MANAGEMENT & QUALITY CONTROL

1A 200727

DETERMINING MANPOWER NEEDS FOR CONSTRUCTION INSPECTION

A MANPOWER MANAGEMENT OBJECTIVE WAS ADOPTED BY THE NORTH DAKOTA DEPARTMENT OF HIGHWAYS TO (1) RELATE MANPOWER TO WORK LOADS IN THE CONSTRUCTION INSPECTION AND MATERIALS TESTING FUNCTIONS, (2) EXPRESS THOSE RELATIONSHIPS IN TERMS OF STANDARD STAFFING PATTERNS FOR STANDARD WORK ACTIVITIES, (3) DEVELOP WAYS OF REDUCING THE STANDARD STAFFING COMPLEMENTS INsofar AS POSSIBLE IN ORDER TO INCREASE THE SALARY LEVELS OF THE PERSONS EMPLOYED, (4) PREDICT FUTURE MANPOWER NEEDS, AND (5) DEVELOP MANPOWER PLANS, PROGRAMS, AND POLICIES BASED ON FUTURE NEEDS. A RESEARCH PROJECT WAS UNDERTAKEN TO ACCOMPLISH THE MANPOWER MANAGEMENT OBJECTIVE. THE STUDY APPROACHES USED AND THE RESULTS OBTAINED ARE DISCUSSED IN THIS PAPER. /AUTHOR/

Spier, EG Bell, GL *Highway Research Record, Hwy Res Board* 1969

1A 200730

DEVELOPING PROGRAMMED LEARNING COURSES FOR HIGHWAY CONSTRUCTION INSPECTION TRAINING

THE CHARACTERISTICS OF PROGRAMMED LEARNING AND THE WAY THEY LEND THEMSELVES TO THE AREA OF CONSTRUCTION INSPECTION TRAINING ARE DESCRIBED. THE PURPOSES OF THIS PAPER ARE (1) TO DEMONSTRATE THE EFFICIENCY OF PROGRAMMED LEARNING, (2) TO DESCRIBE THE LIMITS OF POTENTIAL OF THIS TEACHING PROCESS, AND (3) TO SHOW THE NEED FOR MANAGEMENT, UNDERSTANDING, AND INVOLVEMENT IN ALL STAGES OF DEVELOPMENT. MORE PROGRAMMED LEARNING EFFORTS FAIL DURING THEIR ADMINISTRATION THAN IN ANY OTHER STAGE OF THEIR DEVELOPMENT. SOME EFFORTS FAIL FOR NATURAL REASONS: A POOR PROGRAM. FOR THE MOST PART, HOWEVER, THE MAJORITY OF THE EFFORTS FAIL BECAUSE MANAGEMENT COULD NOT OR DID NOT SEE WHAT PROGRAMMING REALLY INVOLVED. THE VIRGINIA DEPARTMENT OF HIGHWAYS HAS DEVELOPED SEVERAL PROGRAMMED COURSES, THE USE OF WHICH HAS PROVEN HIGHLY SUCCESSFUL. AS A RESULT OF THE IMPLEMENTATION OF THIS TRAINING DEVICE, 90-PLUS PERCENT OF ALL NEW CONSTRUCTION INSPECTOR TRAINEES RECEIVE TRAINING IN MATHEMATICS, PLAN READING, SPECIFICATIONS AND STANDARDS, AND FUNDAMENTALS OF LEVELING WITHIN 6 MONTHS OF EMPLOYMENT. /AUTHOR/

Miller, AL *Highway Research Record, Hwy Res Board* 1969

1A 200731

DEVELOPING SUBJECT MATTER AND A DECENTRALIZED ORGANIZATION FOR HIGHWAY CONSTRUCTION INSPECTION TRAINING

FACTORS AFFECTING THE INITIATION OF A FORMAL TRAINING PROGRAM FOR CONSTRUCTION INSPECTION PERSONNEL ARE IDENTIFIED. THE ORGANIZATIONAL STRUCTURE OF A HIGHWAY TRAINING SYSTEM IS DESCRIBED. REQUISITE CHARACTERISTICS OF THE TRAINING PERSONNEL ARE DETAILED, ALONG WITH DUTIES AND RESPONSIBILITIES OF THE DIFFERENT JOB POSITIONS. A SYSTEMS APPROACH TO TRAINING WAS ADOPTED. THE APPROACH WAS BASED ON THE FINDINGS OF A TRAINING NEEDS STUDY. SOME SIGNIFICANT FINDINGS OF THE TRAINING NEEDS STUDY THAT CONTRIBUTED TO THE INITIATION OF A SYSTEMS APPROACH WERE THE IDENTIFICATION OF THE CONSTRUCTION INSPECTION JOB ELEMENTS AND THE KNOWLEDGE-SKILL-ABILITY COMBINATIONS NEEDED TO PERFORM SPECIFIC JOBS. PROBLEMS RELATED TO THE DEVELOPMENT OF MEANINGFUL, ACCURATE AND COMPLETE SUBJECT MATTER ARE DESCRIBED. THE APPROACH TO SUBJECT MATTER DEVELOPMENT, WITH AWARENESS OF THE INHERENT PROBLEMS OF THE LOUISIANA DEPARTMENT OF HIGHWAYS, IS GIVEN. THIS APPROACH INCLUDES THE COLLECTION OF BASIC DATA FROM FIELD

PERSONNEL, OFFICIAL DOCUMENTS, AND MANUALS OF REFERENCE, AND THE REVIEW AND APPROVAL OF THESE DATA BY AN AUTHORITATIVE COMMITTEE OF DEPARTMENT ENGINEERS. /AUTHOR/

Guilbeau, LH *Highway Research Record, Hwy Res Board* 1969

1A 200734

EDUCATIONAL NEEDS FOR RIGID PAVEMENT CONSTRUCTION

THE CHANGING PICTURE IN PORTLAND CEMENT CONCRETE PAVEMENT CONSTRUCTION PRACTICES IS PRESENTED AND SOME SUGGESTIONS ARE OFFERED ON NEEDED PROGRAMS OF CONTINUING EDUCATION AND TRAINING. COMMUNICATIONS ARE DISCUSSED AS A TOOL FOR TEACHING A SKILL. THE PORTLAND CEMENT ASSOCIATION, NATIONAL READY MIX CONCRETE ASSOCIATION AND THE AMERICAN CONCRETE INSTITUTE ARE WORKING WITH THE DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE TO DEVELOP A 2-YEAR CURRICULUM AND MATERIALS FOR TRAINING WORKERS IN CONCRETE TECHNOLOGY AND VARIOUS JOB CLASSIFICATIONS. THE FIRST PHASE OF THE PROGRAM IS INTENDED TO: (1) PROVIDE COURSE CONTENT AND TEACHING GUIDES FOR AN AREA OF VOCATIONAL EDUCATION WHERE NO SUCH TRAINING EXISTS, (2) BROADEN EMPLOYMENT OPPORTUNITIES IN AN EXPANDING INDUSTRY FOR NON-ACADEMIC POST HIGH SCHOOL YOUTH, (3) PROVIDE A BASIS FOR IN-SERVICE JOB UPGRADING AND OTHER ADULT VOCATIONAL EDUCATION PROGRAMS, (4) REDUCE A CRITICAL SHORTAGE OF SKILLED MANPOWER IN THE GROWING CEMENT AND CONCRETE INDUSTRIES, (5) PROVIDE NEW AVENUES OF EMPLOYMENT FOR PERSONS FROM SOCIALLY OR ECONOMICALLY DISADVANTAGED GROUPS, AND (6) INITIATE VOCATIONAL EDUCATION TRAINING PROGRAMS TO FILL THE MANPOWER NEEDS OF THE CEMENT AND CONCRETE INDUSTRIES. THE SECOND PHASE OF THE PROGRAM WILL BE A 2-YEAR PILOT PROGRAM TO PROVIDE THROUGH FIELD TESTS THE LEVEL OF TRAINING FOR WHICH THE BASIC CURRICULUM IS DESIGNED. ADAPTATION OF CURRICULUM MATERIALS DEVELOPED IN THE FIRST PHASE FOR OTHER LEVELS OF VOCATIONAL EDUCATION AND FOR TRAINING PROGRAMS FOR SPECIFIC OCCUPATIONS WILL BE ACCOMPLISHED IN THE THIRD PHASE. IT IS ADVISED THAT THERE ARE NEEDS FOR SEVERAL KINDS OF EFFORTS IN CONTINUING EDUCATION FOR BETTER BUILDING OF PORTLAND CEMENT CONCRETE PAVEMENTS. SUGGESTIONS ARE FOR BETTER MANAGEMENT AT THE TOP, BETTER SUPERVISION, BETTER OPERATION OF EQUIPMENT, BETTER SPECIFICATIONS, AND BETTER INSPECTION WHICH CAN ALL BE OBTAINED THROUGH CONTINUING EDUCATION.

Highway Research News, Hwy Res Board 1969

1A 201810

EDP ON THE JOB-BETTER INFORMATION FOR BETTER PROJECT MANAGEMENT

SUCCESSFUL CONTRACTORS ARE USING AUTOMATIC DATA PROCESSING SYSTEMS TO PROVIDE CURRENT INFORMATION ON PRESENT AND PAST COSTS AND FURNISH ACTIVITY STATUS REPORTS THAT ARE COMPLETE, ACCURATE AND UP-TO-DATE. EDP IS USED IN ESTIMATING THE CONTRACT BY: (1) DETERMINING COMPONENTS, COMPLEXITY IN LOOKING UP PRICES, AND (2) CLASSIFYING AND PRINTING THE FINAL ESTIMATE. THE QUANTITY TAKE-OFF FROM THE ORIGINAL BLUEPRINT MUST STILL BE DONE BY AN ESTIMATOR, BUT THE COMPUTER IS OF GREAT HELP IN REDUCING THE TIME CONSUMPTION OF THE PROCESS AS WELL AS SIMPLIFYING THE MANY UPDATES. THE TYPICAL ESTIMATING PROCEDURE IS PRESENTED WITH ILLUSTRATIONS. THE CRITICAL PATH METHOD IS USED FOR CONTRACT SCHEDULING WITH HELP OF EDP. THE PROGRAM EVALUATION AND REVIEW TECHNIQUE (PERT) AND CPM TECHNIQUES ARE USED IN PROJECT PLANNING AND SCHEDULING WITH COMPUTER PROGRAMS DOING THE PAPER WORK. A RECENTLY INTRODUCED COM-

SYSTEM CONSTRUCTION, MANAGEMENT & QUALITY CONTROL 1A

PUTER PROGRAM, CALLED THE PROJECT CONTROL SYSTEM (PCS), CAN ACCEPT INPUT DATA EITHER FOR PERT/CPM OR PRECEDENCE NETWORKS. THE REPORTS PRODUCED BY THE PCS PROGRAM MAY COVER THE ENTIRE PROJECT NETWORK OR ANY PORTION OF IT. LABOR AND MATERIALS CONTROL OF COSTS ARE MANAGED BY EDP. THE NEED FOR BETTER COMMUNICATIONS BETWEEN CONSTRUCTION SITES AND THE HOME OFFICE HAS LED TO THE DEVELOPMENT OF TELE-PROCESSING SYSTEMS LINKING THE SITES AND THE HOME OFFICE. ONE TYPE OF TERMINAL, BEING USED IN DATA NETWORKS BY MANY CONSTRUCTION COMPANIES, PROVIDES ONE-WAY TRANSMISSION OF PUNCHED-CARD AND NUMERICAL INFORMATION FROM THE FIELD TO THE DATA PROCESSING CENTER. TWO-WAY TERMINALS ALSO USED TODAY, CAN BE PLACED AT JOB SITES AND IS CAPABLE OF INPUT AND OUTPUT WITH PUNCHED CARDS OR TYPEWRITERS. A VISUAL DISPLAY TERMINAL CAN PROVIDE THE MANAGER WITH DIRECT ACCESS TO THE COMPUTER TO REQUEST AN IMMEDIATE REPORT ON THE RESULTS.

Reps, JI *Roads and Streets* Mar. 1970

1A 202518 ECONOMIC CONSIDERATIONS OF QUALITY CONTROL FOR ROAD CONSTRUCTION

THIS PAPER DESCRIBES THE ESSENTIAL FEATURES OF A COMPREHENSIVE SCHEME FOR THE RATIONAL APPLICATION OF QUALITY CONTROL IN ROAD CONSTRUCTION. METHODS ARE DEVELOPED TO DETERMINE THE OPTIMUM VALUES FROM ECONOMIC CONSIDERATION OF THE SAMPLE SIZE, AND THE PERCENTAGE DEFECT ASSOCIATED WITH THE ACCEPTANCE LIMIT. THE RELATION BETWEEN GAIN AND THE DEGREE OF COMPLIANCE IS STUDIED AND THE RESULTS ARE OF INTEREST TO BOTH THE CONTRACTOR AND THE CLIENT. THE AVAILABILITY OF THE REQUIRED COST DATA IS ALSO DISCUSSED. /AUTHOR/ TRRL/

Kuehn, SH Burton, RW Slavik, MM *Civil Engineer /S Africa/* Vol. 14 No. 8, Aug. 1972, pp 261-8, 15 Fig, 8 Tab, 4 Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

1A 205310 PROGRESS REPORT ON THE ESTABLISHMENT OF TOLERANCES IN HIGHWAY CONSTRUCTION SPECIFICATIONS

HIGHWAY ENGINEERS AND CONTRACTORS ARE BEING CRITICIZED FOR DEVIATIONS FROM SPECIFICATIONS, EVEN THOUGH IN MANY INSTANCES THERE ARE SOUND ENGINEERING JUSTIFICATIONS FOR PERMITTING THE DEVIATIONS. THIS PROBLEM UNDERSCORES THE NEED FOR TOLERANCE ON SPECIFICATIONS. THIS IS A PROGRESS REPORT ON THE ESTABLISHMENT OF THESE TOLERANCES. /AUTHOR/

Moss, JP *Highway Research Record, Hwy Res Board* 1965

1A 205350 A STUDY OF MISALIGNED DOWELS IN CONCRETE PAVEMENTS

A LABORATORY INVESTIGATION WAS MADE TO MEASURE THE EFFECTS OF MISALIGNED DOWELS (LOAD TRANSFER DEVICES) ON THE FORCE NECESSARY TO SEPARATE TWO CONNECTED SLABS. THIRTY-EIGHT SPECIMENS, 3-FEET WIDE, 5 1/2-FEET LONG, AND 10-INCHES THICK WERE CAST AND TESTED AT 2 AND 7 DAYS AGE. THREE 1 1/4 IN 0 X 16 IN. DOWEL BARS WERE PLACED AT THE MIDDEPTH OF A CONSTRUCTION JOINT FORMED AT THE MIDLENGTH OF THE SPECIMEN. THE DOWELS WERE PLACED ON 1-FOOT CENTERS AND THE 2 OUTER DOWELS WERE ALIGNED PERPENDICULAR TO THE JOINT FACE. THE CENTER DOWEL WAS MISALIGNED UP TO 3 INCHES HORIZONTALLY AND UP TO 1 INCH BOTH VERTICALLY AND OBLIQUELY. THE ANALYSIS PRIMARILY COMPARES THE FORCES NECESSARY TO OPEN THE JOINTS SPECIFIC DISTANCES (1/2 AND 3/4 INCHES), ALTHOUGH THE

MOVEMENTS IN THE OTHER TWO DIRECTIONS ARE ALSO PRESENTED. THE MEASURED FORCES ARE ADJUSTED FOR DIFFERENT CONCRETE STRENGTHS AND ARE PLOTTED AGAINST THE MAGNITUDE OF THE MISALIGNMENT. IT WAS FOUND THAT (1) THE FORCE REQUIRED TO PRODUCE A SPECIFIC OPENING VARIED AS A FUNCTION OF THE MISALIGNMENT, (2) VERTICAL MISALIGNMENTS ARE THE MOST CRITICAL AND HORIZONTAL THE LEAST SEVERE, (3) 1/4 INCH VERTICALLY OR 3/4 INCH HORIZONTALLY APPEAR TO BE TOLERABLE FOR A 1/2 INCH OPENING, (4) A 1 INCH VERTICAL MISALIGNMENT CAUSES SIGNIFICANT SURFACE SPALLING AT EARLY CONCRETE AGES, (5) MISALIGNMENTS CAUSE CONCRETE CRUSHING ON THE BEARING SURFACES, AND (6) THE DOWEL LUBRICANT APPEARS TO BE A SIGNIFICANT VARIABLE IN DOWEL ACTION. THE RESULTS COULD BE USED TO PROVIDE MEANINGFUL VALUES FOR TOLERATE DOWEL MISALIGNMENTS IN CONSTRUCTION SPECIFICATIONS. /AUTHOR/

Segner, EP Cobb, JR
Alabama University, Alabama State Highway Department Aug. 1967

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4612214 67)PB 178 224, 1C25021054

1A 205961 LOCATION AND NUMBER OF BORINGS IN SAMPLING FOR PAVEMENT CONSTRUCTION CONTROL /IN PORTUGUESE/ SAMPLING FOR THE DESIGN, CONSTRUCTION CONTROL, AND REINFORCEMENT OF PAVEMENTS IS BASED ON THE NATIONAL HIGHWAY DEPARTMENT(DNER) MANUAL ON CONSTRUCTION CONTROL OF PAVEMENTS. RANDOM NUMBERS ARE USED TO PICK SITES FOR BORINGS. AN EXAMPLE IS GIVEN, AND THE BENEFITS AND INCONVENIENCES OF THE PROPOSED METHOD ARE DISCUSSED. /RRI/

Batista, CN
Road Research Institute /Brazil/ July 1971

ACKNOWLEDGMENT: Road Research Institute /Brazil/

1A 206454 APPLICATION OF DEFLECTIONS AND DEFLECTION BASINS TO CONSTRUCTION CONTROL, PAVEMENT DESIGN, AND MAINTENANCE REQUIREMENTS-FINAL REPORT

THERE IS A NEED TO DEFINE NOT ONLY THE MAGNITUDES OF THE DEFLECTION MEASUREMENTS BUT TO USE ALSO THE SHAPE OF THE DEFLECTION BASIN. FOR THIS REASON, THREE PARAMETERS ARE USED TO DESCRIBE THE BASIN CURVE. THEY ARE: DYNAFLECT MAXIMUM DEFLECTION (DMD), THE NUMERICAL VALUE OF THE DYNAFLECTS FIRST SENSOR; SURFACE CURVATURE INDEX (SCR), THE NUMERICAL BETWEEN THE FIRST AND SECOND SENSORS; AND BASE CURVATURE INDEX (BCR), THE NUMERICAL DIFFERENCE BETWEEN THE FOURTH AND FIFTH SENSORS. BY OBSERVING THE DMD, SCI, AND BCI, A TOTAL PICTURE IS AVAILABLE OF THE STRUCTURAL CAPABILITY OF THE MEASURED PAVEMENT STRUCTURE. COMPUTER PROGRAMS UTILIZED THE IBM 360 COMPUTER AND CALCOMP PLOTTER IN THE ANALYSIS OF THE DEFLECTION BASIN SHAPE AS WELL AS IN THE TEMPERATURE AND LAYER EQUIVALENCY STUDIES. IN THE TEMPERATURE STUDY CONDUCTED, IT WAS THE OBJECTIVE TO FIND A TEMPERATURE CORRECTION FACTOR FOR USE IN ELIMINATING TEMPERATURE AS A VARIABLE IN DEFLECTION MEASUREMENTS. LITERATURE WAS REVIEWED AND A DATA COLLECTION PLAN CONCEIVED AND IMPLEMENTED. IT WAS FOUND THAT THE DEFLECTION-TEMPERATURE RELATIONSHIP COULD NOT BE SEPARATED FROM THE MANY OTHER VARIABLES INVOLVED. IT WAS ALSO INDICATED IN THE RESULTS THAT VARIABLES SUCH AS AGE AND SEASONAL VARIATION HAVE LARGE EFFECT ON THE TEMPERATURE-DEFLECTION CURVES. AN OVERLAY DESIGN PROCEDURE WAS ESTABLISHED WHICH USED THE MEASURED DEFLECTION ON A WEAK PAVEMENT AND THE TRAFFIC INFORMATION FOR THAT ROAD SECTION TO FIND THE

1A SYSTEM CONSTRUCTION, MANAGEMENT & QUALITY CONTROL

REQUIRED OVERLAY THICKNESS. THIS THICKNESS COULD ALSO BE CONVERTED TO A REQUIRED STRUCTURAL NUMBER AND THEN BASED ON LAYER EQUIVALENCY. OTHER MATERIALS COULD BE USED TO STRENGTHEN THE ROADWAY. IT WAS FOUND IN REGARD TO EMBANKMENT HEIGHT THAT THERE COULD BE FOUND IN AREAS OF WEAK SUBGRADE A MINIMUM EMBANKMENT FILL WHICH THE PROFILE DESIGNER COULD USE WITHOUT FEAR OF INADEQUATE SUPPORT. THE DYNAFLECT WAS FOUND TO BE INADEQUATE FOR CONSTRUCTION CONTROL. THE FACTORS, RESILIENCE, AGE OF SURFACING, DENSITY, MOISTURE, SOIL SUPPORT, AND VOLUME OF TRAFFIC, WERE TREATED BRIEFLY. RESILIENCE WAS FOUND NOT TO EXHIBIT THE STATE-WIDE VARIATION WHICH WAS ANTICIPATED AT THE TIME OF THE ORIGINAL PROPOSAL. FOR THIS REASON IT WAS NOT GIVEN THE SIGNIFICANCE OF SOME OF THE OTHER FACTORS. AGE OF SURFACE, SOIL SUPPORT, AND VOLUME OF TRAFFIC ARE INCLUDED IN A FIVE YEAR STUDY IN WHICH NO DEFINITE CONCLUSIONS HAVE BEEN REACHED AT PRESENT. DENSITY WAS STUDIED QUALITATIVELY AS WAS MOISTURE. INDICATIONS THAT THESE FACTORS DO AFFECT DEFLECTION MEASUREMENTS ARE PRESENT. HOWEVER, MORE WORK IS NEEDED IN THESE AND OTHER AREAS TO FIND MORE PRACTICAL USES FOR THE DYNAFLECT. /AUTHOR/

Peterson, G Shepard, LW Keane, EG
Utah State Department Highways, Federal Highway Administration /US/
Study No 906

ACKNOWLEDGMENT: Federal Highway Administration (4621022 71)REPORT PENDING, 2C26022656

1A 206464

DEVELOPMENT OF A SYSTEM FOR HIGH-SPEED MEASUREMENT OF PAVEMENT ROUGHNESS /FINAL REPORT/

DETAILED DISCUSSIONS OF RESEARCH ACTIVITIES DURING THIS PAST YEAR, NOT COVERED IN PAST REPORTS, ARE PROVIDED. THESE DISCUSSIONS INCLUDE WHEEL REPLACEMENT INVESTIGATIONS, RESEARCH ACTIVITIES IN CONSTRUCTION CONTROL, SPECTRAL ANALYSIS METHODS, MAYS ROAD METER CORRELATION STUDIES, AND PSI MODEL INVESTIGATIONS. SPECIAL EMPHASIS IS PLACED ON NEW METHODS FOR USING SPECTRAL ANALYSIS FOR IDENTIFICATION OF VARIOUS ROAD PROFILE CHARACTERISTICS. EXTENSION OF THESE NEW METHODS MAY PROVIDE THE BEST APPROACH YET AVAILABLE TO DEVELOPMENT OF ADEQUATE ROAD PROFILE SPECIFICATIONS AND CONSTRUCTION CONTROL. /AUTHOR/

Walker, RS Hudson, WR Roberts, FL
Texas University, Austin, Federal Highway Administration /US/, Texas
State Department of Highways & Public Transp Study No 73-5f

ACKNOWLEDGMENT: Federal Highway Administration (4723393 71)NTIS
PB 204 270, 2C26022719

1A 206486

DEFLECTION ANALYSIS OF FLEXIBLE PAVEMENTS

THREE PARAMETERS ARE USED TO DESCRIBE THE DEFLECTION BASIN CURVE: (1) DYNAFLECT MAXIMUM DEFLECTION, (2) SURFACE CURVATURE INDEX, AND (3) BASE CURVATURE INDEX. MEASUREMENTS PROVIDE A MEANS OF ANALYZING THE BEHAVIOR OF THE PAVEMENT STRUCTURE. THE IBM 360 COMPUTER AND CALCOMP PLOTTER WERE USED IN THE ANALYSIS OF THE DEFLECTION BASIN SHAPE AS WELL AS IN TEMPERATURE AND LAYER EQUIVALENCY STUDIES. THE OBJECTIVE OF THE TEMPERATURE STUDY WAS TO FIND A CORRECTION FACTOR TO USE IN ELIMINATING TEMPERATURE AS A VARIABLE IN DEFLECTION MEASUREMENTS. IT WAS FOUND (1) THAT THE DEFLECTION-TEMPERATURE RELATIONSHIP COULD NOT BE SEPARATED FROM THE MANY OTHER VARIABLES INVOLVED, AND (2) THAT VARIABLES SUCH AS AGE AND SEASONAL VARIATION HAD A LARGE EFFECT ON THE TEMPERATURE-DEFLECTION CURVES. IN

THE AREAS OF LAYER EQUIVALENCY, EMBANKMENT HEIGHT, OVERLAY DESIGN AND CONSTRUCTION CONTROL, A GREAT AMOUNT OF USEFUL INFORMATION WAS ACCRUED. AN OVERLAY DESIGN PROCEDURE BASED ON DEFLECTION WAS ESTABLISHED. AREAS OF WEAK EMBANKMENT COULD BE DETECTED PRIOR TO INITIAL SURFACING ALLOWING CORRECTIONS TO BE MADE. ALSO, MINIMUM EMBANKMENT FILL COULD BE DETERMINED WHICH THE DESIGNER COULD USE WITHOUT APPREHENSION. USING THE DYNAFLECT FOR CONSTRUCTION CONTROL INCORPORATED ALL LEVELS OF CONSTRUCTION; HOWEVER, TO BE UTILIZED SATISFACTORILY ON EMBANKMENT MATERIALS, THE EMBANKMENT MUST BE GRADED TO A SMOOTH SURFACE TO ALLOW ACCESS TO THE TEST AREA. RESILIENCE, AGE OF SURFACING, DENSITY, MOISTURE, SOIL SUPPORT, AND VOLUME OF TRAFFIC ARE TREATED BRIEFLY. RESILIENCE WAS FOUND NOT TO EXHIBIT THE STATEWIDE VARIATION THAT HAD BEEN ANTICIPATED. FOR THIS REASON RESILIENCE WAS ELIMINATED AS A SIGNIFICANT FACTOR. AGE OF SURFACE, SOIL SUPPORT, AND VOLUME OF TRAFFIC ARE INCLUDED. /FHWA/

Peterson, G Shepherd, LW
Utah State Department Highways Jan. 1972, 137 pp

ACKNOWLEDGMENT: Federal Highway Administration NTIS PB 210 044,
3C26022992

1A 207038

DEVELOPMENT OF A CONSTRUCTION CONTROL PROFILOGRAPH

DUE TO AN INCREASING AWARENESS OF THE IMPORTANCE OF THE PAVEMENT ROUGHNESS AT THE TIME OF CONSTRUCTION, A PROFILOGRAPH FOR MEASURING CONSTRUCTION ROUGHNESS WAS DEVELOPED AND OBTAINED. THE PROFILOGRAPH UTILIZED WAS DESIGNED AND FABRICATED BY RAINHART COMPANY OF AUSTIN, TEXAS. THE PROFILOGRAPH FEATURED (1) TWELVE AVERAGING WHEELS ARRANGED IN A SYSTEMATIC METHOD, (2) EQUALLY SPACED AVERAGING WHEELS, BOTH LONGITUDINALLY AND TRANSVERSELY, (3) A RECORDER ESPECIALLY DESIGNED TO EMIT BOTH A GRAPHICAL PROFILE AND A DIGITAL ROUGHNESS INDEX NUMBER, AND (4) OUTRIGGER WHEELS ALLOWING THE PROFILOGRAPH TO BE TOWED TO VARIOUS TESTING LOCATIONS WITHOUT DISASSEMBLY. STUDIES OF THE INFLUENCE OF TEXTURE IN PAVEMENT ROUGHNESS WERE MADE LEADING TO A MODIFICATION IN THE PROFILOGRAPH RECORDING MECHANISM FOR A FILTER BAND. A 0.1-INCH FILTER BAND WAS UTILIZED TO REDUCE THE INFLUENCE OF TEXTURE IN PAVEMENT ROUGHNESS MEASUREMENTS. BASED ON FIELD STUDIES WITH THE 0.1-INCH FILTER BAND A PROFILE INDEX OF 26 INCHES PER MILE WAS DETERMINED AND A SUGGESTED SPECIFICATION WAS WRITTEN EMPLOYING A MAXIMUM PROFILE INDEX AND A MAXIMUM SINGLE PEAK DEVIATION. /AUTHOR/

Hankins, KD Orellana, H
Texas State Department of Highways & Public Transp Aug. 1968

1A 207395

PRACTICAL USES OF SPECTRAL ANALYSIS WITH SURFACE DYNAMICS ROAD PROFILOMETER

A BRIEF DESCRIPTION OF SPECTRAL AND COHERENCE ANALYSES IS PROVIDED, ALONG WITH SOME PRACTICAL EXAMPLES OF THEIR USE. THE FIRST APPLICATION IS AN INVESTIGATION OF DIFFERENCES BETWEEN AN INEXPENSIVE REPLACEMENT ROAD-FOLLOWING WHEEL AND THE STANDARD WHEEL THAT COMES WITH THE PROFILOMETER. THE SECOND EXAMPLE INVOLVES CONSTRUCTION CONTROL AND IDENTIFICATION OF DIFFERENCES BETWEEN 2 METHODS FOR LAYING ASPHALTIC BASE MATERIALS. BOTH OF THESE INVESTIGATIONS INVOLVED STATISTICALLY DESIGNED EXPERIMENTS SO THAT MORE RELIABLE CONCLUSIONS COULD BE OBTAINED AND CONFIDENCE LIMITS DEFINED. SLOPE VARIANCE AND ROUGHNESS INDEX STATISTICS WERE EXAMINED AND COMPARED WITH THE SPECTRAL AND COHERENCE

TERMINE THE QUALITY CHARACTERISTICS OF CURRENT CONSTRUCTION, MANY STATES HAVE BEEN MEASURING VARIATIONS IN ACCEPTED BITUMINOUS PRODUCTION. IT HAS BEEN FOUND THAT THE PRODUCTION OF HIGHWAY QUALITY BITUMINOUS PAVEMENT REQUIRES THE DILIGENCE OF THE PRODUCER, THE CONTRACTOR AND THE CONTRACTING AGENCY. THE STATISTICALLY MEASURED VARIATIONS OF ACCEPTED CONSTRUCTION INDICATE THAT MUCH MORE VARIABILITY EXISTS THAN IS REVEALED BY THE USUAL ACCEPTANCE TESTS. VARIATIONS IN EXCESS OF THOSE NORMALLY EXPECTED FOR GOOD PRACTICE WERE PREVALENT ON ALMOST EVERY JOB STUDIED. LARGE SAMPLING AND TESTING ERRORS VIRTUALLY PREVENT A TRUE EVALUATION OF THE MATERIAL VARIATION ON A SPECIFIC JOB. IT IS DIFFICULT TO ASSESS THE DEGREE TO WHICH VARIATIONS AFFECT ACTUAL PAVEMENT PERFORMANCE. RESEARCH RESULTS INDICATE THAT MUCH IMPROVEMENT COULD BE OBTAINED AND TESTING LOAD REDUCED BY THE FOLLOWING CHANGES: (1) ADJUST TOLERANCE LIMITS ON GRADATION TO CONFORM TO THE PRINCIPLE OF MOST TOLERANCE ON LARGEST FRACTION RETAINED ON A SIEVE, (2) CONTROL THE UNIFORMITY OF GRADATION OF THE MIXTURE BY HOT BIN SIEVE TESTS, WHEN A PRINTED RECORD OF BATCH WEIGHTS IS AVAILABLE, (3) REDUCE TO A MINIMUM THE NUMBER OF SIEVES USED FOR CONTROL TESTING, (4) EXERCISE MORE DILIGENCE IN THE TRAINING AND SURVEILLANCE OF OPERATORS PERFORMING CONTROL AND ACCEPTANCE TESTS, (5) REQUIRE INSTALLATION OF AUTOMATIC FEATURES ON ASPHALT PLANTS AND FINISHERS TO REDUCE HUMAN ERROR, AND (6) USE RANDOM SAMPLING TO OBTAIN ALL TEST PORTIONS.

Granley, EC *Public Roads, Us Bureau Public Roads* AUG69

1A 211467 ASPHALT PAVING TECHNOLOGY-SOME CURRENT DEVELOPMENTS AND TRENDS

A BRIEF SUMMARY IS PRESENTED OF RESEARCH AND DEVELOPMENT TRENDS IN THE DESIGN, CONSTRUCTION AND PERFORMANCE OF ASPHALT PAVEMENTS. IMPROVEMENT EFFORTS HAVE INCLUDED ACTIVITIES RELATED TO: (1) DEVELOPMENT OF IMPROVED SPECIFICATIONS FOR ASPHALT, (2) MEASUREMENT OF THE RESPONSE CHARACTERISTICS OF ASPHALTS AND ASPHALT PAVING MIXTURES IN MORE FUNDAMENTAL TERMS, (3) ANALYSIS OF SYSTEMS REPRESENTATIVE OF ASPHALT PAVEMENT STRUCTURES WITH SOME APPLICATIONS TO DESIGN, (4) CONSTRUCTION OPERATIONS INCLUDING THICK-LIFT ASPHALT CONCRETE CONSTRUCTION, USE OF PNEUMATIC-TIRED ROLLERS, AND INCREASED MIXTURE PRODUCTION CAPABILITIES, AND (5) CONSTRUCTION CONTROL INCLUDING STATISTICAL SPECIFICATIONS AND IMPROVED CONTROL OF THE COMPACTION OPERATION THROUGH ESTABLISHMENT OF COMPACTION EFFORT BY MEANS OF SMALL TEST SECTIONS, PAVEMENT PERMEABILITY MEASUREMENTS, OR NUCLEAR MEASUREMENTS. AN EXAMPLE IS PRESENTED TO DESCRIBE THE RESULTS OF SOME OF THESE STUDIES THAT HAVE BEEN UTILIZED TO DEVELOP A PAVEMENT DESIGN FOR A CITY-COUNTY HIGHWAY IN CALIFORNIA. TRENDS ILLUSTRATED IN THE EXAMPLE ARE THESE OF FIXED SECTIONS OF ASPHALT CONCRETE, PARTICULARLY FOR HEAVY DUTY HIGHWAYS, THE USE OF THEORY TO ASSIST IN DESIGN, IMPROVED CHARACTERIZATION OF MATERIALS TO UTILIZE THEORY AND COMPACTION PROCEDURES TO ACCOMPANY THICK-LIFT DESIGNS. ADDITIONAL TOOLS ARE PRESENTED AS SUPPLEMENTING EXISTING PROCEDURES TO EXTEND THE SCOPE OF ASPHALT PAVING TECHNOLOGY.

Monismith, CL *Civil Engineering Asce* Aug. 1969

1A 211791 LOUISIANA'S EXPERIENCE WITH END RESULT SPECIFICATIONS FOR CONSTRUCTION OF ASPHALTIC CONCRETE

HISTORICAL DATA AND VERY LARGE NUMBERS OF TEST RESULTS HAVE BEEN USED IN THE DEVELOPMENT OF END

SPECIFICATIONS. THREE DECISIONS THAT HAVE TO BE MADE BEFORE WORK CAN BEGIN ARE REVIEWED. THE BACKBONE OF THE SPECIFICATIONS IS THE FACT THAT THE CONTROLS ARE DONE BY THE MANUFACTURER OR THE CONTRACTOR. THE METHOD OF ACCEPTANCE HAS TO BE ESTABLISHED AND INCLUDED. A DECISION HAS TO BE MADE ON WHAT IS TO BE CONSIDERED "QUALITY". A PAY SCHEDULE WHERE PAYMENT TO THE CONTRACTOR IS BASED ON ADJUSTMENT IN UNIT PRICE COMMENSURATE WITH THE QUALITY FURNISHED MUST NEXT BE DEVELOPED. FIGURES ILLUSTRATE A CONTROL CHART. IN A CONSIDERATION OF THE BASIS OF PAYMENT, ACCEPTANCE ON A LOT BASIS (A "NORMAL DAYS PRODUCTION OR A FRACTION THEREOF") IS RECOMMENDED. ACCEPTANCE IS BASED ON THE TEST RESULTS OF THE STABILITY, ROADWAY DENSITY, AND THE SURFACE SMOOTHNESS. THE PAYMENT SCALE FOR A SURFACE COURSE MIX IS PRESENTED. THE SCALE FOR MARSHALL STABILITY, THE ROADWAY DENSITY REQUIREMENTS, PAYMENT SCALE FOR SURFACE SMOOTHNESS, AND THE REQUIREMENTS FOR ASPHALT CEMENT ARE TABULATED. USEFUL INFORMATION GAINED IN VARIOUS PROJECTS IS PRESENTED. THE PROBLEM OF CERTIFICATION (WHICH REQUIRES TRAINING MATERIALS, MANUALS, AND ADOPTION OF CERTIFICATION POLICIES) IS DISCUSSED. THE ADOPTION OF END RESULT SPECIFICATIONS IS RECOMMENDED PROVIDED THEY CAN BE FULLY IMPLEMENTED. CAUTION IS URGED AGAINST UNREASONABLE REQUIREMENTS.

Adam, V *Paving Forum /Napa/* 1972, pp 7-11, 6 Fig

1A 212057 DEVELOPING AND TRIAL USE OF ACCEPTANCE PLANS FOR COMPACTED EMBANKMENTS

PREVIOUS RESEARCH INDICATED THAT PRESENTLY ACCEPTED EMBANKMENT CONSTRUCTION WAS COMPACTED TO LESS THAN 100 PERCENT CONFORMANCE TO SPECIFICATIONS. A TRIAL SPECIFICATION, DEVELOPED FROM MIL. ST'D 414, ST'D DEV. UNKNOWN AND A SAMPLE SIZE OF 5, WAS USED TO SIMULATE ACCEPTANCE ON 3 PROJECTS TO COMPARE ITS EFFECTIVENESS WITH CONVENTIONAL TESTING. RANDOM DENSITY DETERMINATIONS WERE MADE ON 70 LOTS OF ACCEPTED WORK WITH A DIRECT TRANSMISSION NUCLEAR GAGE. TWO OF 70 LOTS WOULD HAVE BEEN REJECTED HAD THE SPECIFICATION BEEN APPLIED ON A CONTRACTUAL BASIS. THE MOVING AVERAGE OF 5 CONTROL CHARTS DEVELOPED FROM THE RESEARCH DATA SHOWED WHERE CORRECTIVE ACTION COULD HAVE BEEN MADE TO ADVERT ANY REJECTION. THE REPORT CONCLUDES THAT THE TRIAL SPECIFICATION WILL PROVIDE LESS CHANCE OF ACCEPTING DEFECTIVE CONSTRUCTION. /BPR/

Jorgenson, JL
North Dakota State University, North Dakota State Highway Dept.
Bureau of Public Roads /US/

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4601483 69)

1A 212254 METHOD FOR EARLY PREDICTION OF CONCRETE STRENGTH

AN ACCELERATED TEST TO DETERMINE THE COMPRESSIVE STRENGTH OF CONCRETE HAS BEEN MADE URGENT BY THE ADVENT OF PRESTRESSED CONCRETE. THE METHOD PROPOSED IN THIS ARTICLE REQUIRES 28 1/2 HOURS BETWEEN MOULDING AND TESTING AND PREDICTS 28 DAY STRENGTH TO AN ACCURACY OF PLUS OR MINUS 12%. THIS METHOD UTILIZES BOILING WATER AS A CURING AGENT FOR THE CYLINDERS. THE 12% ACCURACY IS CONSIDERED SUFFICIENT FOR ROUTINE QUALITY CONTROL. /CGRA/

Malhotra, VM , Dept Mines and Technical Surveys Ottawa
/Can/ Zoldners, NG Lapinas, R , Mount Royal Paving and
Supplies Ltd Montreal/ca *Engineering Journal /Canada/* Apr. 1965

1A SYSTEM CONSTRUCTION, MANAGEMENT & QUALITY CONTROL

1A 212259

COMPUTER EVALUATION OF CONCRETE QUALITY

THE HIGHWAY ENGINEER IS CURRENTLY FACED WITH AN INFORMATION AND CONSTRUCTION EXPLOSION IN WHICH IT HAS BECOME INCREASINGLY DIFFICULT TO SORT OUT THE RELEVANT FACTS IN TIME FOR THEM TO BE APPLIED, ESPECIALLY AS THE WORK PROCEEDS, TO IMPROVE THE QUALITY OF CONCRETE. PROBLEMS AND PITFALLS OF PRESENT SPECIFICATIONS AND PROCEDURES FOR CONTROL TESTING ARE DISCUSSED AND IT IS SUGGESTED THAT THESE ARE IN NEED OF REVIEW TO PLACE THEM ON A SOUNDER STATISTICAL BASIS USING ACCELERATED TESTS, ESPECIALLY FOR CONCRETE STRENGTH WHEREVER POSSIBLE. MODERN METHODS OF DATA PROCESSING, STORAGE AND RETRIEVAL ARE SHOWN TO OFFER POTENTIAL FOR THE FASTER HANDLING OF INFORMATION. AN INTEGRATED PROJECT, AT PRESENT BEING INTRODUCED BY THE DEPARTMENT OF HIGHWAYS IN ONTARIO, IS DESCRIBED. NEW REPORTING SYSTEMS HAVE BEEN ESTABLISHED TO FEED CONCRETE DATA TO A COMPUTER. THE DATA ARE THEN PROCESSED, STORED, RETRIEVED AND EVALUATED AS NEEDED FOR THE CONTROL OF QUALITY AT THE TIME OF CONSTRUCTION, THE SELECTION OF CONCRETE BEST SUITED TO A PARTICULAR STRUCTURAL DESIGN OR FOR THE STUDY OF PERFORMANCE. THE SHORT TERM BENEFIT IS IN BETTER CONTROL OF CONCRETE QUALITY AT THE TIME OF CONSTRUCTION. THE LONG TERM, AND PERHAPS EVEN MORE IMPORTANT BENEFIT, SHOULD BE THAT THE PROPERTIES OF CONCRETE WHICH INFLUENCE PERFORMANCE CAN BE IDENTIFIED AND BETTER SPECIFICATIONS PREPARED FOR FUTURE WORK. /AUTHOR/

Smith, P *Canadian Good Roads Association Proc* 1966

ACKNOWLEDGMENT: Canadian Good Roads Association

1A 212426

IMPULSE METHODS FOR CONTROLLING THE CONSTRUCTION SPEED OF PRESTRESSED CONCRETE BRIDGES

THE APPLICATION IS DESCRIBED OF TWO NONDESTRUCTIVE IMPULSE METHODS, VIZ., THE ULTRASONIC AND THE SONIC HAMMER METHODS FOR CHECKING THE QUALITY OF CONCRETE. THE TWO METHODS ARE COMPARED GIVING THEIR ADVANTAGES AND DISADVANTAGES ESPECIALLY IN RELATION TO SPEEDING UP THE CONSTRUCTION OF PRESTRESSED CONCRETE BRIDGES. /AUTHOR/

Javor, T *Am Concrete Inst Journal & Proceedings* May 1967

1A 213194

INVESTIGATION OF THE IMPACT-TYPE CONCRETE TEST HAMMER

THIS WORK DESCRIBES A SERIES OF TESTS DESIGNED TO DETERMINE THE RELIABILITY OF RESULTS, THE FEASIBILITY OF USE, AND THE PRACTICAL APPLICATIONS OF THE TEST HAMMER IN CONSTRUCTION CONTROL. TEST RESULTS ARE COMPARED TO THE PUBLISHED FINDINGS OF OTHER INVESTIGATORS AND THE RELIABILITY OF CALIBRATION CURVES UNDER VARIOUS TEST CONDITIONS IS CAREFULLY INVESTIGATED. INDICATED STRENGTHS ARE SIGNIFICANTLY AFFECTED BY SPECIMEN SIZE, RESTRAINT OR CLAMPING IN TESTING MACHINE, SURFACE TEXTURE, MIX PROPORTIONS, AND TYPE OF AGGREGATE. COEFFICIENT OF VARIATION OVER A WIDE VARIETY OF SPECIMENS AVERAGE 18.8 PERCENT AND EXCEEDED 30 PERCENT FOR SOME GROUPS OF SPECIMENS. IT IS RECOMMENDED THAT SPECIAL CALIBRATIONS BE PROVIDED FOR EACH MIX OR CHANGE OF AGGREGATE, AND THAT USE OF THE TEST HAMMER ON WEAK OR YOUNG CONCRETE BE KEPT TO A MINIMUM BECAUSE SUCH TESTING MAY PRODUCE SIGNIFICANT SURFACE BLEMISHES. /AUTHOR/

Mitchell, LJ Hoagland, GG *Highway Research Board Bulletin* 1961

1A 213384

SIGNIFICANCE OF ACCELERATED DURABILITY TESTS OF CONCRETE

PROCEDURES ARE REVIEWED THAT ARE APPLIED TO CONCRETE TO EVALUATE ITS DURABILITY IN FUTURE SERVICE. WITH PARTICULAR REGARD TO ITS RESISTANCE TO FREEZING AND THAWING AND DELETERIOUS CEMENT-AGGREGATE REACTIONS. OTHER EXPOSURE CONDITIONS ARE NOTED, SUCH AS ATTACK BY AGGRESSIVE SOLUTIONS AND OTHER MEDIA, ABRASION AND CAVITATION, AND HIGH TEMPERATURE. AN ACCELERATED TEST OF DURABILITY OF CONCRETE IS A PROCEDURE INTENDED TO EVALUATE RAPIDLY, IN EITHER ABSOLUTE OR RELATIVE TERMS, THE ABILITY OF THE MATERIAL TO WITHSTAND A SPECIFIED EXPOSURE. APPLICATION OF SUCH PROCEDURE REQUIRES THE FOLLOWING STEPS: (1) ESTABLISHING THE QUALITIES THAT CONTROL THE RATE OF DISINTEGRATION OF THE CONCRETE, (2) DEVELOPING PRACTICAL PROCEDURES BY WHICH THE CONTROLLING QUALITIES CAN BE MEASURED, (3) ESTABLISHING THE ACCURACY AND PRECISION OF THE PROCEDURES IN PREDICTING THE RATE OF DISINTEGRATION OF THE CONTRACT, AND (4) SPECIFYING QUALITY ASSURANCE PROGRAMS IN THE SELECTION OF CONCRETE-MAKING MATERIALS, MANUFACTURE OF THE CONCRETE, AND CONSTRUCTION PROCEDURES THAT WILL GUARANTEE THAT THE CONCRETE IN PLACE POSSESSES THE REQUIRED PROPERTIES. A BRIEF SUMMARY IS PRESENTED OF THE ESSENTIAL PHENOMENA BY WHICH CONCRETE CAN BE DAMAGED BY FREEZING AND THAWING. THE CONDITIONS THAT MUST BE ACCOMMODATED SO THAT AN ACCELERATED TEST WILL AFFORD A REALISTIC MEASURE OF THE RESISTANCE OF A GIVEN CONCRETE TO FREEZING DURING SERVICE ARE: (1) RATE OF FREEZING, (2) MINIMUM TEMPERATURE ATTAINED, (3) DURATION OF FREEZING CONDITION, (4) FREEZABLE WATER CONTENT OF THE CEMENT PASTE AND AGGREGATE, (5) AIR VOID VOLUME AVAILABLE FOR ACCOMMODATION OF THE WATER EXPELLED FROM THE FREEZING ZONES, AND (6) PARTICLE SIZE, PORE CHARACTERISTICS, AND PROPERTIES OF THE AGGREGATE PARTICLES. THE FOLLOWING PROCEDURES ARE REVIEWED WHICH HAVE BEEN DEVELOPED TO PROVIDE FOR ACCELERATED EVALUATION OF THE RESISTANCE OF HARDENED CONCRETE TO FREEZING AND THAWING: (1) ASTM METHODS OF TEST, (2) POWERS' TEST, AND (3) SCALING TESTS. THE FOLLOWING ACCELERATED TESTING METHODS ARE REVIEWED: (1) HEATING-COOLING AND WETTING-DRYING EXPOSURE OF CONCRETE, (2) THE ALKALI-SILICA REACTION IN CONCRETE, (3) EXPANSIVE REACTION IN CONCRETE CONTAINING CARBONATE ROCK AGGREGATES, (4) RESISTANCE OF CONCRETE TO ATTACK BY AGGRESSIVE MEDIA, (5) EVALUATION OF AGGRESSIVE MEDIA FROM INTERNAL SOURCES, (6) ABRASION RESISTANCE OF CONCRETE, AND (7) HIGH-TEMPERATURE EXPOSURE OF CONCRETE. THE VALUE OF ANY ACCELERATED TEST LIES IN THE DEGREE TO WHICH THE SERVICE CONDITION IS SIMULATED AND THE EXTENT TO WHICH THE PHYSICAL, CHEMICAL, AND MECHANICAL RESPONSES OF THE CONCRETE IN THE SERVICE CONDITION ARE REPRODUCED IN THE METHOD OF TEST.

Mielenz, RC *Highway Research Record, Hwy Res Board* 1969

1A 214124

ADVANCES IN NONDESTRUCTIVE TESTING OF CONCRETE

THIS PAPER REVIEWS RECENT ADVANCES IN THE FOLLOWING NONDESTRUCTIVE METHODS OF TESTING CONCRETE: ULTRASONIC, RESONANCE, RADIOACTIVE, ELECTRICAL, INITIAL SURFACE ABSORPTION, CHEMICAL ANALYSIS, AND HARDNESS. A BRIEF REVIEW IS GIVEN OF THE RESEARCH WORK IN PROGRESS AT THE SOUTH DAKOTA SCHOOL OF MINES AND TECHNOLOGY. THERE IS A GREAT POTENTIAL IN THE CONCRETE INDUSTRY FOR NONDESTRUCTIVE METHODS OF TESTING CONCRETE. TWO MAJOR FIELDS WHERE THOSE METHODS COULD PROVE TO BE SUPERIOR TO TRADITIONAL METHODS ARE QUALITY CONTROL IN THE CONSTRUCTION

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OF STRUCTURAL MEMBERS, BOTH PRECAST AND CAST-IN-PLACE, AND MONITORING STRENGTH DEVELOPMENT TO DETERMINE ACCEPTABLE TIMES FOR THE REMOVAL OF FORM WORK OR TRANSFER OF PRESTRESSING FORCE TO CONCRETE. /AUTHOR/

Li, S Ramakrishnan, V Russell, JE *Highway Research Record, Hwy Res Board* No. 378, 1972, pp 1-11, 37 Ref

1A 214424

DEVELOPMENT OF GUIDELINES FOR PRACTICAL AND REALISTIC CONSTRUCTION SPECIFICATIONS

CURRENT SPECIFICATIONS ARE SURVEYED AND GUIDELINES ARE DEVELOPED FOR DESIGNING PRACTICAL AND REALISTIC CONSTRUCTION SPECIFICATIONS WITH DUE CONSIDERATION BEING GIVEN TO PURPOSE, FORMAT, LANGUAGE, OBJECTIVITY, COMPREHENSIVENESS IN SCOPE AND DESIGN, AND APPLICATION OF SUCH CONCEPTS AS VALUE ENGINEERING, STATISTICAL ANALYSIS, AND THE THEORY OF INHERENT RISKS ASSOCIATED WITH MAKING DECISIONS BASED ON ACCEPTANCE SAMPLES. GRADATION REQUIREMENTS FOR AGGREGATES AND MIXTURES OF AGGREGATES WITH OTHER MATERIALS ARE BASED ON THE CONTROL OF SIZE AND QUANTITY OF VOIDS, AS DETERMINED BY THE GIVEN THEORETICAL METHOD, MODIFIED TO INCLUDE VARIATIONS TO BE EXPECTED UNDER NORMAL CONSTRUCTION CONDITIONS. PAVEMENT SMOOTHNESS REQUIREMENTS ARE BASED ON BOTH THE DEVIATIONS FROM A STRAIGHTEDGE, AND THEIR SPAN, IN ACCORDANCE WITH SLOPE-VARIANCE CRITERIA DEVELOPED AT THE AASHO ROAD TEST. TOLERANCES AND PENALTIES FOR DEFICIENCY OF THICKNESS OF PAVEMENT COURSES SHOULD BE RELATED TO REDUCTION IN SERVICE LIFE IN TERMS OF DAILY TRAFFIC. THEORETICAL LOSS OF PERFORMANCE IS TWICE THE COST, ON A FRACTIONAL-INCH BASIS, FOR FLEXIBLE PAVEMENTS AND FIVE TIMES THE COST FOR RIGID PAVEMENTS.

Highway Research Board Nchrp Reports 1965

1A 214427

SYMPOSIUM-THICKNESS VARIATION OF ASPHALT CONCRETE-PART 1- IMPORTANCE OF THICKNESS CONTROL-HOW WELL CAN WE EXPECT TO CONTROL THICKNESS?

THE AASHO ROAD TEST WAS A RESEARCH PROJECT, THEREFORE UNIFORMITY IN CONSTRUCTION CONTROL WAS EXTREMELY IMPORTANT. TO SECURE THE REQUIRED UNIFORMITY IN THICKNESS THE EMBANKMENT SOIL, SUB-BASE AND BASE WERE SUBGRADED BY MECHANICAL SUBGRADERS RIDING ON SIDE FORMS. EACH SUBGRADED LAYER WAS REQUIRED TO BE WITHIN PLUS OR MINUS 1/8 IN. OF ESTABLISHED GRADE AND THE BASE AND SUBBASE WERE NOT PERMITTED TO DEVIATE MORE THAN PLUS OR MINUS 1/2 IN. FROM PLAN THICKNESS. THE ASPHALT CONCRETE SURFACING WAS REQUIRED TO BE WITHIN 1/8 IN. OF ESTABLISHED GRADE WHEN CHECKED BY A 10 FT. STRAIGHT EDGE. THE TOTAL THICKNESS OF THE COMPLETED MAT /SURFACE PLUS BINDER/ WAS TO BE WITHIN PLUS OR MINUS 1/4 IN. OF THE DESIGN THICKNESS. GUIDE WIRES FOR THE PAVER AND ROD AND LEVEL MEASUREMENTS WERE USED TO SECURE THE REQUIRED CONTROL. A QUESTION PERTINENT TO THE SUBJECT OF THIS SYMPOSIUM IS, HOW WELL DID WE CONTROL THICKNESS ON THE AASHO ROAD TEST? REFERENCE TO THICKNESS MEASUREMENTS REPORTED IN THE AASHO ROAD TEST, REPORT 2, MATERIALS AND CONSTRUCTION /1/ AND TO INDEPENDENT ANALYSES OF THE DATA WILL BE MADE IN DISCUSSING THIS QUESTION. /NAPA/

Shook, JF *Assoc Asphalt Paving Technol Proc* Feb. 1964

ACKNOWLEDGMENT: National Asphalt Pavement Association NAPA4085, 3C33017018

1A 214433

REPORT ON THE EVALUATION OF A CORING RIG FOR THE PURPOSE OF REDUCING THE TIME INVOLVED TO DIG A UNIFORM DENSITY HOLE

A SUITABLE CORRELATION HAS BEEN MADE OF DUPLICATE DENSITY TESTS MADE BY A NUCLEAR GAGE AND A WATER-BALLOON APPARATUS IN HOLES DRILLED WITH A PORTABLE CORING RIG. THE DRILLED HOLES ARE COMPLETED IN ABOUT ONE-HALF THE TIME NEEDED WHEN USING CONVENTIONAL METHODS IN LIMEROCK BASE COURSES. THE CORING RIG METHOD IS NOW USED FOR ROUTINE CONSTRUCTION CONTROL TESTING.

Todor, PC

Florida State Road Department Hpr, Oct. 1965

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4722884 66)

1A 214437

STATISTICAL QUALITY CONTROL

THIS PROJECT WAS TYPE I, SPECIAL A ASPHALTIC CONCRETE SURFACING 3 INCHES THICK AND 24 FEET WIDE WITH A TOTAL LENGTH OF 12 MILES. A CONTINUOUS BATCH PLANT WAS EMPLOYED USING CRUSHED SAND-GRAVEL AND CRUSHED LIMESTONE ROCK WITH THE ASPHALT AT A DESIGN VALUE OF 4.9%. RANDOM SAMPLES WERE OBTAINED TO DETERMINE TEMPERATURE, THICKNESS AND DENSITY IN THE FIELD, AND TO DETERMINE VALUES OF STABILITY, GRADUATION, VOIDS AND ASPHALT CONTENT IN THE LABORATORY. FIELD AND LABORATORY DATA SHEETS ARE PRESENTED. STATISTICAL PARAMETERS INCLUDE STANDARD DEVIATION, VARIANCE DUE TO MATERIAL SAMPLING AND TESTING, AND THE OVERALL COEFFICIENT OF VARIATION. THESE PARAMETERS DISCLOSE ANY WEAKNESS OF UNIFORMITY OF MATERIAL, SAMPLING OR TESTING FOR THE PROJECT. THE DATA WILL SUPPLEMENT THE PUBLIC ROADS RESERVIOR OF SIMILAR DATA FOR USE IN FUTURE SPECIFICATIONS AND CONSTRUCTION CONTROL. THE STATE OFFERS NO CONCLUSIONS OR RECOMMENDATIONS AT THIS TIME ON THIS TYPE OF CONSTRUCTION. /BPR/

Nebraska Department Roads

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4721263 66)PB 173 931, 1C33020523

1A 214441

COMPACTION CONTROL OF A MAJOR CONSTRUCTION PROJECT WITH THE MICHIGAN NUCLEAR GAGE

DURING THE 1965 FIELD TESTS THE MICHIGAN COMBINATION-TYPE NUCLEAR MOISTURE-DENSITY GAUGE PROVED TO BE A SATISFACTORY MEANS OF EMBANKMENT COMPACTION CONTROL FOR ALL SOIL AND AGGREGATE MATERIALS TESTED. THE TESTING TIME USING THE NUCLEAR GAUGE WAS ABOUT ONE-HALF THAT REQUIRED WITH CONVENTIONAL METHODS. THE CONVENTIONAL RAINHART CHECK TEST INDICATED PROPER JOB CONTROL WITH THE NUCLEAR METHOD. NORMAL JOB SAMPLING PROCEDURES WERE COMPARED WITH STATISTICALLY RANDOM SAMPLING WITH PROMISING RESULTS. FURTHER EXPERIMENTATION IS PLANNED DURING CY 1966 OPERATIONS ON THIS PROJECT DURING WHICH TIME MORE CAREFUL AND COMPLETE EVALUATION OF THE STATISTICAL RANDOM SAMPLING TECHNIQUES WILL BE PERFORMED. /AUTHOR/

Defoe, JH Mainfort, RC

Michigan Dept State Highways Sept. 1966

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4722102 66)PB 173 553, 1C33020629

1A 214442

QUALITY CONTROL ANALYSIS, PART III, CONCRETE AND CONCRETE AGGREGATES

THIS IS THE THIRD AND LAST REPORT ON THE QUALITY CONTROL ANALYSIS OF HIGHWAY CONSTRUCTION MATERI-

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ALS. IT DEALS WITH THE STATISTICAL EVALUATION OF DATA FROM SEVERAL CONSTRUCTION PROJECTS TO DETERMINE VARIABILITY OF SLUMP AND OF AGGREGATES. THE ANALYSIS INDICATED /1/ THAT THE FREQUENCY DISTRIBUTION OF MOST OF THE DATA TEND TO FOLLOW NORMAL DISTRIBUTION, /2/ THAT THERE IS CONSIDERABLE VARIATION IN CONCRETE PRODUCTION FROM BATCH TO BATCH, /3/ THAT FOR FINE AGGREGATE, THE STOCKPILE COMPONENT OF VARIANCE CONTRIBUTES MORE TO THE OVERALL VARIANCE THAN SAMPLES WITHIN STOCKPILE COMPONENT, AND /4/ THAT IN THE CASE OF COARSE AGGREGATES THE SAMPLE WITHIN STOCKPILE COMPONENTS SHOW LARGER VARIANCE THAN BETWEEN STOCKPILE COMPONENTS. THE STUDY REVEALED HOW CONTROL CHARTS CAN BE USED FOR CONTROL AND ACCEPTANCE OF P.C. CONCRETE. THE REPORT INCLUDES AN ANALYSIS OF THICKNESS OF PAVEMENT AND ANALYSIS OF BITUMINOUS HOT MIX DENSITY AND DISCHARGE TEMPERATURE. /BPR/

Louisiana Department Highways Sept. 1966

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4721183 66)PB 173 822, 1C62020484, 3C33083225, 1C33020631, 3C33021718

1A 214444

THE COMPACTION OF SOIL AND ROCK MATERIALS FOR HIGHWAY PURPOSES

THE MANY FACTORS RELATED TO THE PHENOMENUM OF SOIL AND SOIL-AGGREGATE COMPACTION IN THE PRESENCE OF MOISTURE AND THE BEHAVIOR OF THE SOIL-MOISTURE MASS WHEN SUBJECTED TO STRESS ARE REVIEWED. THE REPORT PROVIDES A REVIEW OF CURRENT KNOWLEDGE OF THE EQUIPMENT AND PROCESSES THAT INFLUENCE THE COMPACTION OPERATION AND THE PROPERTIES OF THE RESULTANT MASS BOTH IN THE LABORATORY AND IN THE FIELD. NO ORIGINAL RESEARCH WAS DONE IN THIS PHASE. THE AUTHORS COMPILED AND ANALYZED CURRENT STATE HIGHWAY DEPARTMENT COMPACTION SPECIFICATIONS AND FIELD PRACTICES, AND REVIEWED COMPACTION CONTROL PROCEDURES. METHODS WERE OFFERED TO DETERMINE THE VARIABILITY AND CONTROL OF QUALITY OF COMPACTED MASSES BY STATISTICAL QUALITY CONTROL DISCIPLINES. ON THE BASIS OF KNOWLEDGE OF THE STATE OF THE ART OF SOIL COMPACTION, THE AUTHORS OFFER RECOMMENDATIONS FOR CURRENT PRACTICES AND SPECIFICATIONS AS WELL AS FOR FUTURE RESEARCH. /BPR/

Wahls, HE Fisher, CP Langfelder, LJ
North Carolina State University Final Rpt. FHWA-RD-73-8, Aug. 1966,
457 pp

RESPONSIBLE INDIVIDUAL: McMahon, TF

Contract CPR-11-0954

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (3723993 66)
PB-227913/AS

1A 214445

PRESPLITTING-A CONTROLLED BLASTING TECHNIQUE FOR ROCK CUTS

RESEARCH WAS CONDUCTED ON CONSTRUCTION METHODS OF IMPROVED QUALITY AND LOWER COSTS IN THE HIGHWAY BUILDING OPERATIONS. THE EFFICACY AND ECONOMIC FEASIBILITY OF PRESPLITTING WORK IN HIGHWAY CUT SECTIONS WERE INVESTIGATED, AS WERE DEVELOPMENTS IN BLASTING, SUCH AS DRILL HOLE PATTERNS, DELAY CAPS, CONTROL OF SHOCK WAVE, SMOOTH WALL EXCAVATION TECHNIQUES, NEW TYPES OF EXPLOSIVES AND RESULTS ACHIEVED ON ROAD CONSTRUCTION. A COLLECTION OF CONSTRUCTION SPECIFICATIONS IN USE AND A SERIES OF PHOTOGRAPHS ILLUSTRATING RESULTS ACHIEVED ON SPECIFIC PROJECT APPLICATIONS ARE PRESENTED. THE FINDINGS DEMONSTRATE THAT SIGNIFICANT ADVANTAGES IN QUALITY OF CONSTRUCTION, SAFETY AND MAINTENANCE ARE ATTAINABLE THROUGH APPROPRIATE USE OF CONTROLLED BLASTING TECHNIQUES.

State Highway Departments Feb. 1967
ACKNOWLEDGMENT: Bureau of Public Roads /US/ (2723013 67)

1A 214447

CONSTRUCTION CONTROL PROFILOGRAPH PRINCIPLES

IN 1963, THE TEXAS HIGHWAY DEPARTMENT IN COOPERATION WITH THE BUREAU OF PUBLIC ROADS INITIATED A RESEARCH PROJECT TO DEVELOP A PROFILOGRAPH WITH WHICH TO CONTROL PAVEMENT SURFACE ROUGHNESS DURING CONSTRUCTION OPERATIONS. TO DETERMINE THE DESIRABLE QUALITIES OF SUCH AN INSTRUMENT, STUDIES WERE MADE OF THE EFFECT OF THE NUMBER OF AVERAGING WHEELS, THE ARRANGEMENT OF THE AVERAGING WHEELS AND FRAMEWORK, AND THE LENGTH OF THE INSTRUMENT. STUDIES HAVE INDICATED THAT THE NUMBER OF AVERAGING WHEELS AFFECTS THE ACCURACY OR READABILITY OF THE OUTPUT RESULTS. BETTER RESULTS ARE PRODUCED IF THE AVERAGING WHEELS ARE SPACED EVENLY ALONG THE LENGTH OF THE INSTRUMENT. THE SELECTION OF THE LENGTH OF THE EQUIPMENT DEPENDS UPON THE MAGNITUDE OF THE LENGTH OF THE SURFACE IRREGULARITIES TO BE EXPERIENCED. THE STUDIES WERE MADE USING A MODEL AND CONFIRMED USING THEORETICAL METHODS. /AUTHOR/

Hankins, KD
Texas State Department of Highways & Public Transp Jan. 1967

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4723403 67)CFSTI PB 177 470, HRIS 26 021175, 1C33020821

1A 214450

AN INVESTIGATION OF COMPACTION VARIABILITY FOR SELECTED HIGHWAY PROJECTS IN INDIANA

THE AREA OF STUDY CHOSEN FOR THIS PROJECT WAS COMPACTION CONTROL OF SUBBASE AND SUBGRADE ELEMENTS AS USED UNDER RIGID PAVEMENTS. THREE PROJECTS OF EACH WERE SELECTED FOR INVESTIGATION IN INDIANA. THE OBJECTIVE WAS /1/ TO GATHER DATA TO DETERMINE WHAT LEVEL OF COMPACTION WAS ACTUALLY BEING ACHIEVED UNDER PRESENT CONSTRUCTION PRACTICES BY STUDYING THE VARIABILITY IN COMPACTION AND THE FACTORS CAUSING THE VARIABILITY, AND /2/ TO DETERMINE HOW A STATISTICAL QUALITY CONTROL MIGHT BE DEVELOPED FROM THESE DATA. TO ASSURE A REALISTIC ESTIMATE OF THE TRUE LEVEL OF COMPACTION, ONE HUNDRED FIELD DENSITY TESTS WERE PERFORMED FOR EACH PROJECT BY SELECTING TEN UNITS OF CONSTRUCTION OF EQUAL SIZE AND MAKING FIVE RANDOMLY REPLICATED DENSITY TESTS IN EACH. REFERENCE VALUES FOR PERCENT COMPACTION WAS THE USE OF ONE-POINT FIELD COMPACTION TEST IN CONJUNCTION WITH A FAMILY OF TYPICAL CURVES. RESULTS OBTAINED INDICATED AN OVERALL LEVEL OF COMPACTION LOWER THAN THAT SPECIFIED. VARIABILITY IN COMPACTION WAS LARGE. DATA INDICATED GREATER VARIABILITY IN THE SUBGRADE COMPACTION THAN IN THE SUBBASES. THE STATISTICAL ANALYSIS INDICATED MORE TESTS FOR A UNIT WERE REQUIRED TO INSURE UNIFORM COMPACTION. A MAIN PROBLEM IS TO INSURE THAT TESTS ARE PROPERLY PERFORMED. /AUTHOR/

Williamson, TG Yoder, EJ
Purdue & Ind State Hwy Comm Jhrp Hpr, 1967

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4601163 67)CFSTI PB 177 453, 1C33020857

1A 214459

THE STATISTICAL APPROACH TO QUALITY CONTROL IN HIGHWAY CONSTRUCTION

THIS PUBLICATION IS INTENDED TO ASSIST STATE HIGHWAY DEPARTMENTS IN PLANNING RESEARCH PROGRAMS TO ESTABLISH QUANTITATIVE VALUES OF STATISTICAL PARAMETERS FOR HIGHWAY MATERIALS AND PROCESSES. THESE PARAMETERS ARE NEEDED TO APPLY STATISTICAL CON-

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CEPTS TO QUALITY CONTROL IN HIGHWAY CONSTRUCTION. THIS PUBLICATION INCLUDES BACKGROUND INFORMATION CONCERNING THE DEVELOPMENT OF AN OVERALL PLAN FOR APPLICATION OF THE STATISTICAL APPROACH TO QUALITY CONTROL IN HIGHWAY CONSTRUCTION. TO AVOID MISUNDERSTANDING, IT MUST BE EMPHASIZED THAT THE RELATIVELY LARGE AMOUNT OF SAMPLING AND TESTING REQUIRED IN THIS RESEARCH PROGRAM TO ESTABLISH SIGNIFICANT PARAMETERS INVOLVED WILL NOT BE REQUIRED WHEN SPECIFICATIONS ARE BASED ON STATISTICAL CONCEPTS. THE METHODS OF APPLICATION OF STATISTICAL PRINCIPLES TO SPECIFIC CONTROL PROBLEMS IN HIGHWAY CONSTRUCTION HAVE NOT, AS YET, BEEN SELECTED. IN CERTAIN CASES, IT IS LIKELY THAT PRESENT CONTROL PRACTICES WILL BE CONTINUED WHEREAS, IN OTHER CASES, A DIFFERENT SYSTEM OF CONTROL EMPLOYING CONSIDERABLY REDUCED NUMBER OF TESTS MAY BE ADEQUATE. HOWEVER, A NEW CONCEPT OF INTERPRETATION OF TEST RESULTS THEN WILL BE NECESSARY. /BPR/

Bureau of Public Roads /US/ Apr. 1965

ACKNOWLEDGMENT: Bureau of Public Roads /US/PB 176 059, 1C33021018

1A 214461

QUALITY ASSURANCE THROUGH PROCESS CONTROL AND ACCEPTANCE SAMPLING

THIS PAMPHLET EXPRESSES THE PHILOSOPHY BEHIND THE RESEARCH EFFORT OF THE QUALITY ASSURANCE GROUP OF THE OFFICE OF RESEARCH AND DEVELOPMENT, BUREAU OF PUBLIC ROADS. IT PRESENTS MANY OF THE STATISTICAL CONCEPTS AND METHODS EMPLOYED IN THE PROCESS OF QUALITY ASSURANCE. QUALITY ASSURANCE FOR HIGHWAYS REQUIRES THE ANSWER TO (1) HOW DO WE ORDER WHAT WE NEED TO PERFORM THE SERVICE REQUIRED AND (2) HOW DO WE KNOW WE ARE GETTING WHAT WE ORDERED? SPECIFICATIONS MUST RECOGNIZE VARIABILITIES AND BE WRITTEN ON A PROBABILITY RATHER THAN AN ABSOLUTE BASIS. THE NECESSARY LEVEL OF QUALITY MUST BE CONSIDERED. STATISTICAL APPROACH TO MATERIALS SPECIFICATIONS MUST PROVIDE FOR A CLEAR UNDERSTANDING OF HOW MEASUREMENTS WILL BE MADE. SAMPLING PLANS ARE DESIGNATED AND CORRESPONDING TOLERANCES DOCUMENTED. THIS REPORT IS A GUIDE TO INSTRUMENTING SUCH A PROGRAM WITH REFERENCES TO PRIOR STUDIES ON THIS NEWER CONCEPT OF EVALUATING AND ACCEPTING HIGHWAY MATERIALS AND CONSTRUCTION PROCESSES. ANALYSIS OF VARIANCES OF CHARACTERISTICS AND ATTRIBUTES DISCLOSE AREAS NEEDING CORRECTIVE ACTION THUS PROVIDING ECONOMIC SATISFACTION FOR BOTH THE BUYER AND SELLER. /BPR/

Bureau of Public Roads /US/ Adm. Apr. 1967

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (2601012 67)PB 176 335, 2C33084583, 1C33021088

1A 214466

APPLICATION OF STATISTICAL SPECIFICATIONS FOR HIGHWAY CONSTRUCTION

A BRIEF SUMMARY IS PRESENTED OF THE STUDY TITLED APPLICATION OF STATISTICAL QUALITY CONTROL METHODS IN THE FORM OF A PAPER FOR PRESENTATION AT A TECHNICAL CONFERENCE, OUTLINING THE APPLICATION OF STATISTICAL QUALITY CONTROL METHODS FOR ANALYSIS OF DATA ON DETERMINATION OF PENETRATION TESTS OF ASPHALT, GRADATION OF AGGREGATE, COMPACTION OF EMBANKMENTS AND THE USE OF CONTROL CHARTS OF MOVING AVERAGES. THE REPORT DOES NOT ATTEMPT TO SPECIFY FREQUENCY OF SAMPLING NOR DEFINE THE LOT OF MATERIAL. THE STATE IS WORKING TOWARDS THE GOAL OF DEVELOPING MORE ENFORCEABLE SPECIFICATIONS. /BPR/

Watkins, RO

California Division Highways, Bureau of Public Roads /US/ 1968

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4601413 68)

1A 214468

THE STATISTICAL APPROACH TO QUALITY CONTROL IN HIGHWAY CONSTRUCTION, PHASE I, MEASURING THE VARIABILITY, PART A- COMPACTED EMBANKMENTS
THE WORK REPORTS ON MEASUREMENTS OF VARIABILITY OF PERCENT COMPACTION AND MOISTURE CONTENT OF ACCEPTED EMBANKMENTS ON THREE HIGHWAY GRADING PROJECTS, EACH LOCATED IN A MAJOR GEOLOGICAL AREA OF THE STATE. IN-PLACE RANDOM DENSITY COMPARISONS WERE MADE OF THE WATER BALLOON METHOD, WITH NUCLEAR MOISTURE DENSITY GAGE IN DIRECT TRANSMISSION WITH 6 INCH PROBE PENETRATION AND WITH BACKSCATTER POSITION READINGS OF FLUSH DENSITY, FLUSH MOISTURE CONTENT, TWO-INCH AIR GAP DENSITY AND STANDARD COUNTS FOR MOISTURE AND DENSITY. /BPR/

Jorgenson, JL

North Dakota State University, North Dakota State Highway Dept,
Bureau of Public Roads /US/ Mar. 1968

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4601483 68)CFSTI PB 182 285, HRIS 33021344, HRIS 021947, 1C33021315

1A 214471

THE STATISTICAL APPROACH TO QUALITY CONTROL IN HIGHWAY CONSTRUCTION, PHASE I, MEASURING THE VARIABILITY, PART B, ASPHALT CONSTRUCTION
MEASUREMENTS ARE REPORTED OF VARIABILITY OF BITUMINOUS CONCRETE CONSTRUCTION ON 3 JOBS. TEST MEASUREMENTS VARIATIONS REPORTED ON INCLUDE: HOT BIN GRADATION, EXTRACTED GRADATION, ASPHALT CONTENT, ACTUAL ASPHALT USED, MIX TEMPERATURE AT PLANT AND PAVER, STABILITY FROM LAB MIXES AND PAVEMENT CORES, CONVENTIONAL AND FLUSH AND AIR GAP NUCLEAR DENSITY, PAVEMENT THICKNESS, VOLUME OF VOIDS. TEST RESULTS INCLUDE: TESTING, SAMPLING AND MATERIAL VARIANCE. /BPR/

Jorgenson, JL

North Dakota State University, North Dakota State Highway Dept,
Bureau of Public Roads /US/

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4601483 68)PB 182 286, 1C33021315, 1C33021947, 1C33021344

1A 214474

STATISTICAL QUALITY CONTROL OF HIGHWAY CONSTRUCTION MATERIAL

A SUMMARY OF THE FINDINGS OF SEVERAL INTERIM REPORTS ON STATISTICAL QUALITY CONTROL OF HIGHWAY CONSTRUCTION MATERIAL IS PRESENTED. THE ADVANTAGES AND LIMITATIONS OF THE PRESENT CONTROL PROCEDURES ARE DISCUSSED. THE WORK DONE TO DATE INDICATES THAT STATISTICAL SPECIFICATION CAN BE USED TO THE ADVANTAGE OF THE HIGHWAY ENGINEER. DURING THE STUDY SOME OF THE PROBLEMS IDENTIFIED THAT NEED ADDITIONAL ATTENTION WERE: PERSONNEL TRAINING, REPRODUCIBILITY OF TESTS, PRESERVATION OF ENGINEERING JUDGMENT, AND COST OF ADMINISTRATION. POSSIBLE SOLUTIONS TO THESE PROBLEMS ARE DISCUSSED INCLUDING DETERMINING THE PRECISION OF TEST METHOD AND PROCEDURES FOR ASSURING THAT A LABORATORY IS IN OPERATIONAL CONTROL. ONE SPECIFIC PROCEDURE, QUALITY CONTROL BY THE MOVING AVERAGE USING CONTROL CHARTS, IS PROPOSED. IT IS ANTICIPATED THAT THIS PROCEDURE WILL PROVIDE CONTROL WITHOUT INCREASING COST WHILE AT THE SAME TIME SUPPLYING MANAGEMENT INFORMATION IN THE FORM OF CHARTS AND GRAPHS. /AUTHOR/

Sherman, GB Watkins, RO

California Division Highways, Bureau of Public Roads /US/ 1968

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4601123 68)PB 180260, 3C33021382

1A SYSTEM CONSTRUCTION, MANAGEMENT & QUALITY CONTROL

1A 214477

DETERMINATION OF STATISTICAL PARAMETERS FOR HIGHWAY CONSTRUCTION

RESULTS OF TESTS ON PORTLAND CEMENT CONCRETE PAVEMENT INDICATE THAT THE LEVEL AND OVERALL COEFFICIENT OF VARIATION WAS SATISFACTORY ON MOST PROJECTS, BUT THE TESTING ERROR WAS SOMEWHAT HIGH. MEASUREMENTS OF BITUMINOUS PAVING MIXTURES SHOW EXCESSIVE VARIATION IN THE DETERMINATION OF BITUMIN CONTENT, THUS THE STATE DEVELOPED A NEWER METHOD OF TEST, THE PYCONOMETER METHOD, WHICH SHOWED PROMISE AS A BETTER TEST. DENSITY OF BITUMINOUS PAVEMENT MATERIAL WAS DETERMINED BY THE NUCLEAR METER WHICH QUICKLY DISCLOSED THE VARIATION TRANSVERSELY AND LONGITUDINALLY ON THE ROADWAY. PERHAPS THE MOST IMPORTANT PHASE OF THE STUDY WAS THE SIMULATION OF STATISTICALLY DERIVED ACCEPTANCE PLANS WHICH PROVED THAT THE PLAN IS PRACTICAL IN WELL CONTROLLED CONCRETE PAVEMENT MATERIAL, AND CONCRETE OF INFERIOR QUALITY WILL BE PAID FOR AT A PROPORTIONAL REDUCED PRICE. /AUTHOR/

Materials Research & Development, Inc, West Virginia State Road Commission, Bureau of Public Roads /US/ State No 18, July 1968

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4601463 68)PB 182 328, 1C33021426

1A 214485

STATISTICAL QUALITY CONTROL STUDIES AND FINDINGS RELATIVE TO HIGHWAY CONSTRUCTION: AN ANNOTATED BIBLIOGRAPHY

THE REPORT PRESENTS A BRIEF HISTORY OF STATISTICAL QUALITY CONTROL, A DIGEST OF PERTINENT ACTIVITIES WITH RESPECT TO S.Q.C. IN HIGHWAY CONSTRUCTION AND A BRIEF SECTION ON THE MANAGEMENT OF THE SQC FUNCTION. IT CONSISTS MAINLY OF AN ANNOTATED BIBLIOGRAPHY. /BPR/

Darroch, JG
Texas Transportation Institute, Texas State Department of Highways & Public Transp, Bureau of Public Roads /US/

PB 182 624, 3B33021570

1A 214495

INVESTIGATION INTO THE USES OF STATISTICAL PROCEDURES IN SPECIFICATION WRITING AND QUALITY CONTROL

THE APPLICATION OF SEVERAL METHODS AND TECHNIQUES OF STATISTICAL ANALYSIS TO ACCEPTED TESTS OF HIGHWAY CONSTRUCTION MATERIALS WAS DEMONSTRATED. THE RESULTS VARY RATHER WIDELY IN NUMERICAL VALUES. SOME TECHNIQUES COULD AND HAVE BEEN PUT IN ROUTINE USE AS A RESULT OF THE STUDY. OTHER TECHNIQUES ON CERTAIN MATERIALS YIELDED SUCH EXTREME VALUES THAT THE AUTHORS QUESTIONED THEM AS BEING IN ERROR OR THE METHOD BEING INAPPROPRIATE. THE AUTHORS CONCLUDED THAT THERE ARE AREAS WHERE STATISTICAL CONTROL TECHNIQUES ARE SUITABLE FOR USE AND OTHER AREAS EXIST WHERE THERE IS A NEED FOR CHANGE IN STATISTICAL CONCEPTS OR TEST METHODS, OR BOTH BEFORE THE S.R.C. PROCEEDS WITH WRITING AND ENFORCEMENT OF STATISTICALLY ORIENTED SPECIFICATIONS. /AUTHOR/

Smith, NL Parrish, AS
Maryland State Roads Commission, Bureau of Public Roads /US/ Apr. 1969

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4601203 69)

1A 214499

PROCEEDINGS STATISTICAL QUALITY ASSURANCE WORKSHOP

APPROXIMATELY 125 STATE AND BUREAU OF PUBLIC ROADS ENGINEERS ATTENDED THE WORKSHOP IN WASHINGTON, D.

C., OCTOBER 22-23 AND 24, 1968, TO DISCUSS RESEARCH, DEVELOPMENT AND IMPLEMENTATION OF STATISTICAL QUALITY ASSURANCE IN HIGHWAY CONSTRUCTION. THE PROCEEDINGS CONTAIN A DIGEST OF THE TALKS, DISCUSSIONS, PAPERS, AND SUMMARIES OF THE MEETINGS TO CONSIDER THE QUALITY CONTROL OF BITUMINOUS MIXTURES, PORTLAND CEMENT CONCRETE, EMBANKMENT AND BASES AS MANUFACTURED MATERIALS SUCH AS PAINTS AND STEEL. PROCEDURES FOR SAMPLING AND TESTING TO ASCERTAIN THE UNIFORMITY OF QUALITY ARE OFFERED FOR THE VARIOUS TYPES OF CONSTRUCTION. THE AMOUNT OF ACCEPTABLE VARIANCE OF THE TEST RESULTS FOR MATERIALS IS SUGGESTED SEVERAL PROPOSED SPECIFICATIONS BASED ON STATISTICAL CONCEPTS ARE REPRODUCED IN THE APPENDIX. /BPR/

Research & Development Hpr, Oct. 1968

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (2601012 69)

1A 214504

DEVELOPING AND TRIAL USE OF ACCEPTANCE SAMPLING PLANS FOR ASPHALT CONSTRUCTION

PREVIOUS RESEARCH INDICATED THAT PRESENT ACCEPTED BITUMINOUS PAVEMENT CONSTRUCTION DOES NOT MEET SPECIFIED REQUIREMENTS. ALSO ON PROJECTS RESEARCHED EACH CONTRACTOR WAS PAID 100 PERCENT OF BID PRICE EVEN THOUGH THERE WAS A WIDE RANGE OF BELOW SPECIFICATION CONSTRUCTION BETWEEN JOBS. A SPECIFICATION DEVELOPED WILL ACCEPT CONSTRUCTION ON THE BASIS OF THE AVERAGE OF 5 TEST RESULTS PER LOT FOR (1) NOMINAL LARGEST SIEVE, #4 SIEVE, #30 SIEVE, #200 SIEVE, AC CONTENT, COMPACTION AND THICKNESS. ADJUSTMENT PRICE SCHEDULES ARE PROVIDED FOR THE ACCEPTANCE OF BELOW STANDARD CONSTRUCTION. A NUCLEAR GAGE CORRELATION WITH DENSITIES OBTAINED FROM CORES IS INCLUDED. /BPR/

Jorgenson, JL
North Dakota State University, North Dakota State Highway Dept, Bureau of Public Roads /US/

ACKNOWLEDGMENT: Bureau of Public Roads /US/ REPORT PENDING, 1C33021315, 1C33021344, 1C33021947

1A 214506

DETERMINATION OF STATISTICAL PARAMETERS FOR HIGHWAY CONSTRUCTION (CONTINUATION II). INTERIM REPORT FOR PERIOD APRIL 1968 TO APRIL 1970

THIS REPORT PRESENTS IN PART I, THE DETERMINATION OF ADDITIONAL STATISTICAL PARAMETERS FOR WEST VIRGINIA HIGHWAY CONSTRUCTION AND COMPARES THESE VALUES WITH THOSE PREVIOUSLY DETERMINED, AND INCLUDES FINDINGS OF DESIGNED EXPERIMENTS PERFORMED TO DETERMINE THE PATTERN OF VARIATIONS OF DENSITY OF BITUMINOUS CONCRETE PAVEMENTS, SUBGRADES AND EMBANKMENTS. PART II REPORTS THE RESULTS OF A SERIES OF DESIGNED LABORATORY EXPERIMENTS THAT INVESTIGATED THE RELIABILITY OF PREDICTING THE POTENTIAL STRENGTH OF CONCRETE. A SERIES OF DENSITY MEASUREMENTS CONFIRMED THE LARGE VARIATION OF DENSITY ACROSS THE WIDTH OF BITUMINOUS PAVING LANES AND REVEALED THAT THE PATTERN OF VARIATION IS CHANGED BY THE EFFECT OF TRAFFIC, THE DENSITY IS FAIRLY UNIFORM WITH SMALL AREAS BUT VARIES FROM AREA TO AREA. WHEREAS THE OPPOSITE PATTERN WAS FOUND IN DENSITY OF EMBANKMENT. THE DENSITY FOR A SUBGRADE WAS FOUND TO BE ESSENTIALLY RANDOM. TESTS ON PORTLAND CEMENT CONCRETE USED IN STRUCTURES INDICATED AN AVERAGE LEVEL OF COMPRESSIVE STRENGTH BUT ONE PROJECT HAD EXCESSIVE VARIATION. WITHIN TEST VARIABILITY OR TESTING ERROR WAS HIGHER THAN SHOULD BE EXPECTED. TESTS WITH THE KELLY BALL AND CHASE AIR METER COMPARED TO SLUMP CONE AND ROLL-A-METER REVEALED SOME ANOMALIES. /AUTHOR/

SYSTEM CONSTRUCTION, MANAGEMENT & QUALITY CONTROL 1A

Bowery, FJ
Materials Research & Development, Inc, West Virginia State Road
Commission, Bureau of Public Roads /US/

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4601463 70)REPORT
PENDING, 1C33022156

1A 214511

THE ECONOMIC FEASIBILITY OF THE APPLICATION OF STATISTICAL CONCEPTS AND METHODS TO THE CONTROL AND ACCEPTANCE OF HIGHWAY MATERIALS AND CONSTRUCTION

STATISTICAL QUALITY CONTROL IS NOT GENERALLY PRACTICED IN THE HIGHWAY INDUSTRY; THE PROBABLE COSTS OF SUCH A SYSTEM WERE ESTIMATED BY PROJECTION OF CURRENT COSTS OF CONTRACTORS AND PRODUCERS WHO ARE CURRENTLY MAINTAINING VOLUNTARY TESTING PROGRAMS. ESTIMATES BASED ON DATA OBTAINED FROM 49 CONCERNS IN 15 STATES INDICATE THAT THE COST OF AN ACCEPTABLE DEGREE OF QUALITY CONTROL OF HIGHWAY MATERIALS OR CONSTRUCTION BY THE CONTRACTOR OR PRODUCER WOULD AVERAGE ABOUT FOUR PERCENT OF CONTRACT PRICE. AVAILABLE INFORMATION INDICATES THAT THE CURRENT TOTAL ENGINEERING EXPENDITURES BY STATE AGENCIES ON FEDERAL AID PROJECTS IS IN THE ORDER OF 10 PERCENT OF CONTRACT PRICE. COMPARISONS OF RELATIVE COSTS BASED ON THESE NUMBERS AND ON DIFFERENT PROPORTIONS OF QUALITY CONTROL EFFORT SHARED BY THE CONTRACTOR AND THE STATE AGENCY INDICATE THAT THE OPTIMUM QUALITY ASSURANCE SYSTEM WOULD BE QUALITY CONTROL BY THE CONTRACTOR WITH ACCEPTANCE TESTING BY THE STATE AGENCY. THE DOLLAR COST OF SUCH A SYSTEM IS ESTIMATED TO BE ABOUT 20 PERCENT LESS THAN THAT OF CURRENT PROCEDURES. A RELATED ACTIVITY WAS A STUDY OF THE RELATIVE SIZE OF BUYER'S AND SELLER'S RISKS USING CURRENT ACCEPTANCE PROCEDURES AS COMPARED TO THOSE WHICH WOULD BE ASSOCIATED WITH A SYSTEM OF COORDINATED QUALITY CONTROL, REVISED SPECIFICATIONS, AND STATISTICAL SAMPLING PLANS. THIS STUDY INDICATED THAT THE LOWEST RISKS FOR THE SAME LEVEL OF TESTING EFFORT WOULD BE REALIZED WHEN A STATE OF STATISTICAL CONTROL OF PRODUCTION AND CONSTRUCTION PROCESSES WAS OBTAINED. /FHWA/

Materials Research & Development, Inc, California Division Highways,
Federal Highway Administration /US/

ACKNOWLEDGMENT: Federal Highway Administration (3601143
71)REPORT PENDING, 1C33022387

1A 214516

NUCLEAR TEST EQUIPMENT

THE CONCLUSIONS ARE: (1) NO RADIATION HAZARD EXISTS WHEN THE NUCLEAR GAUGES ARE PROPERLY HANDLED. (2) BEFORE USING NUCLEAR TESTING EQUIPMENT AN OPERATOR SHOULD RECEIVE INSTRUCTIONS ON THEORY, RADIATION, HEALTH SAFETY, MAINTENANCE, TESTING PROCEDURES, AND CALIBRATION. (3) STATISTICAL ANALYSIS OF THE DATA INDICATES THAT THE VARIANCE IN COUNT RATE ERROR IS BETTER DEFINED AS THE LENGTH OF TEST IS INCREASED. (4) CORRELATION CURVES DEVELOPED DURING THIS STUDY DO NOT AGREE WITH THOSE SUPPLIED BY THE MANUFACTURER, AND THE DEGREE OF CORRELATION IS IMPROVED WHEN A CURVE IS DEVELOPED FOR EACH TYPE OF MATERIAL TESTED. (5) THE STANDARD ERROR OF ESTIMATE FOR THE NUCLEAR TEST COMPARES FAVORABLY WITH THAT FOR THE VOLUMEASURE TEST IF AT LEAST A FOUR MINUTE COUNT RATE IS USED AND (6) NUCLEAR TESTING IS AN ACCEPTABLE MEANS OF CONSTRUCTION CONTROL. HOWEVER, PRESENT SPECIFICATIONS SHOULD BE REVISED TO COINCIDE WITH THIS CONCEPT OF TESTING. /AUTHOR/

Ramsey, WJ
Nebraska Department Roads, Federal Highway Administration /US/
Study No 64-5

ACKNOWLEDGMENT: Federal Highway Administration (4723094
71)REPORT PENDING, 2C33022599

1A 214524

ECONOMIC FEASIBILITY OF APPLICATION OF STATISTICAL CONCEPTS AND METHODS TO THE CONTROL AND ACCEPTANCE OF HIGHWAY MATERIALS AND CONSTRUCTION

THE PROBABLE COST OF A STATISTICAL QUALITY CONTROL SYSTEM WAS ESTIMATED BY PROJECTION OF CURRENT COSTS OF CONTRACTORS AND PRODUCERS WHO ARE CURRENTLY MAINTAINING VOLUNTARY TESTING PROGRAMS. ESTIMATES BASED ON DATA OBTAINED INDICATE THAT THE COST OF AN ACCEPTABLE DEGREE OF QUALITY CONTROL OF HIGHWAY MATERIALS OR CONSTRUCTION BY THE CONTRACTOR OR PRODUCER WOULD AVERAGE ABOUT 4 PERCENT OF CONTRACT PRICE. COMPARISONS OF RELATIVE COSTS INDICATE THAT THE OPTIMUM QUALITY ASSURANCE SYSTEM WOULD BE QUALITY CONTROL BY THE CONTRACTOR WITH ACCEPTANCE TESTING BY THE STATE AGENCY. THE DOLLAR COST OF SUCH A SYSTEM IS ESTIMATED TO BE ABOUT 20 PERCENT LESS THAN THAT OF CURRENT PROCEDURES. THE ECONOMIC BENEFITS IN TERMS OF THE DEGREE OF QUALITY ASSURANCE OBTAINED BY THIS SYSTEM AS COMPARED TO THE EXISTING SYSTEM ARE ESTIMATED TO BE EVEN MORE FAVORABLE. A STUDY OF THE SIZE OF BUYER'S AND SELLER'S RISKS WAS COMPARED TO THOSE WHICH WOULD BE ASSOCIATED WITH REVISED SPECIFICATIONS AND STATISTICAL SAMPLING PLANS. THE LOWEST RISKS FOR THE SAME LEVEL OF TESTING EFFORT WOULD BE REALIZED WHEN A STATE OF STATISTICAL CONTROL OF PRODUCTION AND CONSTRUCTION PROCESSES WAS OBTAINED. /AUTHOR/

Hudson, SB Bowery, FJ
Materials Research & Development, Federal Highway Administration
/US/ Fh-11-7272

ACKNOWLEDGMENT: Federal Highway Administration (3601143
72)REPORT PENDING, 3C33022772

1A 214525

CONTROL STRIP STUDY

THIS REPORT IS CONCERNED WITH THE APPLICATION OF THE "CONTROL STRIP" TECHNIQUE USING NUCLEAR DEVICES FOR COMPACTION CONTROL OF CERTAIN BASE COURSES AND ASPHALTIC CONCRETE SURFACE COURSES. THE TECHNIQUE, EVALUATED HERE, CONSISTS OF APPLYING INCREASINGLY COMPACTIVE EFFORT TO A SMALL SECTION (300 FEET) OF THE MATERIAL TO ESTABLISH THE OPTIMUM ROLLING PATTERN FOR THAT MATERIAL. NUCLEAR TESTING WAS USED TO DETERMINE BOTH THE MAXIMUM DENSITY AND DESIRED ROLLER PATTERN IN THE "CONTROL STRIP." THE ENSUING CONSTRUCTION WAS THEN TESTED IN SEGMENTS (2000 FEET) BY NUCLEAR MEANS TO CHECK FOR CONFORMANCE TO A CERTAIN PERCENTAGE OF THE "CONTROL STRIP" DENSITY. THE DATA COLLECTED AND THE FIELD EXPERIENCE GAINED INDICATED (1) THAT THE "CONTROL STRIP" TECHNIQUE USING NUCLEAR DEVICES OFFERED A QUICK AND FLEXIBLE APPROACH TO THE COMPACTION CONTROL OF BASE AND ASPHALTIC CONCRETE SURFACE COURSES; (2) THAT THE VARIABILITY OF DATA USING THESE PROCEDURES WAS NORMALLY WITHIN THE MAGNITUDE OF VARIATION ENCOUNTERED WITH THE CONVENTIONAL METHODS OF DENSITY DETERMINATIONS; (3) THE VARIATION IN THE LEVEL OF COMPACTION FROM ONE SECTION TO ANOTHER WAS MUCH MORE PRONOUNCED FOR CEMENT STABILIZED BASE COURSES THAN UNSTABILIZED BASES. /AUTHOR/

Shaw, SC Melancon, JL Hirschmann, JJ
Louisiana Department Highways, Federal Highway Administration /US/
Study No 69 - 2s

ACKNOWLEDGMENT: Federal Highway AdministrationREPORT PENDING, 3C33022849

1A SYSTEM CONSTRUCTION, MANAGEMENT & QUALITY CONTROL

1A 214527

HIGHWAY QUALITY CONTROL PROGRAM

THE OVERALL ACCEPTANCE TESTING PROGRAM FOR MATERIALS AND CONSTRUCTION WAS REVIEWED FOR PURPOSES OF DEVELOPING PRACTICAL AND MEANINGFUL SPECIFICATION LIMITS AND CONTROLS FOR IMPROVED ACCEPTANCE SAMPLING. SPECIAL EMPHASIS WAS GIVEN TO MODULUS OF RUPTURE CONCRETE FLEXURAL TESTS, PREFORMED NEOPRENE JOINT SEALANTS, CLASS III GRANULAR MATERIAL AND 22A AGGREGATE GRADATION. /FHWA/

Church, CD Copple, F Zepata, CA
Michigan Dept State Highways, Federal Highway Administration /US/

ACKNOWLEDGMENT: Federal Highway Administration REPORT PENDING, 3C33022855

1A 214559

MODERN CONCEPTS FOR DENSITY CONTROL PHASE I: BITUMINOUS WEARING COURSES

DURING 1969, 1970 AND 1971 DENSITY DATA WERE OBTAINED ON BITUMINOUS WEARING COURSES THAT WERE BEING CONSTRUCTED ON SEVERAL MINNESOTA TRUNK HIGHWAYS. DATA WERE COLLECTED AND ANALYZED FROM RANDOMLY SELECTED LOCATIONS ON FIVE BITUMINOUS SURFACING PROJECTS. A STATISTICAL ANALYSIS WAS ALSO PERFORMED ON RESULTS FROM ELEVEN OTHER BITUMINOUS PROJECTS AND ON LABORATORY TEST RESULTS. VARIATION WAS DETERMINED FROM THESE DATA BY COMPUTING THE MEAN AND STANDARD DEVIATION TO REVEAL EXISTING VARIABILITY IN ACCEPTABLE CONSTRUCTION OF BITUMINOUS WEARING COURSES. THE RESULTS WERE USED TO EVALUATE PRESENT SPECIFICATIONS AND TO DEVELOP A NEW ACCEPTANCE SAMPLING PLAN. THE PLAN IS BASED ON STATISTICAL CONCEPTS THAT WILL DEFINE THE DEGREE OF ACCEPTABLE VARIATION UPON WHICH DECISIONS CAN BE MADE WITH AN ESTABLISHED DEGREE OF CONFIDENCE. PROPOSED STATISTICAL SPECIFICATIONS ARE PRESENTED.

Wolters, RO
Minnesota Department of Highways Final Rept. 1973

ACKNOWLEDGMENT: Federal Highway Administration, Minnesota Department of Highways FHWA P-0041, NTIS PB 228473/AS, 2C33023585

1A 214560

CONSTRUCTION CONTROL OF RIGID PAVEMENT ROUGHNESS

PAVING PROCEDURES WERE MONITORED AND PERFORMANCE SURVEYED FOR 5 YEARS ON 108 PORTLAND CEMENT CONCRETE PAVEMENT PROJECTS TO DETERMINE THE FACTORS AFFECTING AS-BUILT SURFACE ROUGHNESS. THE CALIFORNIA PROFILOGRAPH WAS REPORTED EARLIER IN THIS INVESTIGATION TO BE A FAST, ACCURATE, AND REPRODUCIBLE METHOD OF MEASURING ROUGHNESS WITHIN A FEW HOURS AFTER PAVING. BY CONTRAST, CONSCIENTIOUS INSPECTION WITH A 10-FT STRAIGHT EDGE AND CORRECTION OF OUT-OF-TOLERANCE BUMPS DURING CONSTRUCTION DO NOT ASSURE SMOOTH-RIDING PAVEMENT. SLIP-FORM PAVING GENERALLY PRODUCES A MUCH SMOOTHER SURFACE THAN PAVING WITH CONVENTIONAL FIXED SIDE-FORMS. ALTHOUGH GOOD RESULTS CAN BE ACHIEVED BY EITHER METHOD, NEITHER ASSURES SMOOTHNESS. AMONG THE FACTORS FOUND TO AFFECT THE RESULTS FOR SLIP-FORM PAVEMENT ARE PAVING MACHINE BACKUP, PAN FLOATS, NUMBER OF SCREEDS, NIGHT JOINTS, PAVING EQUIPMENT CONDITION, AND PAVEMENT ALIGNMENT AND CROSS-SLOPE. FOR SLIP-FORM PAVING, THE MOST IMPORTANT ARE CONDITION OF THE FINE GRADE AND SUBGRADE, MESH PLACEMENT, NIGHT JOINTS, AND CHANGES IN CONCRETE SLIP. THE CLARY SCREED ALSO SHOWS PROMISE AS A MEANS OF REDUCING PAVEMENT ROUGHNESS WITH SLIP-FORM PAVING. GENERAL REQUIREMENTS FOR A SPECIFICATION TO ASSURE CONSTRUCTION OF SMOOTH PAVEMENT ARE ALSO DISCUSSED.

Bryden, JE Rider, RW

New York State Dept Transportation Vol. ysd0 No. -erd, Nov. 1973, 54 pp

ACKNOWLEDGMENT: New York State Dept Transportation, Federal Highway Administration FHWA P-0040, NTIS PB 228 572/AS, 1C33023586

1A 214618

QUALITY CONTROL IN AUTOROUTE CONSTRUCTION

THE QUALITY CONTROL PROCEDURES EMPLOYED BY THE QUEBEC AUTOROUTE AUTHORITY IN THE CONSTRUCTION OF TOLL ROADS IS DESCRIBED. THE STANDARDS FOR MATERIALS AND CONSTRUCTION ARE INDICATED AS WELL AS ALLOWABLE DEVIATIONS. THE APPLICATION OF QUALITY CONTROL CHARTS IS ILLUSTRATED. THESE PROCEDURES ARE APPLIED TO SUBGRADE CONSTRUCTION, RIGID PAVEMENT CONSTRUCTION, FLEXIBLE PAVEMENT CONSTRUCTION, CONCRETE MIXES, ASPHALT MIXES, AGGREGATE GRADATION. THE AUTHORITY PAYS CONSULTANTS A LUMP SUM FOR QUALITY CONTROL INSPECTION WHICH AMOUNTS TO BETWEEN 2 AND 2.5 PERCENT OF THE TOTAL VALUE OF THE CONTRACT. /CGRA/

Trudeau, RT *Canadian Good Roads Association Proc* Oct. 1964

1A 214619

THE STATISTICAL BASIS OF QUALITY CONTROL CHARTS

THE STATISTICAL PRINCIPLES AND ASSUMPTIONS THAT FORM THE BASIS OF QUALITY CONTROL CHARTS ARE REVIEWED AND THE PROCEDURE FOR CONSTRUCTING THESE CONTROL CHARTS IS ILLUSTRATED WITH AN EXAMPLE. SPECIAL EMPHASIS IS PLACED ON THE PROCESSING OF HIGHWAY PAVING MATERIALS. THE SUMMARY AND CONCLUSIONS OF THE PAPER INDICATE THE APPLICATION AND LIMITATIONS OF THE METHOD IN CONSTRUCTION CONTROL AND SPECIFICATION INTERPRETATION.

Hutchinson, BG *Canadian Good Roads Association Proc* Oct. 1964

1A 214620

SIGNIFICANCE OF QUALITY CONTROL

THIS PAPER DESCRIBES THE PURPOSES OF INSPECTION AND TESTING IN HIGHWAY CONSTRUCTION, THE GENERAL PROCEDURE FOR QUALITY CONTROL, THE VALUE OF INSPECTION AND TESTING, THE NATURE OF SAMPLES, THE VALUE OF TEST RESULTS, SPECIFICATIONS AND EFFECTIVENESS OF JOB CONTROL. IT IS POINTED OUT THAT GOOD QUALITY CONTROL OF MATERIALS AND CONSTRUCTION OPERATIONS IS OF BENEFIT TO THE OWNER, THE ENGINEER, THE CONTRACTOR AND THE MATERIALS SUPPLIER. THE NEED FOR REALISTIC SPECIFICATIONS IS DISCUSSED TOGETHER WITH SUGGESTIONS FOR ACHIEVING THEM

Kerr, BT Henault, GG *Canadian Good Roads Association Proc* P233-38, Oct. 1964

1A 214621

QUALITY CONTROL OF ASPHALT PAVEMENT CONSTRUCTION

BECAUSE OF THE LIMITED INFORMATION AVAILABLE IN THE FIELD OF QUALITY CONTROL OF ASPHALT PAVEMENTS, AN INTENSIVE STUDY WAS MADE OF HUNDREDS OF TEST RESULTS FROM ACTUAL PAVING PROJECTS TO DETERMINE THE ACTUAL VARIATIONS WHICH DO OCCUR IN CONTROL TESTS. THE MEAN VALUES AND STANDARD DEVIATION VALUES WERE CALCULATED AND HISTOGRAMS SHOWING VARIATION WERE PLOTTED FOR ASPHALT PENETRATION, ASPHALT CONTENT, AGGREGATE GRADATION, SURFACE DENSITY, AIR VOIDS, MARSHALL STABILITY AND FLOW, ASPHALT SURFACE THICKNESS VARIATION. THE TEST RESULTS WERE COMPARED TO DESIGN VALUES AND SPECIFICATIONS. THE RESULTS INDICATE THE PERCENTAGE OF TEST RESULTS WHICH CAN BE EXPECTED TO FALL OUTSIDE OF SPECIFICATION LIMITS AND INDICATE THE USEFULNESS OF QUALITY CONTROL CHARTS IN INTERPRETING DATA. /CGRA/

SYSTEM CONSTRUCTION, MANAGEMENT & QUALITY CONTROL 1A

Huculak, NA *Canadian Good Roads Association Proc* Oct. 1964

1A 214625

SOIL COMPACTION FOR HIGHWAY CONSTRUCTION

THIS IS A PANEL DISCUSSION ON COMPACTION CONTROL. A BRIEF OUTLINE OF THE IMPORTANCE OF COMPACTION AND ITS EFFECTS AS WELL AS FACTORS INFLUENCING COMPACTION IS GIVEN. COMPACTION OF SUBGRADE AFFECTS PAVEMENT DURABILITY AND COMPACTION REQUIREMENTS FOR ALL AGENCIES SHOULD BE FAIRLY UNIFORM. /CGRA/

Keyser, JH, Central and Research Laboratory Montreal /Can/ Reid, GD, Department of Public Works Ottawa /Can/ Canadian Construction Association Proc Jan. 1965

1A 214627

CONSTRUCTION OF A FULL-SCALE ROAD EXPERIMENT AS PART OF A UNIT-PRICE CONTRACT

AN EXPERIMENTAL PAVEMENT COMPRISING 36 TEST SECTIONS WAS CONSTRUCTED, AS PART OF A UNIT-PRICE HIGHWAY CONTRACT, BETWEEN MAY AND SEPTEMBER, 1965. SPECIAL PROVISIONS WERE INTRODUCED INTO THE CONTRACT DOCUMENTS DEALING WITH THE SPECIAL CONSTRUCTION SEQUENCES, TOLERANCES, TESTING, AND THE CONTROL OF TRAFFIC DURING CONSTRUCTION. CONSTRUCTION CONTROL AND CONTRACT SPECIFICATIONS ARE DESCRIBED AND THE DEGREE OF UNIFORMITY OF MATERIALS, COMPACTION, MOISTURE CONTENTS, LAYER THICKNESSES, ETC., ACHIEVED WITHIN THE FRAMEWORK OF THE CONTRACT IS REPORTED. THE SPECIAL PROVISIONS ARE MENTIONED IN THIS REPORT AND THE DEGREE OF COMPLIANCE, AS MEASURED BY A COMPREHENSIVE SERIES OF TESTS DURING CONSTRUCTION, IS DESCRIBED. IT IS CONCLUDED THAT A GENERALLY ACCEPTABLE STANDARD OF CONTROL WAS ACHIEVED AND THE EXPERIMENTAL PAVEMENT WAS CONSTRUCTED IN A VERY SHORT TIME. /AUTHOR/

Schonfeld, R *Canadian Good Roads Association Proc* 1967

ACKNOWLEDGMENT: Canadian Good Roads Association

1A 214640

CANADIAN CONSTRUCTION ASSOCIATION PROCEEDINGS OF THE 49TH ANNUAL MEETING

CONTENTS: BENEFITS OF EQUITABLE STANDARD FORMS OF CONSTRUCTION CONTRACTS: OWNER-CONTRACTOR CONTRACT FORMS, R. E. BRIGGS, CONTRACTOR-SUBCONTRACTOR FORMS, R. G. CURRY. USE OF COMPUTERS IN CONSTRUCTION: THE CRITICAL PATH METHOD, S. BROWN, GENERAL APPLICATIONS, KEITH PROSSER, SPECIFICATION PREPARATION, PETER PENNINGTON, PROGRESS REPORTS: D.P.W. RE-ORGANIZATION, LUCIEN LALONDE, CONSTRUCTION LABOUR RELATIONS ENQUIRY, JOHN CRISPO. EXPANDED CONSTRUCTION PROGRAMMES THROUGH URBAN RE-DEVELOPMENT, ELLIOTT N. YARMON. GENERAL CONTRACTORS: PLANNING FOR PROFITS, C. G. MCKENZIE, WATERLOO'S APPROACH TO ENGINEERING EDUCATION, A. N. SHERBOURNE. ROAD BUILDERS AND HEAVY CONSTRUCTION: PLANNING FOR PROGRESS, GEORGE GOMME. CANADIAN WATER UTILIZATION, E. KUIPER, THE GRAND CANAL CONCEPT, T. W. KIERANS, WHOSE RESPONSIBILITY IS SAFETY?, D. A. CAMPBELL, REPORTS OF THE PROVINCIAL AFFILIATES, NOVA SCOTIA, PRINCE EDWARD ISLAND, NEW BRUNSWICK, ONTARIO, MANITOBA, SASKATCHEWAN, AND ALBERTA. MANUFACTURERS AND SUPPLIERS: THE BEAM PROGRAM, R. B. HINDSON, THE CANADIAN JOINT COMMITTEE ON CONSTRUCTION MATERIALS, E. L. MAHONEY, THE M&S SECTION AS A TOOL IN SOLVING ITS MEMBERS' PROBLEMS, PANEL DISCUSSION, A. W. PURDY, J. R. FAULDS AND J. F. SADLER.

Canadian Construction Association Proc Jan. 1967

ACKNOWLEDGMENT: Canadian Good Roads Association

1A 214678

THE USE OF A NUCLEAR METER FOR THE CONTROL OF MOISTURE AND DENSITY IN PAVEMENT CONSTRUCTION

THREE YEARS EXPERIENCE WITH USE OF A NUCLEAR METER FOR QUALITY CONTROL OF SUCH ELEMENTS AS PAVEMENT CONSTRUCTION AND EARTHWORKS AND FOR CALIBRATION OF COMPACTION EQUIPMENT WAS DESCRIBED. CLOSE CORRELATION OF RESULTS WITH THOSE OF OTHER METHODS, WHICH THE METER HAS LARGELY REPLACED, WAS ILLUSTRATED BY RESULTS FROM FIELD CONSTRUCTION. OPERATING PROCEDURES AND SOURCES OF ERRORS WERE DISCUSSED IN DETAIL.

Read, DW *Australian Road Research Board Proc* Paper 264 29 pp, Sept. 1966

ACKNOWLEDGMENT: Highway Res Abstracts Hwy Res Board

1A 214687

AN INSPECTION RATIONALE

INSPECTION OF CONCRETE CONSTRUCTION SUGGESTS A NUMBER OF FUNCTIONS THAT SHOULD BE COVERED BY CONCRETE INSPECTION' /1/ INSPECTION AND APPROVAL OF BATCHING AND MIXING FACILITIES, /2/ CONTROL OF THE PROPORTIONING OF CONCRETE MIXES, /3/ INSPECTING IN THE BATCH PLANT WHERE SIZE OF JOB OR TYPE OF CONCRETE WARRANTS IT, /4/ INSPECTION, TESTING, AND APPROVAL OF MATERIALS, /5/ INSPECTION OF FORMS AND FALSEWORK, EMBEDDED ITEMS, REINFORCING STEEL, AND OTHER ITEMS RELATED TO THE PRELIMINARIES BEFORE ACTUAL PLACEMENT OF THE CONCRETE, /6/ INSPECTION OF CONCRETE HANDLING AND PLACING EQUIPMENT SUCH AS BUCKETS, CHUTES, HOPPERS, VIBRATORS, AND PUMPS, /7/ INSPECTION OF THE ACTUAL PLACING AND HANDLING OF THE CONCRETE, INCLUDING CONSOLIDATION, FINISHING, CURING, PROTECTION, AND REPAIR, /8/ INSPECTION OF REMOVAL OF FORMS AND SHORING, /9/ PREPARING AND TESTING CONCRETE STRENGTH SPECIMENS, /10/ INSPECTION AT PRECASTING PLANTS FOR PRESTRESSED CONCRETE AND SPECIAL PRECAST UNITS, AND /11/ PREPARING REPORTS COVERING ALL OF THESE INSPECTIONS AND TESTS. THE ARRANGEMENT OF THESE INSPECTION PROCEDURES IS A VERY COMPLICATED AND DIFFICULT TIMING PROBLEM. GOOD, REALISTIC INSPECTION SPECIFICATIONS MUST BE DEFINED PROPERLY AND JUSTLY ADMINISTERED. REFERENCES' RECOMMENDED PRACTICE FOR CONCRETE INSPECTION, ACT COMMITTEE 311 REPORT.

Waddell, JJ *Concrete Construction* Oct. 1966

1A 214704

HANDBOOK OF HEAVY CONSTRUCTION

ADVICE IS GIVEN ON ALL PHASES OF CONSTRUCTION, FROM EQUIPMENT COSTS TO ERECTION, PLANNING TO FIELD OPERATION. ANSWERS ARE GIVEN TO A WIDE RANGE OF CONSTRUCTION PROBLEMS. EXPERTS OUTLINE THE BEST CURRENT PRACTICES IN THEIR FIELD, SHOW WHERE DIFFICULTIES MAY ARISE AND ELIMINATE NEED FOR COSTLY TRIAL AND ERROR. CASE HISTORIES ARE INCLUDED.

Stubbs, FW
Handbook of Heavy Construction 1040 pp

1A 214724

HOW TO SAVE A MILLION /THEORETICALLY/

THE COST OF WEATHER CONDITIONS TO CONTRACTORS CAN BE ALLEVIATED BY SEVERAL AIDS PROVIDED BY THE U.S. WEATHER BUREAU AND WEATHER CONSULTANTS. BASIC READING FOR CONSTRUCTION CONTRACTORS IS THE BOOKLET, WEATHER AND THE CONSTRUCTION INDUSTRY, PRODUCED BY THE U.S. DEPARTMENT OF COMMERCE. LOCAL CLIMATOLOGICAL DATA, DISTRIBUTED FROM THE NATIONAL WEATHER RECORDS CENTER IN ASHVILLE, NORTH CAROLINA, TELLS THE CONTRACTOR QUITE ACCURATELY SUCH THINGS AS' /1/ HOW MANY LOST DAYS TO EXPECT

1A SYSTEM CONSTRUCTION, MANAGEMENT & QUALITY CONTROL

FROM RAIN, SNOW AND OTHER SEVERE WEATHER CONDITIONS, /2/ WHEN CONCRETE CAN BE POURED AND CURED PROPERLY, /3/ WHEN HE CAN EXPECT STOPPAGES DUE TO UNION CHILL FEATURE CAUSES, AND /4/ HOW MANY DAYS WILL BE REQUIRED TO COMPLETE THE JOB. FROM THESE DATA, MONTHLY SCHEDULES MAY BE PROJECTED INTO A ROUGH DAILY SCHEDULE FOR CONSTRUCTION ECONOMICS.

Constructor Jan. 1967

1A 214731 EVALUATION OF CONSTRUCTION CONTROL PROCEDURES-INTERIM REPORT

VARIATIONS INHERENT IN AGGREGATE GRADATIONS IN WIDELY DIFFERENT GEOGRAPHICAL LOCATIONS WERE EVALUATED. STATISTICAL TECHNIQUES WERE USED FOR DETERMINING THE RELATIVE EFFECT OF TESTING ACCURACY, SAMPLING METHODS, AND SEGREGATION, WITH RELATION TO THE EVALUATION AND ACCEPTANCE OF COARSE AGGREGATE USED FOR HIGHWAY CONSTRUCTION. A PRECISION STATEMENT WAS DEVELOPED FOR THE AGGREGATE GRADATION TEST, AND A METHOD OF DRAFTING A REALISTIC AND ADEQUATE ACCEPTANCE GRADATION SPECIFICATION FOR COARSE AGGREGATES. THE STANDARD DEVIATION FOR THE REPEATABILITY OF THE GRADATION TEST ON COARSE AGGREGATE, UNDER ROUTINE CONDITIONS, IS APPROXIMATELY 4 PERCENT. RECOMMENDED METHODS OF INCORPORATING THE RESULTS OF THIS STUDY INTO HIGHWAY CONSTRUCTION SPECIFICATIONS AND PROCEDURES ARE PRESENTED IN THE FORM OF A COMPLETE MODEL SPECIFICATION FOR GRADED COARSE AGGREGATE.

Highway Research Board Nchrp Reports 1967

1A 214737 RESPONSIBILITY FOR QUALITY IN HIGHWAY CONSTRUCTION

THE PROBLEMS OF RESPONSIBLE CONTROL FOR QUALITY IN HIGHWAY CONSTRUCTION ARE DISCUSSED. PERFORMANCE DEPENDS ON THE DESIGN OF THE PAVEMENT STRUCTURE AT LEAST AS MUCH AS ON THE QUALITY OF MATERIALS AND CONSTRUCTION USED. THE ULTIMATE CONCEPT IN RESPONSIBILITY WOULD BE HAVING THE CONTRACTOR OR GOVERNMENT AGENCY REQUIRED TO DESIGN, BUILD AND GUARANTEE THE PERFORMANCE OF THE HIGHWAY. HOWEVER, INITIATIVE IN USING NEW CONSTRUCTION METHODS MUST NOT BE HAMPERED. CONSTRUCTION CONTROL TOLERANCES AND THE RESPONSIBILITY FOR QUALITY CONTROL TESTING ARE DISCUSSED.

Smith, P *Highway Research News, Hwy Res Board* 1967

1A 214740 RECOMMENDED PRACTICE FOR CONCRETE FORMWORK

PRESENTS BRIEF INTRODUCTORY STATEMENT ON THE NEED FOR FORMWORK STANDARDS BASED ON THE FACT THAT 35 TO 60 PERCENT OF THE TOTAL COST OF THE CONCRETE WORK IN A PROJECT IN THE UNITED STATES IS IN THE FORMWORK. A SECTION IS GIVEN ON ENGINEER-ARCHITECT SPECIFICATIONS NOTING THE KIND AND AMOUNT OF SPECIFICATION THE ENGINEER OR ARCHITECT SHOULD PROVIDE THE CONTRACTOR. SINCE THE COMMITTEE CONCLUDES THAT FORMWORK DESIGN AND ENGINEERING, AS WELL AS CONSTRUCTION, MUST BE THE RESPONSIBILITY OF THE CONTRACTOR, THE RECOMMENDATIONS CONTAINED IN THE REPORT ARE DIRECTED TO THAT GROUP. HOWEVER, AN UNDERSTANDING OF THE RECOMMENDATIONS BY ENGINEERS AND ARCHITECTS WILL AID THESE GROUPS IN THEIR SPECIFICATION FUNCTIONS. THE REPORT IS DIVIDED INTO FIVE CHAPTERS: 1. DESIGN, 2. CONSTRUCTION, 3. MATERIALS FOR FORMWORK, 4. FORMS FOR SPECIAL STRUCTURES, AND 5. FORMWORK FOR SPECIAL METHODS OF CONSTRUCTION. /AUTHOR/

Am Concrete Inst Journal & Proceedings July 1967

1A 214752 FEASIBILITY OF COLD WEATHER EARTHWORK IN INDIANA

THE EFFECTS OF COLD AND INCLEMENT WEATHER ON MEN, MACHINES, AND MATERIALS INVOLVED IN HIGHWAY EARTHWORK WERE REVIEWED. THE COLD WEATHER EARTHWORK EXPERIENCE OF THE NORTHERN STATES OF THE UNITED STATES, THE PROVINCES OF CANADA, AND THE SCANDINAVIAN COUNTRIES HAS BEEN REVIEWED WITH THE AIM OF DETERMINING, (1) HOW WEATHER AND SOIL CONDITIONS TEND TO RESTRICT THE LENGTH OF THE CONSTRUCTION SEASON, AND (2) WHAT COLD WEATHER CONSTRUCTION PRACTICES MIGHT BE APPLICABLE IN INDIANA. THE SEASONAL VARIATIONS OF WEATHER AND CERTAIN SOIL CONDITIONS IN INDIANA HAVE BEEN STUDIED. THE INCREASED COSTS OF VARIOUS EARTHWORK OPERATIONS IN INDIANA DURING COLD WEATHER HAVE BEEN ESTIMATED. THE PROBABLE BENEFITS OF (1) REDUCED INTEREST AND INFLATION COSTS, (2) REDUCED ACCIDENT AND INCONVENIENCE COSTS, AND (3) BETTER UTILIZATION OF THE RESOURCES OF LABOR, CONTRACTORS, AND THE STATE HIGHWAY COMMISSION HAVE BEEN WEIGHED AGAINST HEIGHTENED TECHNOLOGICAL DEMANDS. A HYPOTHETICAL EXAMPLE HAS BEEN DEVELOPED WHICH SHOWS THAT COLD WEATHER EARTHWORK IS FEASIBLE ON AN INTER-STATE HIGHWAY CONSTRUCTION PROJECT IN NORTHERN INDIANA AND THAT YEAR-ROUND CONSTRUCTION SCHEDULING CAN PRODUCE AN ECONOMIC BENEFIT. /AUTHOR/

Osborne, AM
Purdue & Ind State Hwy Comm Jhrp June 1967

1A 214756 ROAD AND BRIDGE CONSTRUCTION HANDBOOK: BASED ON U.S. HIGHWAY PRACTICES

THIS HANDBOOK IS A SUMMARY OF ALL ESSENTIAL POLICIES AS TO HIGHWAY TECHNIQUES IN THE UNITED STATES WITH THE NECESSARY ADAPTATIONS FOR USE IN OTHER COUNTRIES. DISCUSSION OF THE FOLLOWING IS PRESENTED: CONSTRUCTION CONTRACTS, PREPARATORY WORKS AND EARTHWORKS, PAVEMENTS AND BASE-COURSES. MISCELLANEOUS WORKS INCLUDING PORTLAND CEMENT CONCRETE, STRUCTURAL CONCRETE AND PROTECTION STRUCTURES. BRIDGE CONSTRUCTION, SPECIFICATIONS, TRAINING OF ROAD TECHNICIANS AND FINANCING ROAD WORKS.

Fraenkel, BB
Brazilian National Engineering School 1967

1A 214760 THE LEGAL IMPLICATIONS OF QUALITY CONTROL

THE CONTRACT BETWEEN THE ENGINEER AND HIS CLIENT, WHETHER ARCHITECT OR OWNER, IS NOT THE MEASURE OF LIABILITY TO THIRD PERSONS. HIS PROFESSIONAL RESPONSIBILITIES EXTEND TO ALL WHO MIGHT REASONABLY BE EXPECTED TO BE INJURED BY HIS FAILURE TO CARRY THEM OUT, WHETHER HE IS A CONTRACTOR'S EMPLOYEE, THE OWNER, OR SIMPLY A PASSERBY. HERE IS WHERE THE DISTINCTION BETWEEN DESIGN SERVICES ONLY AND DESIGN AND INSPECTION SERVICES WITH RESPECT TO ACTUAL ERECTION ARE APPARENT. THE DUTY WITH RESPECT TO EITHER DESIGN OR SUPERVISION IS THE SAME. SUPERVISION OF SITE WORK IS A STILL BROADER ASSUMPTION OF RESPONSIBILITY AND CARRIES WITH IT A BURDEN OF INCREASED LIABILITY. AN ENGINEER IS UNDER A DUTY TO FURNISH PLANS, APPROVALS AND DECISIONS WITHOUT DELAY. DELAYS CAN SUBJECT HIM TO LIABILITY TO THE CONTRACTOR FOR OVERHEAD OR EXCESS COST OF OVERCOMING UNREASONABLE DELAYS. EVEN WITH TIME AND AN ADEQUATE BUDGET, RAPID CHANGES IN TECHNOLOGY, NEW PRODUCTS AND NEW EQUIPMENT CONSTANTLY IMPOSE NEW HAZARDS. WHERE A COMPLETED STRUCTURE IS DEFECTIVE, DAMAGE IS ASSESSED IN TWO WAYS: (1) IF THE DEFECT CAN BE REMEDIATED AT REASONABLE COST, THE OWNER IS ENTITLED TO THE COST OF REPAIRS, AND (2) IF THE DEFICIENCIES

CANNOT BE REMEDIED, THE OWNER IS ENTITLED TO RECOVER THE DIFFERENCE BETWEEN THE VALUE OF THE BUILDING AS CONSTRUCTED AND THE VALUE IT WOULD HAVE HAD IF IT HAD BEEN BUILT UNDER CORRECT PLANS AND SPECIFICATIONS AND WITH PROPER SUPERVISION. RECENT CHANGES IN THE LAW CONCERNING AN INJURED WORKMAN WHO COLLECTS WORKMAN'S COMPENSATION AND IS FORECLOSED FROM SUING HIS EMPLOYER HAVE EXPOSED ENGINEERS AND ARCHITECTS TO A LIABILITY VIRTUALLY UNKNOWN A FEW YEARS AGO. A WORKMAN INJURED BECAUSE OF THE COLLAPSE OF A NEGLIGENTLY DESIGNED STRUCTURE SHOULD BE ENTITLED TO RECOVER HIS ACTUAL DAMAGES FROM THE PERSON AT FAULT. CURRENTLY, THE DESIGN PROFESSIONAL IS BEING CHARGED WITH LIABILITY BEYOND HIS CONTROL. THERE IS QUESTION IN SOME JURISDICTIONS WHETHER OR NOT A HOLD HARMLESS PROVISION IN A CONTRACT IS VALID AT ALL, SINCE IT CAN BE REGARDED AS A VIOLATION OF PUBLIC POLICY TO CONTRACT AWAY ONE'S LEGAL RESPONSIBILITY FOR HIS OWN FAULT. THE HOLD HARMLESS SOLUTION TO LEGAL EXPOSURE SEEMS TO BE AN APPLICATION OF TOO BROAD A BRUSH TO A VERY COMPLEX SUBJECT. IT IS OF DOUBTFUL LEGALITY IN MANY JURISDICTIONS AND IMPRACTICAL FROM A COST STANDPOINT IN ALMOST ALL AREAS. ASSERTED LIABILITY FOR A DEFICIENTLY DESIGNED STRUCTURE PRESENTLY HAS NO LIMITATION. ANY LEGAL LIMITATION OF LIABILITY AGAINST THE INEVITABLE RISKS OF DESIGN AND SUPERVISION SIMPLY MEANS SOME OTHER PART OF THE INDUSTRY WILL ASSUME THOSE RISKS.

Davidson, DM *Civil Engineering Asce* Nov. 1967

1A 214768 NATIONAL CONFERENCE ON STATISTICAL QUALITY CONTROL METHODOLOGY IN HIGHWAY AND AIRFIELD CONSTRUCTION

SESSION I-CONCEPTS OF STATISTICS CONCEPTS OF DISTRIBUTION AND SAMPLING, A. J. DUNCAN CONCEPTS OF DECISION CRITERIA, PAUL IRICK CONCEPTS OF CONTROL CHARTS, N. L. ENRICK CONCEPTS OF ACCEPTANCE SAMPLING, H. WEINGARTEN SESSION II-GENERAL SESSION SEVERAL INDUSTRIAL APPROACHES TO STATISTICAL QUALITY CONTROL, M. E. WESCOTT CONTRACTUAL RELATIONSHIPS BETWEEN GOVERNMENT AND CONTRACTORS IN QUALITY ASSURANCE, J. J. RIORDAN THE NEED FOR CHANGE IN CONSTRUCTION CONTROL PROCEDURES, W. N. CAREY, JR. AND J. F. SHOOK EXPERIENCE IN THE APPLICATION OF STATISTICAL METHODS IN ROAD CONSTRUCTION AND MATERIALS, J. HODE KEYSER SELECTING APPROPRIATE LEVELS OF QUALITY, B. MATHER SESSION III-VARIABILITY VARIABILITY OF COMPACTED SOILS, E. T. SELIG STOCKPILING OF AGGREGATE FOR GRADATION UNIFORMITY, H. F. WALLER, JR. VARIABILITY IN BITUMINOUS CONSTRUCTION, J. F. SHOOK VARIABILITY OF PORTLAND CEMENT CONCRETE, H. H. NEWLON A COMPARISON OF SOIL CLASSIFICATION SYSTEMS BY ANALYSIS OF VARIANCE, H. E. WAHLS AND G. E. FUTRELL APPLICATION OF STATISTICAL EVALUATION TECHNIQUES FOR QUALITY CONTROL OF STEAM CURED CONCRETE, H. E. BROWN VARIABILITY OF SOME SELECTED LABORATORY SOIL TESTS, T. K. LIU AND M. R. THOMPSON AN ANALYSIS OF VARIATIONS ENCOUNTERED IN NUCLEAR DENSITY TESTING, C. S. HUGHES AND M. C. ANDAY SESSION IV-APPLICATIONS OF STATISTICAL METHODS ACCEPTANCE SAMPLING FOR ATTRIBUTES, HARRY WEINGARTEN ACCEPTANCE SAMPLING BY VARIABLES, A. GRANDAGE THE USE OF STATISTICAL TECHNIQUES IN JUDGING COMPLIANCE WITH SPECIFICATION AND IN THE CONTROL OF THE MANUFACTURE OF BITUMINOUS MATERIALS, D. H. MATHEWS AND R. HARDMAN APPLICATIONS OF CONTROL CHARTS, P. F. WADE, M. KUSHNER, AND J. HODE KEYSER ADAPTING STATISTICAL METHODS TO CONCRETE PRODUCTION, E. A. ABDUN-NUR INTERPRETING THE ANALYSIS OF VARIANCE (FOR PHYSICAL SCIENTISTS), R. E. WHEELER SUMMARY OF BUREAU OF RECLAMATION EXPERIENCE IN STATISTICAL CONTROL OF EARTH DAM EMBANKMENT CON-

STRUCTION, F. J. DAVIS APPLICATION OF SEQUENTIAL ANALYSIS TO COMPACTION CONTROL, C. P. FISHER AND A. SANVER SOME BASIC CONSIDERATIONS IN THE APPLICATION OF STATISTICAL METHODS TO HIGHWAY PROBLEMS, R. L. DAVIS SESSION V-IMPLICATIONS OF STATISTICAL METHODS BROAD ASPECTS OF STATISTICAL QUALITY CONTROL, R. F. BAKER IMPLICATIONS OF STATISTICAL QUALITY CONTROL TO AN AUDITOR, D. A. SCHRAHEK IMPLICATIONS OF STATISTICAL QUALITY CONTROL TO A HIGHWAY ENGINEER, G. W. MCALPIN IMPLICATIONS OF STATISTICAL QUALITY CONTROL TO A MATERIALS SUPPLIER, R. S. REIGELUTH THE EQUIPMENT MANUFACTURER AND THE PHILOSOPHY OF STATISTICAL QUALITY CONTROL, J. J. BENSON IMPLICATIONS OF STATISTICAL QUALITY CONTROL FROM THE CONTRACTOR'S VIEWPOINT, C. R. FOSTER AND R. R. STANDER IMPLICATIONS OF STATISTICAL QUALITY CONTROL AFTER SEVERAL YEARS EXPERIENCE, J. W. G. KERR AND D. R. PARKES.

Virginia University *Proceedings* 664 pp. Nov. 1966

1A 214781 MICROFILM MOVES INTO CONSTRUCTION

MICROFILM IS BEING USED BY SOME CONTRACTING COMPANIES IN TAKE-OFF OPERATIONS. THE 35-MM. MICROFILM COPIES OF THE COMPLETE BID DOCUMENTS ARE MAILED TO THE CONTRACTOR AT THE TIME THE JOB IS RELEASED FOR BIDS. A PROJECTION TABLE WITH A HORIZONTAL READER SCREEN IS USED. IT PERMITS PLANS AND SPECS TO BE PROJECTED TO A DIMENSIONALLY ACCURATE SIZE OF 30 X 42 INCHES. BY HAVING THE MICROFILM IN THE OFFICE, OFFICIALS OF THE COMPANY CLAIM, THE TIME, MONEY AND EFFORT SPENT BY ESTIMATORS IN GETTING TO AND FROM A SET OF ARCHITECTURAL PLANS AND SPECS CAN BE ELIMINATED. BY HAVING THE COMPLETE BID DOCUMENT IN THE OFFICE THROUGHOUT THE OUT-FOR-BID PERIOD, THE ESTIMATOR CAN CHECK AND RE-CHECK HIS WORK WITHOUT HAVING TO RETURN TO THE PLAN ROOM. A NUMBER OF PEOPLE CAN LOOK AT THE PLANS OF A DIFFICULT JOB AT THE SAME TIME AND DISCUSS WAYS IN WHICH TO HANDLE THE PROJECT.

Concrete Construction Nov. 1967

1A 214789 EARTHQUAKE RESISTANCE FOR PRESTRESSED CONCRETE STRUCTURES

THE ELEMENTS OF DESIGN AND CONSTRUCTION CONNECTED WITH PRESTRESSED CONCRETE ARE IMPORTANT IN PLANNING AN EARTHQUAKE RESISTANT STRUCTURE. SEISMIC FORCES AND SEISMIC ANALYSIS PRESENT STRUCTURAL DESIGN CRITERIA FOR THESE TYPES OF STRUCTURES. ENERGY ABSORPTION CAPACITY AND RESILIENCE OF PRESTRESSED CONCRETE, COUPLED WITH PROPER DESIGN, ADEQUATE DETAILS, SOUND CONSTRUCTION AND COMPETENT OBSERVANCE AND INSPECTION CAN PROVIDE THE STRUCTURE WITH THE ABILITY TO WITHSTAND EARTHQUAKES.

Galezewski, S *Concrete Construction* July 1967

1A 214791 BRITISH STANDARD FOR CORROSION PROTECTION

THE RECENT PUBLICATION OF A BRITISH STANDARD CODE OF PRACTICE FOR THE PROTECTION OF IRON AND STEEL STRUCTURES FROM CORROSION IS REVIEWED. THE CODE STARTS WITH THREE SECTIONS SETTING OUT THE BASIC PRINCIPLES GOVERNING THE CORROSION OF BARE FERROUS METALS, CORROSION PREVENTION AND CATHODIC PROTECTION. THESE ARE SUPPLEMENTED BY A SHORT BIBLIOGRAPHY. THE MAIN BODY OF THE CODE CONSISTS OF FOUR PRACTICAL SECTIONS, DEALING WITH PROTECTIVE PRACTICES FOR NEW STRUCTURES GENERALLY: STRUCTURES AND CORROSIVE CONDITIONS FOR WHICH SPECIAL MEASURES ARE NEEDED, MAINTENANCE IN SERVICE, AND METHODS OF ORGANIZATION, INSPECTION AND CONTROL.

1A SYSTEM CONSTRUCTION, MANAGEMENT & QUALITY CONTROL

Corrosion Prevention & Control /UK/ Feb. 1967

1A 214799

HOW TO INSPECT CONSTRUCTION

GOOD INSPECTION OF CONSTRUCTION STARTS WITH GOOD DESIGN AND ADEQUATE PLANS AND SPECIFICATIONS. THESE THE INSPECTOR MUST FULLY UNDERSTAND AND FAIRLY INTERPRET. INADEQUATE OR INCORRECT DETAILS SHOULD BE CLARIFIED BY THE ENGINEER OR ARCHITECT. THE INSPECTOR HAS NO RIGHT TO ASK THE CONTRACTOR OR SUPPLIER FOR MORE THAN THE CONTRACT SPECIFICALLY REQUIRES, AND HE HAS ONLY LIMITED AUTHORITY TO PERMIT LESS. THE CONTRACTOR MAY HAVE A CRITICAL-PATH SCHEDULE STUDIED THOROUGHLY ON A COMPUTER. IF THIS IS AVAILABLE, LOOK FOR OMISSIONS OR DISCREPANCIES THAT MIGHT AFFECT JOB PROGRESS. RESIDENCE AND SMALL STRUCTURES CAN BE HANDLED BY THE USUAL CITY INSPECTORS, WHO MAY HAVE ONLY A CRAFTSMAN'S BACKGROUND. ALL ENGINEERED CONSTRUCTION SHOULD HAVE A PROFESSIONAL ENGINEER AT THE SITE TO HANDLE INSPECTION AND LIAISON WITH THE DESIGNER AND OWNER. THESE JOB FORCES SHOULD BE SUPPORTED WITH ADEQUATE AUTHORITY AND WITH PAY SUFFICIENT TO KEEP THEM IN THIS WORK. IN ADDITION TO TECHNICAL COMPETENCE, THE ENGINEER WHO REPRESENTS THE OWNER IN THE FIELD MUST POSSESS THE QUALITIES OF AN IMPARTIAL ARBITER.

Cohen, BP *Civil Engineering Asce* Oct. 1965

1A 214800

QUALITY CONTROLS FOR STEEL CONSTRUCTION

DEVELOPMENTS IN THE STEEL INDUSTRY PERMITTING THE USE OF A WIDE VARIETY OF STRUCTURAL STEELS, THE EVER-INCREASING USE OF WELDED DESIGNS, AND THE RAPID PACE OF TODAY'S CONSTRUCTION ARE PLACING GREAT RESPONSIBILITY ON THE INSPECTION PHASE OF STRUCTURAL-STEEL PRODUCTION, FABRICATION AND ERECTION. BETTER AND MORE CLOSELY SUPERVISED INSPECTION OF STEEL IS REQUIRED FROM ROLLING MILL THROUGH FABRICATION PLANT TO ERECTION AND FINAL PAINTING. THE SUPPLIER FACES THE CONFLICTING INTERESTS OF LOWERED COST VS. A QUALITY PRODUCT-WITH THE FIRST OF MAJOR IMPORTANCE TO HIS PRODUCTION STAFF. THE OWNER MUST BE CONVINCED THAT HE CAN ECONOMICALLY AFFORD THE BEST INSPECTION AND THAT THE INSPECTION AGENCY SHOULD BE SELECTED BY NEGOTIATION RATHER THAN COMPETITIVE BIDDING. THE ENGINEER MUST KEEP IN CLOSE CONTACT WITH THE INSPECTOR AND MUST BACK HIM UP FULLY IN THE MILL, IN THE FABRICATION SHOP AND AT THE ERECTION SITE. PROPER APPLICATION OF PAINT IS MOST IMPORTANT IN REDUCING MAINTENANCE. THE CURRENT PRACTICE OF ARCHITECTS HAVING FIELD INSPECTION OF BUILDINGS PERFORMED ON THE BASIS OF INFREQUENT VISITS TO THE SITE BY THE DESIGNING ENGINEER IS SUBJECT TO CRITICISM. BECAUSE OF A LACK OF UNDERSTANDING BY THOSE ON THE JOB AS TO THE BASIC DESIGN REQUIREMENTS AND BEHAVIOR OF MATERIALS, THIS PRACTICE OFTEN LEADS TO COSTLY CORRECTIVE ACTION OR INFERIOR WORK. IT IS STRONGLY RECOMMENDED THAT THIS PRACTICE BE GIVEN CLOSE SCRUTINY BY THE ENGINEERING PROFESSION.

Brumer, M Stahl, F *Civil Engineering Asce* Oct. 1965

1A 214810

PROBLEMS FACED BY STATE HIGHWAY DEPARTMENTS IN DEVELOPING STATISTICAL SPECIFICATIONS

PROBLEMS WHICH MUST BE FACED BY STATE HIGHWAY AGENCIES IN APPLYING STATISTICAL PRINCIPLES TO HIGHWAY SPECIFICATIONS ARE DISCUSSED. THREE OF THE MAJOR ENGINEERING PROBLEMS IN WHICH STATISTICAL TOOLS CAN BE HELPFUL ARE: (1) ESTABLISHING NUMERICAL SPECIFICATION LIMITS, (2) PROVIDING GUIDELINES FOR PROPER SAMPLING, AND (3) ANALYZING TEST RESULTS. THE BASIC

OBJECTIVE OF HIGHWAY SPECIFICATIONS IS TO ASSURE SATISFACTORY PERFORMANCE AT MINIMUM COST. UNBIASED DATA IS NEEDED WHICH DEFINES THE AVERAGE LEVEL, THE OVERALL VARIABILITY, AND THE SOURCES OF VARIABILITY OF THE SELECTIVE CHARACTERISTICS OF MATERIALS AND CONSTRUCTION ITEMS OF ACCEPTABLE QUALITY. TO PREVENT FLAT BIAS, A NON-SUBJECTIVE MEANS OF SAMPLE SELECTION SHOULD BE USED, SPECIFICALLY TABLES OF RANDOM NUMBERS. ASSUMING REALISTIC SPECIFICATION TOLERANCES, STATISTICALLY BASED SAMPLING, MEANINGFUL TEST METHODS, AND ACCURATE TESTING, IT IS THE TEST RESULTS WHICH ARE THE PRIMARY INDICATION OF THE QUALITY OF MATERIAL PRODUCED OR OF THE COMPLETE ITEM OF CONSTRUCTION. SUFFICIENT MAJOR RESEARCH WORK HAS BEEN COMPLETED TO INDICATE BOTH THE PRACTICALITY AND THE ECONOMIC NECESSITY OF THE USE OF STATISTICAL TOOLS IN MANY MAJOR ITEMS IN HIGHWAY SPECIFICATIONS. IT WILL STILL BE NECESSARY TO FOLLOW GOOD CONSTRUCTION PRACTICE, TO HAVE INSPECTORS AT ALL CRITICAL POINTS, AND TO EXERCISE GOOD INSPECTION PRACTICES AND TO CONDUCT EVALUATION TESTS. STATISTICS WILL NOT TELL AN INDIVIDUAL WHAT CORRECTIVE ACTION TO TAKE, BUT WILL HELP TO SHOW WHERE CORRECTIVE ACTION IS NEEDED.

Van, TIL CJ

Materials Research & Development, Inc 8 pp, Feb. 1968

1A 214811

EXPERIENCE OF WEST VIRGINIA STATE ROAD COMMISSION IN DEVELOPING STATISTICAL SPECIFICATIONS

SOME RESULTS ARE DISCUSSED FROM A FOUR YEAR PROGRAM OF SAMPLING AND TESTING ON THE VARIATIONS OF THE CHARACTERISTICS OF MATERIALS. AGGREGATE TEST RESULTS SHOWED THE LEVEL OF QUALITY WAS SUCH THAT REQUIREMENTS FOR LOS ANGELES ABRASION AND SODIUM SULPHATE SOUNDNESS WERE BEING CONSISTENTLY MET. THE ACCURACY OF CURRENT METHODS OF DETERMINING ASPHALT CONTENT LEAVES MUCH TO BE DESIRED. A NEW RAPID METHOD OF TESTING PAVING MIXTURES FOR ASPHALT CONTENT IS BEING DEVELOPED. THE METHOD OF SIMULATION IS USED TO INVESTIGATE THE EFFECT OF USING NEWLY DERIVED STATISTICAL SPECIFICATIONS. A SERIES OF RANDOM SAMPLES, INDEPENDENT OF ROUTINE CONTROL SAMPLES, IS TAKEN OF MATERIALS FROM ACTUAL CONSTRUCTION PROJECTS. STATISTICAL ACCEPTANCE CRITERIA ARE APPLIED TO THE RESULTS OF TESTS ON THESE SAMPLES AND THE PERCENTAGE OF MATERIAL WITHIN LIMITS COMPUTED ALONG WITH ANY INDICATED INCENTIVE ADJUSTMENTS IN UNIT COST. ESSENTIAL STEPS IN THE DEVELOPMENT OF PRACTICAL AND REALISTIC STATISTICAL SPECIFICATIONS ARE: (1) SELECT PROJECTS THAT WILL USE MATERIALS FOR CONSTRUCTION ON WHICH VARIABILITY DATA IS AVAILABLE FROM PREVIOUS WORK (2) DECIDE WHAT TYPE OF ACCEPTANCE PLAN IS MOST SUITABLE, (3) ESTABLISH TENTATIVE CRITERIA FOR LOT SIZE, SAMPLING FREQUENCY, SAMPLING PLAN AND SAMPLING POINT FOR EACH MATERIAL OR ITEM OF CONSTRUCTION, (4) ARRANGE FOR INDEPENDENT RANDOM SAMPLES TO BE TAKEN AND POSITIVELY IDENTIFIED, AND (5) WHEN RESULTS OF SIMULATION SAMPLES BECOME AVAILABLE APPLY ACCEPTANCE CRITERIA TO DATA, COMPUTE PERCENT WITHIN THE TENTATIVE LIMITS, AND INCENTIVE ADJUSTMENTS, IF ANY. RESULTS OBTAINED FROM REPEATED APPLICATION OF THE SIMULATED METHOD WILL PREDICT THE PRACTICALITY OF ACCEPTANCE PLANS BASED ON PREVIOUSLY CALCULATED STATISTICAL PARAMETERS.

Steele, WG *Assoc Asphalt Paving Technol Proc* Feb. 1968

1A 214812

QUALITY CONTROL OF ASPHALT PAVEMENT CONSTRUCTION

DATA WERE COLLECTED FROM NINE ASPHALT PAVEMENT CONSTRUCTION PROJECTS TO DETERMINE THE VARIATIONS IN GRADATION, ROAD DENSITIES, AIR VOIDS, MARSHALL STABILITY AND FLOW VALUES, PAVEMENT THICKNESS, AND ASPHALT CEMENT PENETRATION. STANDARD DEVIATIONS FOR EACH ARE PRESENTED IN GRAPHS. THE DESIGN OF A QUALITY CONTROL CHART IS PRESENTED AS THE ESTABLISHMENT OF THE PROBABLE LIMITS OF RANDOM FLUCTUATION AND THE NUMBER OF DEFECTIVES FOUND PER UNIT VOLUME REPRESENTED BY A SERIES OF SAMPLES. THE TECHNIQUE IS INTRODUCED AS A NATURAL FOLLOW-THROUGH IN THE STUDY VARIATION IN PHYSICAL PROPERTIES USED TO DESCRIBE THE QUALITY OF PAVEMENT MIXTURES. THE USE OF QUALITY CONTROL CHARTS SHOULD PROVE TO BE A VALUABLE TOOL IN PAVEMENT PRODUCTION BESIDES AN INVALUABLE HISTORICAL ACCOUNT OF QUALITY-CHARACTERISTICS.

Huculak, NA

Canadian Department Public Works Feb. 1968

1A 214813

VARIABILITY IN ASPHALT PAVING MATERIALS

SELECTION OF STATISTICAL PROCEDURES WHICH WOULD FIT PRESENT PRACTICES AND SPECIFICATIONS WERE MADE TO BE APPLIED TO INDIVIDUAL CONSTRUCTION PROJECT TEST DATA. AN ELECTRONIC DATA PROCESSING ROUTINE WAS ESTABLISHED TO SUMMARIZE INFORMATION FROM INDIVIDUAL CONSTRUCTION PROJECTS AND TO CALCULATE THE MEAN AND STANDARD DEVIATION OF THE METHODS AND TEST RESULTS. THE STATISTICAL PROCEDURES SELECTED ARE A MATCHING SET OF VARIABLES SAMPLING PLANS BASED ON KNOWN STANDARD DEVIATION, UNKNOWN STANDARD DEVIATION AND AVERAGE RANGE WHICH ALL GUARANTEE ESSENTIALLY THE SAME PROTECTION. THE DATA PROCESSING PROGRAM WAS DESIGNED TO CALCULATE THE NUMBER OF SAMPLES, MEAN VALUE, STANDARD DEVIATION, COEFFICIENT OF VARIATION, AND QUALITY INDEX FOR EACH SERIES OF TEST RESULTS ON EACH PROJECT. ALSO PROVIDED WAS AN ADDITIONAL SORT OF THE ABOVE DATA FOR EACH INDIVIDUAL TYPE OF TEST WITH RESPECT TO TYPE OF ASPHALTIC MIX. AN AUXILIARY PROGRAM WAS DESIGNED TO CALCULATE STATE-WIDE POOLED STANDARD DEVIATIONS FOR EACH OF THESE LISTINGS TO REPRESENT STATE-WIDE PRODUCTION. A STATISTICAL ANALYSIS IS PRESENTED OF DATA FROM BASIC CONSTRUCTION WITH TWO TYPES OF HOT-MIXED ASPHALTIC MATERIALS. IT IS CONCLUDED THAT PROCEDURES DEVELOPED IN THIS PROGRAM PROVIDE A PRACTICAL WAY TO HANDLE VARIATIONS IN CONSTRUCTION TEST VALUES FROM NORMAL SPECIFICATION LIMITS.

Deyoung, CE

Iowa State Highway Commission Feb. 1968

1A 214818

STATISTICAL QUALITY CONTROL IN HIGHWAY CONSTRUCTION

CALIFORNIA'S EXPERIENCE IN MAKING A STATISTICAL STUDY OF ITS QUALITY SPECIFICATIONS FOR HIGHWAY AND BRIDGE CONSTRUCTION MATERIALS IS DESCRIBED. FOUR YEARS OF RESEARCH ON SAMPLING AND TESTING OF MATERIALS SUCH AS COMPACTED EMBANKMENT, PLASTIC CONCRETE, CEMENT TREATED BASE, STRUCTURAL CONCRETE AGGREGATE, UNTREATED BASE MATERIAL AND AGGREGATE SUBBASE MATERIAL ARE BEGINNING TO PROVIDE INFORMATION CONCERNING VARIATIONS DUE TO SAMPLING, TESTING, AND THOSE INHERENT IN THE MATERIALS ITSELF. SUGGESTED IN PLACE OF TRADITIONAL METHODS IS STATISTICAL QUALITY CONTROL (SQC). THE USE OF SQC COULD SHIFT THE QUALITY CONTROL RESPONSIBILITY TO

THE CONTRACTOR WITH THE BUYER BASING HIS PURCHASE ON A STATISTICALLY SOUND END POINT EVALUATION. PROBLEMS ARISING IN THE USE OF SQC MAY BE MET BY TRAINING IN THE TECHNOLOGY OF STATISTICAL CONTROL, RECOGNITION OF THE FACT THAT THERE IS NO NEED TO SUPPLY STATISTICAL SPECIFICATIONS TO EVERY CONSTRUCTION ITEM, THE ESTABLISHMENT OF NEW SPECIFICATION LIMITS, AND A REVISION OF TESTING PROCEDURES. /AUTHOR/

Beaton, JL *Am Soc Civil Engr J Construction Div* Jan. 1968

1A 214835

QUALITY CONTROL OF CONSTRUCTION BY STATISTICAL TOLERANCES

TWO YEARS WORK AND STUDY ARE REPORTED IN THE FIELD OF STATISTICAL CONTROL OF CONSTRUCTION TOLERANCES BY THE ALABAMA HIGHWAY DEPARTMENT. THREE CONSTRUCTION PROJECTS WERE EXAMINED IN DETAIL: (1) A GRADING PROJECT, (2) A BASE AND BITUMINOUS PAVEMENT PROJECT, AND (3) A BASE AND PORTLAND CEMENT CONCRETE PAVEMENT PROJECT. THE PROJECTS WERE EXAMINED IN DETAIL AND STRICT COMPLIANCE WITH THE RECOMMENDATIONS CONTAINED IN THE STATISTICAL APPROACH TO QUALITY CONTROL AND HIGHWAY CONSTRUCTION PUBLISHED AS A RESEARCH GUIDE BY THE BUREAU OF PUBLIC ROADS IN APRIL, 1965. THE COMPUTER PROGRAM FOR THE ANALYSIS OF VARIANCE USED IS BASED ON THE PROPOSITION THAT THE VARIANCE OF THE MATERIAL, PLUS THE VARIANCE OF THE SAMPLING, PLUS THE VARIANCE OF THE TESTING IS EQUAL TO THE OVERALL VARIANCE OF THE END RESULT. THE ASPHALT CONCRETE USED IN THE PROJECT INCLUDED IN THE STUDY WAS PLACED IN THREE LAYERS. TABLES ARE PRESENTED ON THE ANALYSIS OF VARIANCE OF A BLACK BASE, BINDER COURSE AND WEARING COURSE. AN EXAMINATION OF THESE THREE TABLES INDICATES THAT THE VARIANCE DUE TO THE THREE COMPONENTS IS REASONABLE AND THERE IS NO INDICATION OF PARTICULAR CORRECTIVE ACTION WHICH SHOULD BE TAKEN. IT IS NOTED THAT WHERE THE VARIANCE TENDS TO BECOME LARGE THE QUANTITIES ARE SMALL. THE MATERIAL PERFORMED VERY WELL WITH THE CONSTRUCTION SPECIFICATIONS. COMPRESSIVE STRENGTH TESTS RESULTS WERE NOTED TO VARY SCANDALOUSLY IN THE ANALYSIS OF VARIANCE OF PORTLAND CEMENT CONCRETE PAVING. AGGREGATES ARE USED FROM APPROVED SOURCES. THE AVERAGE, OR ARITHMETIC MEAN, TAKEN AND TEST MADE, GENERALLY COME VERY CLOSE TO THE SPECIFICATION REQUIREMENTS. RESEARCH SAMPLING AND TESTING AND ACCEPTANCE SAMPLING AND TESTING WERE PERFORMED USING THE SAME SAMPLING AND TESTING TECHNIQUES AND OFTEN BOTH PROCEDURES WERE PERFORMED BY THE SAME PERSONNEL. STATISTICAL RESULTS DO SHOW A TENDENCY FOR A SMALL NUMBER OF RESULTS TO FALL OUTSIDE OF THE CONTRACT SPECIFICATIONS.

David, JH

Alabama State Highway Department May 1967

1A 214837

CONTROL TESTS IN ROAD CONSTRUCTION

THE AMOUNT OF ROAD TESTING WHICH RESPONSIBLE ENGINEERS FROM VARIOUS EUROPEAN COUNTRIES CONSIDER DESIRABLE FOR WORK IN THEIR PARTICULAR COUNTRIES IS SET OUT IN TABULAR FORM. THE AMOUNT OF TESTING CONSIDERED NECESSARY IS SHOWN IN THE NUMBER OF TESTS THAT SHOULD BE CARRIED OUT PER UNIT OF VOLUME OR AREA OF WORK DONE, OR PER DAY OF WEEK IN WHICH THE WORK IS DONE. THE REPORT DOES NOT DISCUSS THE DETAILS OF THE TYPES OF TESTS USED FOR CONTROL PURPOSES, NOR DOES IT COVER THOSE TESTS USED FOR DESIGN PURPOSE AS DISTINCT FROM CONTROL PURPOSES, BUT THE PROS AND CONS OF END-PRODUCT SPECIFICATION VERSUS METHOD SPECIFICATION ARE PRESENTED. SPECIAL SECTIONS ARE INCLUDED AS APPENDICES ON RADIO-ISOTOPES

1A SYSTEM CONSTRUCTION, MANAGEMENT & QUALITY CONTROL

USED IN CONTROLLED TESTING OF ROAD MATERIALS AND VIBRATIONAL TESTING OF ROADS FOR CONTROL PURPOSES.

Perm Intl Assoc Road Congresses Proc 1967

1A 214843

BACKFILL GUIDE

FIELD INVESTIGATIONS HAVE SHOWN THAT IMPROPERLY PLACED AND COMPACTED BACKFILL IS COMMONLY ASSOCIATED WITH PAVEMENT SETTLEMENT AND THE MOVEMENT OF RETAINING STRUCTURES. THIS GUIDE IS PRESENTED TO DEMONSTRATE THE IMPORTANCE OF THE BACKFILL, TO POINT OUT THE REASONS FOR SPECIFIED BACKFILLING PROCEDURES, AND TO SHOW SOME CONSTRUCTION PRACTICES THAT SHOULD BE AVOIDED. THE NECESSITY OF COMPLYING WITH BACKFILL SPECIFICATIONS IS EMPHASIZED. BACKFILL MATERIALS AND CONSTRUCTION PRACTICES ARE DISCUSSED.

Peck, RB Ireland, HO *Am Soc Civil Engr J Structural Div* July 1957

1A 214851

FORCE ACCOUNT VS. CONTRACT CONSTRUCTION

THIS REPORT PRESENTS THE RESULTS OF COMPREHENSIVE JOB COST STUDIES MADE ON THREE CONTRACT AND TWO FORCE ACCOUNT SECONDARY ROAD PROJECTS IN NORTH CAROLINA DURING 1952 AND 1953. THE PURPOSE OF THESE STUDIES WAS TO DEVELOP FACTS ON THE COMPARATIVE COSTS OF THE TWO METHODS OF DOING WORK. IT WAS GENERALLY ACCEPTED THAT THE USEFULNESS OF THE STUDY RESULTS WOULD BE PRINCIPALLY IN FURNISHING CERTAIN FACTUAL BACKGROUND ON EACH METHOD, IN MINIMIZING UNSUBSTANTIATED CLAIMS AS TO EXCESSIVE ECONOMIES OF ONE METHOD OVER THE OTHER, AND IN KEEPING THE MAIN ISSUES INVOLVED FROM BEING COMPLICATED BY MINOR UNRESOLVED DETAILS. RESULTS PRESENTED INCLUDE QUANTITIES OF WORK, TAX AND WAGE RATE DIFFERENTIALS, MATERIALS PROCUREMENT PRACTICES, AND OTHER VARIABLES OF RECORD PERTINENT TO THE COMPARISON. THE FINDINGS TENDED TO FAVOR THE CONTRACT METHOD. /AUTHOR/

Farrell, FB Kilpatrick, MJ *Highway Research Board Proceedings* 1956

1A 214872

SUPERVISION OF CONTROL TESTS AT FERRY FRYSTON ESTATE, CASTLEFORD, U.D.C.

THIS REPORT GIVES AN ACCOUNT OF THE WORK UNDERTAKEN BY THE ASSOCIATION TO ASSIST WITH THE CONSTRUCTION OF SOIL-CEMENT BASES FOR HOUSING ESTATE ROADS AT FERRY FRYSTON, CASTLEFORD. DETAILS ARE GIVEN OF THE METHOD OF CONSTRUCTION EMPLOYED, TOGETHER WITH THE RESULTS OF FIELD TESTS ON A PRELIMINARY AREA OF APPROXIMATELY 1,350 SQ. YARDS. EXTRACTS FROM THE SPECIFICATION ARE INCLUDED.

Lilley, AA *Cement & Concrete Association Res Repts* Oct. 1954

ACKNOWLEDGMENT: Highway Research Board Bibliography

1A 214874

A SPECIFICATION FOR THE CONSTRUCTION OF SOIL-CEMENT BASES BY MIX-IN-PLACE AND STATIONARY PLANT METHODS

THIS REPORT GIVES A SPECIFICATION FOR THE CONSTRUCTION OF SOIL-CEMENT BASES ON ROADS AND AIRFIELD RUNWAYS. PART OF IT IS BASED ON A SPECIFICATION PREPARED BY THE ROAD RESEARCH LABORATORY IN 1953. CLAUSES HAVE, HOWEVER, BEEN ADDED AND OTHERS REVISED IN THE LIGHT OF MORE RECENT EXPERIENCE. IN THE SPECIFICATION THE CONTRACTOR IS ALLOWED TO CHOOSE THE METHOD OF CONSTRUCTION BUT THE ENGINEER DECIDES THE CEMENT CONTENT AND THE COMPACTED DENSITY OF THE MATERIAL.

Blake, LS *Cement & Concrete Association Res Repts* Feb. 1958

ACKNOWLEDGMENT: Highway Research Board Bibliography

1A 214875

STANDARD SPECIFICATIONS FOR CONSTRUCTION OF AIRPORTS

DIVISION II ON PAVING CONSTRUCTION DETAILS MENTIONS: SUBBASE COURSE, CRUSHED AGGREGATE BASE COURSE, SOIL CEMENT BASE COURSE, CEMENT TREATED BASE COURSE, PORTLAND CEMENT CONCRETE PAVEMENT.

Federal Aviation Administration /US/ 1964

ACKNOWLEDGMENT: Portland Cement Association

1A 214940

CONTROL OF PAVEMENT CONSTRUCTION BY MEANS OF THE LA CROIX-LPC DEFLECTOGRAPH (IN FRENCH)

THE LA CROIX-PPC DEFLECTOGRAPH IS MAINLY USED FOR STUDYING THE STRENGTHENING OF EXISTING PAVEMENTS. THIS ARTICLE RELATES ITS UTILIZATION FOR CONTROLLING THE CONSTRUCTION OF TWO MOTORWAY STRETCHES: A RIGID SECTION AND A FLEXIBLE SECTION WITH GRANULATED SLAG-TREATED LAYERS. IN THE CASE OF THE FLEXIBLE PAVEMENT IT ENABLED A SMALL BADLY DRAINED ZONE TO BE LOCATED AND SUBSEQUENTLY TREATED; IN THE CASE OF THE RIGID PAVEMENT, DIFFICULT WEATHER CONDITIONS (RAIN AND LOW TEMPERATURE IN LATE AUTUMN) INTERFERED WITH THE MEASUREMENTS CARRIED OUT ON PAVEMENT LAYERS; HOWEVER, IT WAS POSSIBLE TO OBSERVE A SYSTEMATIC DEFECT IN COMPACTION IN THE VICINITY OF ENGINEERING STRUCTURES, AND TO FOLLOW THE EVOLUTION IN THE SETTING OF GRANULATED SLAG-TREATED LAYERS. THESE RESULTS SHOW THE POSSIBLE USES OF THE DEFLECTOGRAPH FOR THE SURVEILLANCE AND OVERALL CONTROL OF PAVEMENT CONSTRUCTION, OR CONTROL OF EACH LAYER, ASSUMING THAT THE PAVEMENT COURSES ARE SUFFICIENTLY STABLE. /A/LCPC/RRL/

Champion, M Gourdon, JL De, LA SEIGLIERE P *Bull Liaison Labs Routiers /France/* Dec. 1968

ACKNOWLEDGMENT: Road Research Laboratory /UK/

1A 214960

PAVING MATERIALS

DURING THE PAST DECADE, NEW ENGINEERING PROCEDURES FOR THE CONSTRUCTION OF THE ASPHALT PAVEMENTS AND NEW METHODS FOR QUALITY CONTROL HAVE BEEN DEVELOPED. AMONG THE NEW METHODS WHICH ARE COMMANDING ATTENTION ARE: (1) AUTOMATION FOR CONTROL OF BITUMINOUS CONCRETE PLANTS, (2) ELECTRONIC SENSING DEVICES FOR GRADE CONTROL OF THE LAY-DOWN MACHINES, (3) NUCLEAR DEVICE FOR FAST ON-THE-SPOT MEASUREMENTS OF PAVEMENT DENSITY, (4) LOAD/DEFLECTION DEVICES FOR ON-THE- SPOT SURVEYS OF PAVEMENT STRUCTURAL STRENGTH, AND (5) FULL WIDTH AND DEEP LIFT PAVEMENT COURSES. EACH OF THESE NEW USES AND NEW METHODS OF APPLICATION IN THE USE OF ASPHALT IN PAVEMENT STRUCTURES IS DESCRIBED. /RRL/A/

Izatt, JE

World Petroleum Congress Proc 1967

ACKNOWLEDGMENT: Road Research Laboratory /UK/

1A 214974

MATHEMATICAL-STATISTICAL EVALUATION OF MEASURING RESULTS, AND ITS APPLICATION TO THE QUALITY CONTROL OF CONCRETE OR BITUMINOUS MIXTURES IN ROAD CONSTRUCTION /IN GERMAN/

THE IMPORTANCE OF ACCURATE EVALUATION OF TEST RESULTS FOR RELIABLE QUALITY CONTROL OF BITUMINOUS MIXTURES AND CONCRETE DURING ROAD CONSTRUCTION ARE DISCUSSED. THE PRINCIPLES OF THE MATHEMATICAL-STATISTICAL METHOD OF EVALUATION ARE DESCRIBED IN DETAIL. TOGETHER WITH THE ANALYTICAL AND GRAPHIC PROCESSES INVOLVED. DETAILS OF SAMPLING ARE GIVEN. /FG/RRL/

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Muller, K *Strasse, Berlin /Germany/ 1968*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

1A 214975

1A 214975 PRACTICAL ASPECTS OF AND RESEARCH INTO FLEXIBLE ROAD CONSTRUCTION /IN GERMAN/

CONTENTS: RESEARCH AND STANDARDIZATION IN THE FIELD OF ROAD CONSTRUCTION IN BERLIN, W. LEIPOLD. ROAD CONSTRUCTION AND TRAFFIC ASPECTS OF EXPERIENCES WITH INTERMEDIATE DEVELOPMENT, W. MAUCH. STATE OF THE ART AND DEVELOPMENT TRENDS IN FLEXIBLE ROAD CONSTRUCTION IN SWEDEN, H. TAGT. APPLICATION OF MATHEMATICAL STATISTICS TO THE QUALITY CONTROL OF BITUMINOUS MIXTURES, G. PAULMANN. EXAMPLES OF THE CONTROL AND EVALUATION OF BITUMINOUS MIXTURES, A. SCHUHBAUER. STATISTICAL QUALITY CONTROL IN STATIONARY MIXING PLANTS, F. GRAGGER. REJECTION LIMIT IN VDI SPECIFICATION NO. 2283 FOR PREPARATION AND MIXING PLANTS FOR FLEXIBLE ROAD CONSTRUCTION, P. WIEMER. HISTORY AND DEVELOPMENT OF THE "HEATING AND PLANING" METHOD FOR REPAIRING ROAD SURFACES, E. M. WINTERBOTTOM. MECHANICAL METHODS OF SEALING THE SURFACES OF BITUMINOUS ROADS; THE APPLICATION OF THIN COATINGS-STATE AND DEVELOPMENT, DUBOIS. SLURRYMATIC-MACHINES FOR THE LAYING OF BITUMINOUS SLURRIES, H. J. BURMEISTER. DESCRIPTION AND CHARACTERIZATION OF ROAD SURFACE REFLECTION, H. J. HENTSCHEL. ROAD SURFACING AND LUMINANCE, J. ROCH. BRIDGE SURFACINGS ON STEEL, H. THUL. BRIDGE SURFACINGS ON CONCRETE, H. J. VON STOSCH. COMPACTION TECHNOLOGY IN THE NETHERLANDS, K. WESTER. CURRENT STATE OF DEVELOPMENT OF MIXTURE PLACEMENT AND COMPACTION IN GERMANY, K. SCHULZE. RECENT FINDINGS ON AND EXPERIENCES WITH COMPACTION IN THE USA, R. URBAN. USE OF NUCLEAR DENSITOMETERS TO MEASURE COMPACTION DURING THE LAYING OF FINE ASPHALTIC CONCRETE, D. ROSE. /RRL/

Road Research Society /Germany/

ACKNOWLEDGMENT: Road Research Laboratory /UK/

1A 215068

1A 215068 THE APPLICATION OF THE "LINE OF BALANCE" TECHNIQUE TO THE CONSTRUCTION INDUSTRY

BECAUSE OF THE INCREASING COMPLEXITY OF CONSTRUCTION PLANNING, SCHEDULING, PROGRAMMING AND CONTROL, A NUMBER OF PLANNING AND CONTROL METHODS HAVE BEEN INTRODUCED RECENTLY. A SIMPLE, AND EFFECTIVE MEANS OF CONTROL IS THE "LINE OF BALANCE" TECHNIQUE, WHICH CAN BE APPLIED TO A WIDE VARIETY OF CONSTRUCTION PROGRAMS. THE LOB TECHNIQUE IS DESCRIBED BRIEFLY WITH SPECIAL REFERENCE TO THE CONSTRUCTION INDUSTRY, AND IS ILLUSTRATED WITH PRACTICAL EXAMPLES DRAWN FROM THE FIELD. /RRL/

Khisty, CJ *Indian Concrete Journal July 1970*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

1A 215079

1A 215079 THE SIXTH INTERNATIONAL CONFERENCE ON PREFABRICATED CONCRETE (BIBM/969) /IN FRENCH/

THE FIRST 4 SESSIONS OF THIS CONFERENCE ARE CONCERNED WITH QUALITY CONTROL, STANDARDIZATION, MECHANIZATION, AUTOMATION, LIGHTWEIGHT STRUCTURAL CONCRETE, AND NEW PRODUCTS AND TECHNIQUES WITH EXAMPLES OF APPLICATION. THE FIFTH SESSION IS DEVOTED TO THE CONSTRUCTION OF BRIDGES BUILT WITH PRECAST CONCRETE UNITS. IN THIS SESSION, THE REPORTS PRESENTED WERE AS FOLLOWS: ATTEMPT AT STANDARDIZING HORIZONTAL CONSTRUCTION ELEMENTS FOR BRIDGES (UNDERPASSES AND OVERPASSES); PARKING STRUCTURES AND OTHERS; BRIDGE CONSTRUCTION WITH PRECAST CONCRETE UNITS; SOME PRECAST CONCRETE BRIDGES IN SWE-

DEN; CONSTRUCTION OF PRECAST CONCRETE BRIDGES IN SPAIN. DETAILS ARE GIVEN OF BRIDGE CONSTRUCTION METHODS USING PRECAST REINFORCED OR PRESTRESSED CONCRETE ELEMENTS. /LCPC/RRL/

Venuat, M *Rev Matls Constr & Trav Publics /Fr/ Aug. 1969*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

1A 215091

1A 215091 AUTOMATED SPECIFICATIONS-A RESEARCH SURVEY

A STATE-OF-THE-ART SURVEY WAS CONDUCTED OF ORGANIZATIONS USING APPLICATIONS OF AUTOMATION IN THE SPECIFICATIONS PROCESS TO MAKE RECOMMENDATIONS FOR FURTHER STUDY. THE STUDY IS BASED ON THE THESIS THAT THE SPECIFICATION IS A PART OF A LARGER COMMUNICATION PROCESS IN ENGINEERING DESIGN AND CONSTRUCTION. ECONOMICAL BENEFITS RESULTING FROM AUTOMATION PERMIT THE EMPHASIS TO BE PLACED ON DEVELOPING GOOD MASTER SPECIFICATIONS. A TWO-PHASE SYSTEM IS ANALYZED WHICH ESTABLISHES THE MASTER SPECIFICATION, OR DATA BANK, AND STORES IT IN A FORM THAT PERMITS RETRIEVAL IN A PRINTABLE FORM BY AUTOMATED TECHNIQUES. THE SECOND PHASE PERMITS ANY TRAINED PROFESSIONAL TO USE THE DATA BANK, AND TO PREPARE A BETTER THAN AVERAGE SPECIFICATION. A HIGHER-LEVEL SYSTEM IS USED AS A COMPUTER SYSTEM TO PERFORM LOGICAL PREDETERMINED OPERATIONS UNASSISTED BY HUMAN INTERVENTION. PROJECTS MODCON AND ICES, UNDER DEVELOPMENT AT PENNSYLVANIA STATE UNIVERSITY AND MASSACHUSETTS INSTITUTE OF TECHNOLOGY, RESPECTIVELY, ARE REVIEWED. UNDER EITHER SYSTEM THE DESIGNER SPECIFIES THE FUNCTIONAL REQUIREMENTS REQUIRED FOR WEARABILITY, STRENGTH, REFLECTANCE, AND HEAT LOSS OR GAIN ALLOWABLE. AFTER THE CRITERIA HAVE BEEN ESTABLISHED HE ENTERS A DATA BANK ON AVAILABLE MATERIALS, AND IS ABLE TO SEE ALL THE SELECTIONS THAT WILL MEET HIS CRITERIA.

Engineering News-record 1968, 1 Pp-123

1A 215119

1A 215119 INSPECTION AND QUALITY CONTROL OF CONCRETE

A SYMPOSIUM OF SEVEN BRIEF PAPERS BASED ON A SESSION SPONSORED BY ACI COMMITTEE 311, INSPECTION OF CONCRETE, AT THE 1967 ACI FALL MEETING IN DES MOINES ARE PRESENTED. THE ESSENTIALS OF SPECIFICATION PREPARATION ARE DISCUSSED. AN ENGINEER DISCUSSES THE ENGINEER'S ROLE IN CONSTRUCTION INSPECTION, AND A CONTRACTOR PRESENTS THE VIEW THAT THE MAJOR RESPONSIBILITY FOR INSPECTION SHOULD BE THE CONTRACTOR'S. SOME PROBLEMS ENCOUNTERED IN INSPECTION ARE NOTED AND A PROCEDURE TO SOLVE THEM OFFERED. THE ADVANTAGES OR QUALITY CONTROL ARE LOOKED AT AND THE MEANS BY WHICH INSPECTION IS ACTUALLY BEING PROVIDED ARE REVIEWED. THE FINAL PAPER DISCUSSES WAYS IN WHICH PRIVATE ORGANIZATIONS CAN HELP TRAIN INSPECTORS. /AUTHOR/

Am Concrete Inst Journal & Proceedings Aug. 1968

1A 215120

1A 215120 CRITERIA FOR PRESENT DAY CONCRETE PAVEMENT CONSTRUCTION

THE CRITERIA ARE PRESENTED WHICH SHOULD BE USED IN PREPARING PLANS AND SPECIFICATIONS FOR THE CONTROL OF MODERN CONCRETE PAVEMENT CONSTRUCTION. THESE CRITERIA ARE DEVELOPED FROM THREE BASIC CONCEPTS: (1) THE OBJECTIVES OF THE OWNER, REPRESENTED BY THE ENGINEER OR INSPECTOR, AND THE CONTRACTOR ARE, OR SHOULD BE, IDENTICAL. (2) A CONCRETE PAVEMENT CONSTRUCTION OPERATION IS IN REALITY AN OUTDOOR MASS PRODUCTION ASSEMBLY LINE AND AS SUCH IS SUBJECT TO THE SAME RULES OF OPERATIONAL PROCEDURE AS ANY MASS PRODUCTION ASSEMBLY LINE. (3) AN ACCURATELY

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ADJUSTED AND PROPERLY OPERATED MACHINE, DESIGNED TO PERFORM A SPECIFIC OPERATION IN THE LINE, WILL DO A BETTER JOB THAN A MAN OR A GROUP OF MEN. EACH OF THESE BASIC RULES IS ANALYZED IN SOME DETAIL WITH RESPECT TO THEIR APPLICATION IN THE PREPARATION OF PLANS AND SPECIFICATIONS FOR CONTROL OF CONCRETE PAVEMENT CONSTRUCTION AND THE ACHIEVEMENT OF PRINCIPAL OBJECTIVES OF SUCH CONSTRUCTION WORK. CRITERIA ARE INDICATED FOR CONTROL OF EACH OF THE FOUR PRINCIPAL AREAS OF OPERATION IN PAVEMENT CONSTRUCTION: (1) ASSEMBLING BATCHING AND HAULING MATERIALS, (2) SUBGRADING AND FORMING, (3) MIXING AND PLACING, AND (4) FINISHING AND CURING. /AUTHOR/

Peyton, RL *Highway Research Board Bulletin* 1957

1A 215124

CONSTRUCTION SAFETY STANDARDS

'CONSTRUCTION SAFETY STANDARDS' IS DEDICATED TO THE IMPROVEMENT OF THE SAFETY RECORD IN THE CONSTRUCTION INDUSTRY. SAFETY STANDARDS HAVE BEEN INCORPORATED IN THE BUREAU OF RECLAMATION CONTRACT SPECIFICATIONS FOR MANY YEARS IN ORDER TO INSURE THAT SAFE WORKING CONDITIONS ARE MAINTAINED AND SAFE PRACTICES FOLLOWED IN ALL CONTRACT OPERATIONS. NUMEROUS LIVES ARE LOST EVERY YEAR DUE TO FAILURE TO PROPERLY GROUND ELECTRICAL EQUIPMENT, FAILURE TO CONSTRUCT AND SAFELY MAINTAIN ADEQUATE SCAFFOLDING, ABSENCE OF TRENCH SHORING, INADEQUATE MAINTENANCE AND UNSAFE OPERATION OF HEAVY EQUIPMENT, AND LACK OF SAFETY SUPERVISION AND EMPLOYEE SAFETY EDUCATION. EFFECTIVE ACCIDENT PREVENTION CAN BE ADVANCED BY KNOWING AND OBSERVING THE SAFETY STANDARDS APPLICABLE TO EACH OPERATION OR ACTIVITY. SAFETY TECHNIQUES AND STANDARDS MUST CHANGE AND IMPROVE IN ORDER TO KEEP ABREAST OF THE INNOVATIONS AND CHANGES TAKING PLACE IN THE CONSTRUCTION INDUSTRY. FOR EXAMPLE, CONSTRUCTION SAFETY STANDARDS CURRENTLY CONTAINS PROVISIONS FOR EQUIPPING HIGH-SPEED OFF-HIGHWAY EARTHMOVING EQUIPMENT WITH ROLLOVER PROTECTION AND EMERGENCY BRAKING SYSTEMS. THESE STANDARDS COVER THE RESPONSIBILITY OF THE CONTRACTOR, THE INDOCTRINATION OF THE EMPLOYEES, CARE AND HANDLING OF MATERIALS AND TRAFFIC CONTROL ON THE CONSTRUCTION SITES. /AUTHOR/

Bureau of Reclamation /US/ 379 pp, June 1968

1A 215125

THE AASHO ROAD TEST: REPORT 2-MATERIALS AND CONSTRUCTION

CONTENTS: INTRODUCTION EMBANKMENT SUBBASE-FLEXIBLE AND RIGID PAVEMENTS BASE COURSE-FLEXIBLE PAVEMENT SURFACING-FLEXIBLE PAVEMENT SURFACING-RIGID PAVEMENT TEST BRIDGES APPENDIX A. STATISTICAL ANALYSIS OF COMPACTION DATA FOR CONSTRUCTION CONTROL APPENDIX B. ONE-POINT METHOD FOR DETERMINING MAXIMUM DRY DENSITY APPENDIX C. COOPERATIVE MATERIALS TESTING PROGRAM APPENDIX D. TESTS ON ROAD TEST MATERIALS BY THE BUREAU OF PUBLIC ROADS APPENDIX E. RESIDUAL STRESSES AND STATIC YIELD POINT OF STRUCTURAL STEEL FOR TEST BRIDGES APPENDIX F. COMMITTEES, ADVISORY PANELS, AND PROJECT PERSONNEL.

Highway Research Board Special Reports 1962

1A 215129

QUALITY CONCRETE FOR HIGHWAY CONSTRUCTION WITH CENTRAL MIXING PLANT

CENTRAL MIXED CONCRETE, DELIVERED TO JOB BY NEW AGITATED TRUCK BODIES, OFFERS GREAT OPPORTUNITY FOR FAST PLACEMENT, NEW METHODS OF QUALITY CONTROL, AND VERSATILITY IN RESPECT TO PLACING CONCRETE IN BRIDGES AND THE NUMEROUS OTHER STRUCTURES AS

WELL AS THE SLAB ITSELF. THE METHOD IS FUNDAMENTALLY OLD. FIGURES WILL SHOW WORK IN OHIO DURING 1921. THE FIRST LARGE SCALE OPERATION ALONG MODERN LINES WAS THE CONCRETING ON ONE SECTION OF THE OHIO TURNPIKE IN 1954. THERE WERE TWO LARGE SCALE OPERATIONS IN 1955 AND NUMEROUS SMALLER OPERATIONS WHERE ONLY PART OF THE CONCRETE WAS MIXED. IMPROVED PLANTS SUCH AS STATIONARY TRUCK MIXERS, AND STATIONARY PAVERS PERMITTED THE USE OF EQUIPMENT ALREADY AVAILABLE. THIS WAS AFFECTED ON THE GARDEN STATE PARKWAY WIDENING, JUNE 1955, AND ODD PARTS OF US 14 IN OHIO NEAR RAVENNA, SUCH AS BRIDGE APPROACHES, INTERSECTIONS, AND THE LIKE. THE NEED IS SHOWN FOR NEW EQUIPMENT INCLUDING A SPREADER TO CONVEY AND DEPOSIT THE CONCRETE EVENLY ACROSS A FULL 25 FOOT WIDTH OF PAVEMENT. PORTABLE, OR SEMI-PORTABLE, CONCRETE MIXING PLANTS ARE ALSO NEEDED WHICH CAN BE TRANSPORTED IN PARTS FOR RAPID TRAVEL AND ERECTION. THESE PLANTS SHOULD INCORPORATE COMPLETE FACILITIES FOR AUTOMATIC WEIGHING, RECORDING AND TESTING. IT IS PROPOSED THAT THE HEAVY MEDIA METHOD OF TESTING FOR CEMENT CONTENT BE ENLARGED TO TEST THE FIRST, MIDDLE, AND LAST PARTS OF THE CONCRETE AS DISCHARGED FROM THE CENTRAL MIXING PLANTS TO MEASURE UNIFORMITY OF MIXING. IN RESPECT TO PLACING CONCRETE IN THE SLAB A DEVICE SHOULD BE TRIED FOR CONSOLIDATING BY USING BOTH PRESSURE AND VIBRATION IN ORDER TO SUCCESSFULLY PLACE CONCRETE OF ONE INCH OR LESS SLUMP. WITH THE ADDED FLEXIBILITY AND SPEED, CENTRAL MIXED CONCRETE MAY WELL IMPROVE QUALITY AND REDUCE COST OF CONCRETE IN THE COUNTRY'S NEW HIGHWAY PROGRAM. /AUTHOR/

Maxon, G *Highway Research Board Bulletin* 1956

1A 215145

STATISTICAL EVALUATION OF HIGHWAY MATERIALS SPECIFICATIONS

A STATISTICAL EVALUATION OF SOME OF THE MAJOR HIGHWAY MATERIALS SPECIFICATIONS IS REPORTED. THE DATA FOR ANALYSIS AND EVALUATION WERE OBTAINED FROM HISTORICAL SOURCES, WITH LIMITED AMOUNTS FROM RESEARCH SOURCES FOR ASPHALTIC CONCRETE, BASE COURSE, AND CONCRETE CHARACTERISTICS. THE DATA WERE ANALYZED BY COMPUTER AND STANDARD STATISTICAL PROCEDURES. THE ANALYSIS INDICATES THAT (A) MOST OF THE HISTORICAL DATA TEND TO FOLLOW NORMAL DISTRIBUTION, (B) IN GENERAL, THERE IS CONSIDERABLE VARIATION IN PRODUCTION AND CONSTRUCTION CONTROL FOR DIFFERENT CONTRACTORS, AND (C) FURTHERMORE, THERE IS A LACK OF COMPATIBILITY BETWEEN CURRENTLY USED SPECIFICATION LIMITS AND STATISTICAL PARAMETERS. THE REPORT DESCRIBES THE VARIOUS SINGLE-SAMPLING PLANS FOR LOT ACCEPTANCE. THE USE OF CONTROL CHARTS FOR CONTROL AND ACCEPTANCE OF PORTLAND CEMENT AND ASPHALTIC CONCRETE IS ALSO DEMONSTRATED. /AUTHOR/

Shah, SC Adam, V *Highway Research Record, Hwy Res Board* 1968

1A 215155

RESEARCH NEEDS

RESEARCH PROPOSALS BY THE CONSTRUCTION DIVISION OF THE DEPARTMENT OF MATERIALS AND CONSTRUCTION ARE PRESENTED. THE PROBLEM STATEMENTS ARE DIRECTED TOWARD PROVIDING AN ECONOMICAL AND SMOOTH RIDING PAVEMENT SURFACE. THE STATEMENTS INCLUDE OBJECTIVES, REFERENCES, AND PROJECT URGENCY. THEY CONCERN (1) JOINTS IN CONCRETE PAVEMENTS, (2) SMOOTH RIDING CONCRETE PAVEMENTS, (3) THE DEVELOPMENT OF IMPROVED METHODS OF MEASURING MIXING EFFICIENCY OF HOT MIX BITUMINOUS MATERIALS, (4) CONSTRUCTION QUALITY CONTROL, (5) COST OF OPERATION OF EARTH MOVING EQUIPMENT, (6) RAPID MEASUREMENT OF AGGRE-

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GATE QUANTITIES, (7) SAMPLING PROCEDURE FOR AGGREGATES, AND (8) EVALUATION OF PILE BEARING CAPACITIES.

Highway Res Circular, Hwy Res Board Oct. 1966

1A 215167

QUALITY ASSURANCE IN HIGHWAY CONSTRUCTION, PART I- INTRODUCTION AND CONCEPTS

THIS ARTICLE IS THE FIRST OF A CONTINUING SIX-PART SERIES SUMMARIZING A RESEARCH EFFORT INITIATED TO IMPROVE QUALITY ASSURANCE METHODS IN HIGHWAY CONSTRUCTION. IN ADDITION TO THIS REPORT THE PRESENTATION WILL CONSIST OF THE FOLLOWING: (1) QUALITY ASSURANCE OF EMBANKMENTS AND BASE COURSES, QUALITY ASSURANCE OF PORTLAND CEMENT CONCRETE (2) VARIATIONS OF BITUMINOUS CONSTRUCTION (3) SUMMARY OF RESEARCH FOR QUALITY ASSURANCE OF AGGREGATES, (4) AND CONTROL CHARTS. STATISTICALLY BASED QUALITY-CONTROL METHODS HAVE BEEN USED SUCCESSFULLY IN INDUSTRY, PARTICULARLY IN THE DEFENSE PROGRAM, FOR MANY YEARS. ACCORDING TO RESEARCH RESULTS, STATISTICAL QUALITY-ASSURANCE METHODS ALSO SHOULD BE ADAPTABLE TO HIGHWAY CONSTRUCTION, PROVIDED THAT GOVERNING SPECIFICATIONS ARE PROPERLY WRITTEN AND SAMPLING AND TESTING VARIATIONS ESTABLISHED TO CONFORM TO THE CONDITIONS OF THE LOCALITY IN WHICH THEY WILL BE APPLIED. /AUTHOR/

McMahon, TF Halstead, WJ *Public Roads, Us Bureau Public Roads Feb. 1969*

1A 215174

STATISTICAL CONCEPTS ON THE HIGHWAY

THE STATUS IS DISCUSSED OF THE CURRENT DISTINCTION BETWEEN NEEDS FOR ACCEPTANCE PROCEDURES BY THE HIGHWAY DEPARTMENT AND METHODS OF PRODUCT CONTROL BY THE CONTRACTOR. EMPHASIS HAS BEEN PLACED ON ESTABLISHING REALISTIC VARIANCES FOR EACH PROCESS SO THAT STATISTICAL TOLERANCES CAN REPLACE THE INTUITIVE TOLERANCES NOW BEING USED. CONTRACTORS MUST REALIZE THE NECESSITY FOR STATISTICAL CONTROL PROCEDURES. CASE HISTORIES IN VIRGINIA ARE REVIEWED ON A NON-DESTRUCTIVE TESTING PROCEDURE THAT EMPLOYS PORTABLE NUCLEAR TESTING EQUIPMENT. USING THE SMALL NUCLEAR PORTABLE GAUGE WHICH WAS DEVELOPED, A DENSITY TEST CAN BE PERFORMED ON HOT ASPHALTIC CONCRETE IN ONE MINUTE. THE METHOD INCORPORATED A RELATIVE COMPACTION PROCEDURE IN THE FIELD, USING A FIELD-ESTABLISHED STANDARD THAT ELIMINATES THE LABORATORY-TO-FIELD VARIANCE. SPECIFICATION LIMITS WERE ESTABLISHED FOR A REALISTIC ACCEPTANCE PLAN USING RANDOM TESTING. THEY SPECIFY THE NUMBER OF TESTS TO BE MADE PER LOT AS WELL AS LOT SIZE AND PROVIDE REQUIREMENTS BASED ON REALISTIC VARIANCES. CONVENTIONAL TEST RESULTS ARE COMPARED TO THE NUCLEAR TEST RESULTS. THIS COMPARISON SHOWS THE CONVENTIONAL VALUES ARE TWO TO THREE TIMES AS LARGE AS THE NUCLEAR VALUES, INDICATING THAT WITH THE SAME NUMBER OF TESTS WITH BOTH METHODS, THE NUCLEAR METHOD WILL PREDICT LOT AVERAGES MORE ACCURATELY.

Hughes, CS
Quality Progress Feb. 1969

1A 215189

APPLICATION OF STATISTICS IN SPECIFICATIONS, QUALITY CONTROL, AND ACCEPTANCE PLANS FOR MATERIALS
AUTHORIZATION OF THE CONSTRUCTION OF THE NATIONAL SYSTEM OF INTERSTATE AND DEFENSE HIGHWAYS PRODUCED GENERAL DISSATISFACTION WITH THE CURRENT INSPECTION POLICIES IN HIGHWAY CONSTRUCTION WHICH LED TO VARIOUS REACTIONS BY THE PARTIES CONCERNED. A CONCEPT OF QUALITY CONTROL BY A STATISTICAL MEANS IS RECOMMENDED TO FURNISH A SOLUTION TO THE DI-

LEMMA IN WHICH THE CONSTRUCTION INDUSTRY FINDS ITSELF. THE BUREAU OF PUBLIC ROADS HAS BEEN PARTICULARLY INTERESTED IN INTRODUCING A SYSTEM OF QUALITY CONTROL BY STATISTICAL MEANS. THE ALABAMA HIGHWAY DEPARTMENT UNDERTOOK A RESEARCH STUDY ON STATISTICAL QUALITY CONTROL OF CONSTRUCTION TOLERANCES. THE STUDY CONSISTED OF THREE PARTS: (1) AN EMBANKMENT PROJECT, (2) A BASE AND BITUMINOUS PAVEMENT PROJECT AND, (3) A BASE AND PORTLAND CEMENT CONCRETE PAVEMENT PROJECT. THE OBJECTIVE OF THE STUDY WAS TO ESTABLISH PARAMETERS TO BE USED IN DEVELOPING STATISTICAL SPECIFICATIONS FOR HIGHWAY CONSTRUCTION. SPECIFICATION WRITING, QUALITY CONTROL, AND ACCEPTANCE PLANS ARE DISCUSSED. THE ALABAMA STUDY HAS PROVED THAT PRESENT SPECIFICATIONS DO PRODUCE AN ACCEPTABLE LEVEL OF QUALITY IN HIGHWAY CONSTRUCTION WHEN ANALYZED BY STATISTICAL METHODS. HOWEVER, THE FOLLOWING OBSTACLES TO THE ACCEPTANCE OF THIS METHOD OF TESTING BY ALL PARTIES ARE: (1) THE EDUCATION OF THE FIELD INSPECTION PERSONNEL WHO WILL BE REQUIRED TO OPERATE THIS SYSTEM, (2) TO OBTAIN THE CONTRACTORS' ACCEPTANCE AND SUPPORT OF THIS SYSTEM, (3) THE ACCEPTANCE OF STATISTICAL QUALITY CONTROL BY THE BUREAU OF PUBLIC ROADS, AND (4) THE NATURAL RESISTANCE TO ANY CHANGE.

David, JH *Southeast Assoc St Hwy Officials Nov. 1967*

1A 215190

UTILIZATION OF STATISTICAL SPECIFICATIONS AND INCENTIVE PROVISIONS IN QUALITY ASSURANCE PROGRAM

THE QUALITY ASSURANCE GROUP OF THE OFFICE OF RESEARCH AND DEVELOPMENT OF THE BUREAU OF PUBLIC ROADS HAS BEEN WORKING ON IMPROVED SPECIFICATION FOR HIGHWAY CONSTRUCTION. THE WRITING OF SPECIFICATIONS ENTAILS HAVING KNOWLEDGE AVAILABLE CONCERNING ALL ASPECTS OF HIGHWAY DESIGN, MATERIALS, CONSTRUCTION PROCESSES, LAW AND ECONOMICS, AND BEING CAPABLE OF EXERCISING SOUND ENGINEERING JUDGMENT. IN AN EFFORT TO UTILIZE THE STATISTICAL CONCEPTS IN RESEARCH SPECIFICATIONS, CONTROL OF MATERIALS AND CONSTRUCTION HAVE BEEN SEPARATED FROM ACCEPTANCE BY WRITING END-RESULT ACCEPTANCE TYPE SPECIFICATIONS WHEREVER POSSIBLE. THE FOLLOWING GROUND RULES ARE BEING FOLLOWED: (1) THE CONTRACTOR IS RESPONSIBLE FOR SUPPLYING THE MATERIAL AND CONSTRUCTION SPECIFIED UNDER THE CONTRACT, BOTH AS TO QUANTITY AND QUALITY, (2) THE STATE IS RESPONSIBLE FOR EVALUATING THE CONTRACTOR COMPLIANCE TO THE SPECIFICATIONS, (3) OBSERVATION BY A STATE INSPECTOR IS A MAJOR DETERENT TO SLOPPY AND OBVIOUSLY DEFECTIVE WORK, (4) EACH ITEM OF MATERIAL OR CONSTRUCTION IS TO BE ADEQUATELY DESCRIBED IN STATISTICAL TERMS WHERE POSSIBLE, (5) A SAMPLING PLAN IS TO BE SPECIFIED FOR EACH ITEM TO BE SAMPLED, AND (6) THE ACCEPTANCE OR REJECTION ACTION TO BE TAKEN, BASED ON THE ANALYSIS OF THE RESULT OF THE PRESCRIPTIONS OF THE DESIRED QUALITY OF MATERIALS OR CONSTRUCTION CAN BE QUITE VERSATILE. THE LEVEL OF QUALITY CAN BE STATED AS THE TARGET VALUE. THE ALLOWABLE VARIATION OF THE AVERAGE QUALITY OR THE VARIATION OF THE INDIVIDUAL TEST RESULTS ABOUT THE AVERAGE CAN BE EXPRESSED EXPLICITLY. THE PERCENT COMPLIANCE CAN BE COMPUTED FROM THE TEST RESULTS WHERE A PERCENT COMPLIANCE IS SPECIFIED AS BEING REQUIRED. THE SAMPLING PLAN DEFINES THE SAMPLING AND TESTING PROCEDURES TO BE USED, THE POINT OF SAMPLING, AND THE NUMBER OF SAMPLES TO BE TAKEN AND TESTED. THE FOLLOWING VARIOUS ACTIONS MUST BE ITEMIZED IN A COMPLETE SPECIFICATION: (1) ACCEPT THE LOT, (2) REJECT THE LOT, (3) ACCEPT AT A REDUCED PRICE, (4) ACCEPT AT A BONUS PRICE, AND (5) REWORK AND RETEST WITH THE RETEST COST TO BE BORNE BY THE CONTRACTOR. DATA HAVE BEEN COLLECTED ON

1A SYSTEM CONSTRUCTION, MANAGEMENT & QUALITY CONTROL

MANY RESEARCH PROJECTS. NEW REALISTIC, ENFORCEABLE PERFORMANCE TYPE SPECIFICATIONS AND NEW TEST METHODS ARE BEING DEVELOPED WHICH WILL MEASURE THE QUALITY OF MATERIALS AND CONSTRUCTION IN TERMS OF PERFORMANCE, THEREBY ALLOWING A SCIENTIFIC APPROACH TO THE ESTABLISHMENT OF DESIGN REQUIREMENTS AND PROCEDURES.

McMahon, TF *Southeast Assoc St Hwy Officials* Nov. 1967

1A 215192

QUALITY ASSURANCE IN HIGHWAY CONSTRUCTION PART 3--QUALITY ASSURANCE OF PORTLAND CEMENT CONCRETE THIS IS THE THIRD PART OF AN INTERPRETATIVE SUMMARY OF THE PROGRESS IN PUBLIC ROADS RESEARCH PROGRAM FOR THE STATISTICAL APPROACH TO QUALITY ASSURANCE IN HIGHWAY CONSTRUCTION. PART 1.-INTRODUCTION AND CONCEPTS, AND PART 2.-QUALITY ASSURANCE OF EMBANKMENTS AND BASE COURSES, WERE PRESENTED IN PREVIOUS ISSUES OF PUBLIC ROADS. THE REMAINING PARTS, TO BE PRESENTED IN SUCCEEDING ISSUES, ARE 4.-VARIATIONS OF BITUMINOUS CONSTRUCTION, 5.-SUMMARY OF RESEARCH FOR QUALITY ASSURANCE OF AGGREGATE, AND 6.- CONTROL CHARTS. /AUTHOR/

Baker, WM McMahon, TF *Public Roads, Us Bureau Public Roads* June 1969

1A 215203

QUALITY ASSURANCE IN HIGHWAY CONSTRUCTION: QUALITY ASSURANCE OF EMBANKMENTS AND BASE COURSES-PART II

PROPER COMPACTION IS ESSENTIAL TO THE PERFORMANCE PROPERTIES OF SOIL AND ROCK MATERIAL. THE CONTROL OF THE COMPACTION PROCESS IS ONE OF THE MOST IMPORTANT ASPECTS IN BASE AND EMBANKMENT CONSTRUCTION. IT HAS BEEN DEMONSTRATED THAT NUCLEAR DENSITY MEASUREMENTS PRODUCE MORE PRECISE DATA THAN CAN BE OBTAINED BY CONVENTIONAL METHODS. VALID MEASUREMENTS OF THE ACTUAL QUALITY OF THE COMPACTION CAN BE MADE ONLY IF THE SAMPLE IS A TRUE REPRESENTATION OF THE TOTAL COMPACTED MATERIAL. THE USE OF STATISTICAL CONCEPTS TO ESTABLISH THE REQUIREMENTS OF SPECIFICATIONS AND TO AID IN THE ANALYSIS OF TEST DATA PROVIDES NEEDED IMPROVEMENT. UNIFORMITY MUST BE CONTROLLED AS WELL AS DEGREE OF COMPACTION. SEVERAL STATES HAVE DEVELOPED SPECIFICATIONS FOR EMBANKMENT OR BASE CONSTRUCTION THAT ARE IMPROVEMENTS OVER PRESENT METHODS AND ARE BASED PARTLY ON STATISTICS. VIRGINIA IS USING A CONTROL STRIP TECHNIQUE FOR CONTROL OF THE COMPACTION OF AGGREGATE BASE. THEY USED THE NUCLEAR FIELD DENSITY TESTING DEVICE, THE SPEED OF WHICH PERMITS DETERMINATION TO BE MADE FOR EACH SECTION OF MATERIAL. RESEARCH IS SHOWING THAT OVERALL STANDARD DEVIATION, A MEASURE OF VARIABILITY, IS NOT IN ITSELF A TRUE INDICATION OF CONTRACTOR-PERFORMANCE VARIABILITY. THE VARIATION IN DENSITY OF ACCEPTED EMBANKMENTS AND BASES HAS BEEN FOUND TO BE MUCH GREATER THAN EXPECTED BY THE BUREAU OF PUBLIC ROADS RESEARCH PROGRAM. IT IS CONCLUDED THAT TEST RESULTS ON BASE AND EMBANKMENT MATERIALS EXHIBIT A GREAT VARIATION. THESE VARIATIONS CAN BE ATTRIBUTED TO MATERIAL VARIANCE, SAMPLING VARIANCE, AND TO TESTING VARIANCE. STATE HIGHWAY DEPARTMENTS SHOULD TAKE STEPS TO IMPLEMENT RANDOM SAMPLING IN THE CONTROL AND ACCEPTANCE OF BASE AND EMBANKMENT CONSTRUCTION.

McMahon, TF *Public Roads, Us Bureau Public Roads* Apr. 1969

1A 215206

CONTROL AND ADJUSTMENTS OF CONSTRUCTION SCHEDULE

A FIVE-YEAR CONSTRUCTION PROGRAM WAS OUTLINED IN MICHIGAN IN 1957. THE COMPLETE PROGRAM WAS MADE

PUBLIC, WITH LETTING DATES ON EACH PROJECT, IN ADVANCE, AND SCHEDULES WITH TARGET DATES WERE SET UP FOR EACH DIVISION TO MEET IN ORDER THAT THE ENTIRE SCHEDULES FOR THE DIVISIONS COULD MEET THE PREDETERMINED LETTING DATES. A CENTRAL SYSTEM OF REPORTING TO TOP MANAGEMENT WAS SET UP FOR A PROGRAM PERFORMANCE CONTROL. THE CENTRAL REPORTING PROCEDURE SET UP THE FOLLOWING STEPS: (1) PREPARATION OF BAR CHARTS, BY DISTRICTS, ON EVERY PROJECT, SHOWING THE WORK SCHEDULES AND TARGET DATES NECESSARY FOR EACH DIVISION AND SECTION TO MEET. (2) PREPARATION OF REPORTING FORMS TO BE USED BY EACH DIVISION FOR REPORTING CURRENT INFORMATION ON THE STATUS OF EVERY PROJECT. (3) THE DEVELOPMENT OF A PROGRAM PERFORMANCE CHART GIVING INFORMATION ON EVERY PROJECT FROM THE SELECTION OF THE CORRIDOR, TO THE FINAL DISPOSAL OF ANY EXCESS PROPERTY THAT MAY HAVE BEEN ACQUIRED IN CONNECTION WITH RIGHT-OF-WAY PURCHASE, AND (4) PREPARATION OF PROGRAM ROUTE REPORTS ON ALL INTERSTATE AND ARTERIAL HIGHWAYS TO GIVE TOP MANAGEMENT A COMPREHENSIVE PICTURE OF EACH PROJECT. CENTRAL REPORTING CAN BE SUCCESSFUL WITH THE FULL COOPERATION BETWEEN TOP MANAGEMENT, THE DIVISIONS, AND THE DISTRICTS.

Walker, MJ *Highway Research Board Special Reports* 1961

1A 215219

EVALUATION OF CONSTRUCTION CONTROL PROCEDURES: AGGREGATE GRADATION VARIATIONS AND EFFECTS

FOUR INDIVIDUAL STUDIES CONCERNED WITH THE GRADATION OF AGGREGATES USED IN HIGHWAY CONSTRUCTION WERE CONDUCTED ON: (1) EFFECT OF VARIATIONS IN GRADATION OF COARSE AGGREGATE ON CHARACTERISTICS OF PORTLAND CEMENT CONCRETE. (2) VARIATION IN GRADATION OF AGGREGATES IN BITUMINOUS HOT-MIX PLANTS. (3) EFFECT OF INCREMENT SIZE ON SAMPLING ACCURACY, AND (4) MATHEMATICAL STUDY OF THE PATTERN OF VARIATIONS IN GRADATION OF AGGREGATES. A STATISTICALLY DESIGNED EXPERIMENT WAS USED TO DETERMINE THE EFFECT OF GRADATION VARIATIONS ON THE WORKABILITY AND COMPRESSIVE STRENGTH OF THE RESULTANT CONCRETE. INVESTIGATION WAS MADE OF VARIATIONS IN GRADATION OF BOTH FINE AND COARSE AGGREGATES AND ASPHALT CONTENTS AT SEVERAL POINTS IN THE PRODUCTION PROCESS OF BITUMINOUS HOT-MIX PLANTS. AN EXPERIMENT WAS CONDUCTED TO ESTABLISH THE PRACTICAL RELATIONSHIP BETWEEN MAXIMUM PARTICLE SIZE AND MINIMUM INCREMENT SIZE FOR DETERMINING THE GRADATION OF A LOT OF AGGREGATE. SEVERAL LOTS OF KNOWN GRADATION WERE PREPARED AND SAMPLED WITH SAMPLING SCOOPS OF PREDETERMINED CAPACITY. IT APPEARED THAT VARIATIONS IN THE GRADATION OF AGGREGATES FOLLOWED AN INHERENT PATTERN. DATA WERE ANALYZED TO DETERMINE THE POSSIBILITIES FOR SELECTING A SINGLE SIEVE FOR USE AS A QUICK CHECK ON COMPLIANCE WITH GRADATION SPECIFICATIONS. THE CONCRETE STUDY INDICATES THAT SAVINGS IN MANPOWER AND TESTING TIME CAN BE EFFECTED BY REDUCING THE SAMPLING FREQUENCY OF COARSE AGGREGATES FOR CONCRETE. THE MOST SIGNIFICANT FINDING WAS THAT COMPRESSIVE STRENGTH REMAINED SUBSTANTIALLY CONSTANT, REGARDLESS OF LARGE VARIATIONS IN THE GRADATION OF THE COARSE AGGREGATE, PROVIDED THE SLUMP WAS MAINTAINED AT A UNIFORM LEVEL. RESCREENING OR RESIZING COARSE AGGREGATES IS CONTRAINDICATED, AND IT IS RECOMMENDED THAT RESTRICTIVE GRADATION SPECIFICATIONS BE BROADENED TO ACCOMMODATE GRADATION VARIATIONS ACTUALLY FOUND TO EXIST. THE HOT-MIX BITUMINOUS PAVING PLANT STUDY FOUND THAT INDICATED VARIATIONS IN THE GRADATION OF BINNED AGGREGATES WERE LARGELY DUE TO WITHIN-BATCH VARIATION. IT IS RECOMMENDED THAT COMPLIANCE WITH JOB-MIX FORMULA GRADATION REQUIREMENTS BE BASED ON QUALITY HISTORY CHARTS

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RATHER THAN ON THE RESULTS OF INDIVIDUAL TESTS. THE USE OF USUAL SAMPLING TOOLS DOES NOT SEEM TO SERIOUSLY BIAS THE RESULTS. THE MATHEMATICAL STUDY CONFIRMED THAT THERE IS A TYPICAL PATTERN TO VARIATIONS OF AGGREGATE GRADATION. GRADATION SPECIFICATION SHOULD HAVE THE GREATEST TOLERANCE ON THOSE SIEVES THAT PASS 50 TO 70% OF THE AGGREGATE. THE REQUIRED SIZE OF TEST PORTIONS DEPENDS ON BOTH THE MAXIMUM PARTICLE SIZE AND THE GRADATION OF THE AGGREGATE.

Hudson, SB Waller, HF *Highway Research Board Nchrp Reports* 1969

1A 215221

EMBANKMENT COMPACTION VARIABILITY-CONTROL TECHNIQUES AND STATISTICAL IMPLICATIONS

THE DEVELOPMENT OF A MORE EFFECTIVE METHOD FOR FIELD CONTROL OF EMBANKMENT COMPACTION MUST BE BASED ON KNOWLEDGE OF THE RESULTS BEING ACHIEVED USING CURRENT INSPECTION PROCEDURES. THE PURPOSE OF THIS STUDY WAS TO DETERMINE THE EXTENT OF COMPACTION VARIABILITY PRESENT IN FILL CONSTRUCTION FOR TYPICAL INDIANA CONSTRUCTION PROJECTS AND TO IDENTIFY THE VARIOUS FACTORS THAT LEAD TO THIS VARIATION. DIFFERENT TECHNIQUES FOR MEASURING IN-PLACE DENSITY, INCLUDING THE SAND CONE REPLACEMENT METHOD, THE WATER-FILLED BALLON VOLUME-MEASURING DEVICE, AND THE SURFACE BACKSCATTER NUCLEAR GAGE, WERE STUDIED TO PROVE VARIANCE ESTIMATES FOR USE IN THE FINAL STATISTICAL ANALYSIS. THE RESULTS INDICATE THAT WIDESPREAD COMPACTION VARIABILITY IS PRESENT IN ALL FIELD CONSTRUCTION REGARDLESS OF TESTING METHOD, AND THAT IT IS CAUSED BY A COMBINATION OF MANY INTERRELATED FACTORS. THIS OBSERVED SPREAD IN COMPACTION RESULTS INDICATES THAT CURRENT CONTROL PROCEDURES DO NOT ACCOUNT FOR VARIABILITY, AND THEREFORE AN INSPECTION PROGRAM USING STATISTICAL QUALITY CONTROL PROCEDURES DEVELOPED FOR THESE DATA IS PRESENTED. THE PROPOSED TECHNIQUE IS THAT OF USING A HYPOTHESIS DECISION THEORY THAT ACCOUNTS FOR THE COMPACTION VARIABILITY BY USING STATISTICAL PARAMETERS BASED ON RANDOM SAMPLING TO MAKE DECISIONS AS TO OVERALL COMPACTION QUALITY. /AUTHOR/

Williamson, TG *Highway Research Record, Hwy Res Board* 1969

1A 215224

STATISTICAL STUDY OF THE COMPLIANCE WITH SPECIFICATION OF CONCRETE SUPPLIED FOR HIGHWAY STRUCTURES IN THE UNITED KINGDOM

A STUDY HAS BEEN MADE OF THE STATISTICAL IMPLICATIONS OF A UNITED KINGDOM SPECIFICATION FOR STRENGTH OF CONCRETE FOR HIGHWAY STRUCTURES AND THE QUALITY OF MATERIALS SUPPLIED TO AND ACCEPTED UNDER THE SPECIFICATION TO SEE IN WHAT WAY THE SPECIFICATION MIGHT BE IMPROVED. THE DISTRIBUTION OF RESULTS FROM STRENGTH TESTS IS NORMAL AND THE PROPORTION OF CONCRETE DEFECTIVE AT ANY SPECIFIED STRENGTH MAY BE ESTIMATED ONCE THE STATISTICAL PARAMETERS OF THE DISTRIBUTION HAVE BEEN EVALUATED. THE PROPORTION DEFECTIVE PROVIDES A USEFUL MEASURE OF EQUALITY THAT CAN BE USED TO STUDY THE EFFECT OF PARTICULAR SPECIFICATION REQUIREMENTS ON THE QUALITY OF CONCRETE SUPPLIED IF THE OPERATING CHARACTERISTIC (OC) CURVE (RELATING THE PROPORTION DEFECTIVE AND THE PROBABILITY OF ACCEPTANCE OF THAT QUALITY) IS COMPUTED OVER A RANGE OF QUALITIES. THE CONCLUSIONS REACHED FROM EXAMINATION OF THE OC CURVE ARE COMPARED WITH THE RESULTS OF A STATISTICAL EXAMINATION OF THE ACTUAL QUALITY OF CONCRETE SUPPLIED TO 186 JOBS WHERE 8,400 TEST RESULTS WERE OBTAINED. METHODS OF IMPROVING SPECIFICATIONS ARE BRIEFLY CONSIDERED IN THE LIGHT OF THE RISKS TO THE PRODUCER OF CONCRETE AND TO THE CONSUMER, THE

OBJECT OF ANY SPECIFICATION BEING TO PROVIDE A FAIR APPORTIONMENT OF THE RISKS OF REJECTION OF 'GOOD' MATERIAL AND ACCEPTANCE OF 'POOR' MATERIAL BETWEEN PRODUCER AND CONSUMER. /AUTHOR/

Mathews, DH Metcalf, JB *Highway Research Record, Hwy Res Board* 1969

1A 215234

BENKELMAN BEAM DEFLECTIONS USED AS A CONTROL FOR HIGHWAY CONSTRUCTION

RECENT WORK IN VARIOUS PARTS OF THE WORLD HAS YIELDED MUCH INFORMATION AS TO WHAT IS A SATISFACTORY DEFLECTION LEVEL ON A PARTICULAR PAVEMENT TYPE SUBJECTED TO PARTICULAR TRAFFIC LOADINGS. THE VALUE OF DEFLECTION ON A FINISHED SURFACE IS RELATED IN SOME WAY TO THE DEFLECTION AT LOWER LEVEL PAVING COURSES. USING THESE FACTS, THIS PAPER DESCRIBES A METHOD OF CONSTRUCTION CONTROL USING DEFLECTIONS TAKEN AT DIFFERENT HORIZONS. THE JOBS ARE MULTI-LANE SECTIONS OF URBAN CONSTRUCTION, SUBJECTED TO HEAVY TRAFFIC, AND CONSTRUCTED OVER FORMER MANGROVE SWAMPS AND RECLAIMED LAND. TEST SECTIONS WERE ALSO CHOSEN ON THE FINISHED PAVEMENT AND SERVICEABILITY STUDIES ARE CONTINUING. /AUTHOR/

Kneipp, HH *Australian Road Research Board Proc* 1968

1A 215235

APPLICATION OF CONSTRUCTION MANAGEMENT TO THE PAVING PROCESS

THE APPLICATION OF CONSTRUCTION MANAGEMENT TO THE PAVING PROCESS BY THE CONTRACTOR CONSISTS OF THE FOLLOWING OPERATIONS: INTERPRETING THE SPECIFICATIONS, OBTAINING, ORGANIZING AND CONTROLLING MAN, EQUIPMENT, AND MATERIALS TO CONSTRUCT A PAVEMENT AT THE RIGHT COST. EVERY STEP OF THE PAVING PROCESS MUST BE PLANNED FROM THE MOMENT OF AWARD UNTIL ACCEPTANCE BY THE AWARDED AGENCY. A PAVING OPERATION SCHEDULE SHOULD BE DETAILED AND EXACT TO THE LAST MINUTE DETAIL. A SAFETY PROGRAM MUST BE DESIGNED TO PREVENT ACCIDENTS AND AVOID INJURIES, AND MUST BE CONSISTENTLY EMPLOYED AND ENFORCED IN EVERY PHASE OF THE PAVING PROCESS. SUPERVISION MUST BE PROVIDED THAT HAS EXPERIENCE, DRIVE, DETERMINATION, & THE ABILITY TO COMMUNICATE, TO INTERPRET SPECIFICATIONS, CARRY OUT THE PAVING PROCESS, STAY ON SCHEDULE, AND MAINTAIN A SAFE OPERATION.

Porter, RL
Sixth Paving Conference Proc pp 107-113, 1968

1A 215236

CALENDAR-DAY CPM

THE SPEED OF PERFORMANCE OF AN OPERATION ON A CONSTRUCTION PROJECT IS DEPENDENT UPON THE TIME OF YEAR WHEN THE OPERATION IS DONE. THE CRITICAL PATH METHOD (CPM) IS A USEFUL CONSTRUCTION PLANNING TOOL, BUT OF LIMITED VALUE IN CONSTRUCTION SCHEDULING. THE BAR CHART TECHNIQUE OF PLANNING AND SCHEDULING ALLOWS FOR THE EXPLICIT INTEGRATED TREATMENT OF THE HOW/HOW-LONG/WHEN ASPECTS OF AN OPERATION, BUT EMPLOYS A NOTATION THAT DOES NOT PERMIT PRECISE DEFINITION OF THE RELATIONSHIPS AMONG THE OPERATIONS. A PROCEDURE COMBINING THE NOTATION OF CPM AND THE SOLUTION PROCESS OF THE BAR CHART TECHNIQUE IS CALENDAR-DAY CPM. EXAMPLES ARE PRESENTED OF THE APPLICATION OF THE CALENDAR-DAY CPM NETWORK OF OPERATIONS. CALENDAR-DAY CPM IS A PLANNING AND SCHEDULING PROCEDURE WHICH PROVIDES THE PRECISION REQUIRED IN DEFINING OPERATIONS AND THE RELATIONSHIPS AMONG OPERATIONS, WHILE UTILIZING A SOLUTION PROCESS WHEREIN THE DURATION OF THE OPERATION IS CORRELATED WITH THE TIME OF YEAR IN WHICH IT IS PERFORMED. IT PROVIDES THE PRECISION AND

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INTEGRATION IN PLANNING AND SCHEDULING REQUIRED TO OBTAIN REALISTIC PLANS AND SCHEDULES OF CONSTRUCTION PROJECTS.

Shaffer, LR *Civil Engineering Asce* Aug. 1969

1A 215250 VALUE ENGINEERING IN FEDERAL CONSTRUCTION AGENCIES

CONTENTS: INTRODUCTION CONCLUSIONS AND OBSERVATIONS BASIC CONCEPTS OF VALUE ENGINEERING PROGRAMS PROBLEMS IN IMPLEMENTING PROGRAMS THE FUTURE OF VALUE ENGINEERING PROGRAMS KEYNOTE, GEORGE B. BEGG VALUE ENGINEERING PROGRAMS IN FEDERAL CONSTRUCTION AGENCIES (PREPARED PAPERS) VALUE ENGINEERING IN THE CORPS OF ENGINEERS, WILLIAM S. ALLDREDGE VALUE ENGINEERING IN THE BUREAU OF RECLAMATION, HAROLD G. ARTHUR VALUE ENGINEERING IN THE NAVAL FACILITIES ENGINEERING COMMAND, LAURENCE SCHUMAN VALUE ENGINEERING IN THE VETERANS ADMINISTRATION, SIDNEY J. HELENE VALUE ENGINEERING IN THE POST OFFICE DEPARTMENT, RILEY A. MURRAY VALUE ENGINEERING IN AIR FORCE CIVIL ENGINEERING, LIEUTENANT COLONEL ANTHONY D. RYNTIES, USAF VALUE ENGINEERING IN THE PUBLIC BUILDINGS SERVICE, FORREST ANDREWS AN ANALYTICAL SUMMATION, HENRY A. BORGER ANALYSIS OF SPECIFIC PROBLEM AREAS IN VALUE ENGINEERING (PREPARED PAPERS) PRINCIPLES OF ORGANIZATIONAL ARRANGEMENTS FOR VALUE ENGINEERING, WILLIAM S. ALLDREDGE COST REDUCTION AND VALUE ENGINEERING, LAURENCE SCHUMAN THE POSITION OF VALUE ENGINEERING IN MANAGEMENT, SIDNEY J. HELENE CONTRACT INCENTIVE CLAUSES, LIEUTENANT COLONEL ANTHONY D. RYNTIES, USAF VALUE ENGINEERING-PROJECT SELECTION AND INITIATION, FORREST ANDREWS CONFIGURATION MANAGEMENT AND THE FUTURE OF VALUE ENGINEERING, RILEY A. MURRAY EMPHASIS-TECHNIQUES OR PROCEDURES? HAROLD G. ARTHUR INNOVATIONS AND MANAGEMENT SUPPORT, GEORGE B. BEGG.

Building Res Advisory Board Nas-nrc 1969

1A 215254 CRITICAL PATH EVALUATIONS OF CONSTRUCTION WORK CHANGES AND DELAYS

AFTER DISCUSSING THE GENERAL PROBLEM OF REALISTIC DETERMINATIONS OF THE EFFECTS OF WORK CHANGES AND DELAYS IN CONSTRUCTION CONTRACTS UNDER CURRENT GENERAL CONDITIONS, THIS PAPER PRESENTS A NEW AND PRACTICAL METHOD FOR THEIR EQUITABLE EVALUATION AND PROPER APPORTIONMENT, BOTH AS TO TIME AND COST, BASED UPON CRITICAL PATH NETWORK ANALYSIS. THIS METHOD ENVISAGES THAT THE CONTRACT SCHEDULE INCLUDES SEPARATE ITEMS FOR INDIRECT PROJECT COSTS, AND THAT THE CONTRACTOR'S WORKS PROGRAM (UPON WHICH HIS PRICE WAS BASED) FORMS PART OF THE CONTRACT. ESSENTIAL FEATURES OF THE CONCEPT INCLUDE PROGRESSIVE DOCUMENTATION OF ACTIVITY STATUS AS AFFECTED BY CHANGE ORDERS AND DELAYS (HOWEVER ARISING) THROUGHOUT THE CONSTRUCTION PERIOD AND PROGRESSIVE PLOTTING OF TIME-SCALED "FACTUAL" NETWORKS AS THE WORK IS EXECUTED. IT HAS BEEN SUCCESSFULLY APPLIED TO FOUR MAJOR PROJECTS NOW COMPLETED. BY THIS TECHNIQUE THE OVERALL EFFECTS OF ALL WORK CHANGES AND DELAYS CAN BE EVALUATED IN DETAIL AND PROPERLY APPORTIONED BETWEEN THE PARTIES IN ACCORDANCE WITH THE TERMS OF A CONTRACT. /AUTHOR/

Anill, JM *Inst Engrs Civil Eng Trans /Australia/* Apr. 1969

1A 215263 METHODS FOR EXTENDING THE RANGE OF NON-COMPUTER CRITICAL PATH APPLICATIONS

A CONTINUATION IS DESCRIBED OF THE RESEARCH IN AN EARLIER REPORT ENTITLED "A NON-COMPUTER APPROACH

TO THE CRITICAL PATH METHOD FOR THE CONSTRUCTION INDUSTRY." ITS PURPOSE IS TO PRESENT IMPROVEMENTS TO SEVERAL OF THE PROCEDURES PREVIOUSLY DEVELOPED AND TO OFFER ADDITIONAL METHODS THAT WILL EXTEND THE RANGE OF THE NON-COMPUTER APPROACH. CHAPTER I DISCUSSES THESE OBJECTIVES AND CERTAIN NOMENCLATURE CHANGES. THE DECISION TO RETAIN THE DIAGRAMMING SYSTEM PRESENTED IN THE EARLIER REPORT, WHICH IS CONSIDERED BY SOME TO BE "NON-STANDARD," IS DISCUSSED AT LENGTH IN CHAPTER II. THIS IS A BASIC MATTER SINCE THE DETAIL OF THE PROCEDURES TO BE PRESENTED IS DEPENDENT ON THE TYPE OF NETWORK DIAGRAM ADOPTED. THE DECIDING FACTOR IS THAT OF SIMPLICITY. IN CHAPTER III, THE BASIC NETWORK ELEMENTS AND THE MECHANICS BY WHICH CHANGES ARE TRANSMITTED THROUGH THE NETWORK ARE EXAMINED. THREE APPROACHES ARE PROPOSED FOR INCREASING THE SIZE OF NETWORK WHICH CAN FEASIBLY BE UPDATED BY NON-COMPUTER PROCEDURES. THIS ABILITY TO UPDATE DATA IS NOT ONLY IMPORTANT AS A FUNCTION BY ITSELF, BUT IT IS A KEY STEP IN SEVERAL OTHER TECHNIQUES, SUCH AS TIME-COST TRADE-OFFS AND RESOURCE ALLOCATION. THEREFORE, THESE APPROACHES ARE SIGNIFICANT IN ACCOMPLISHING THE OBJECTIVES OF THE REPORT. THEY ARE: (1) GREATER SELECTIVITY IN DATA REQUIREMENT; (2) EFFICIENT METHODS FOR UPDATING ONLY THAT DATA AFFECTED BY A CHANGE RATHER THAN RECOMPUTING ALL DATA; AND (3) NETWORK BREAKDOWN THAT PERMITS LARGE NETWORKS TO BE REDUCED TO SMALLER SUBNETS WITHOUT SACRIFICING ESSENTIAL PROPERTIES OF THE OVERALL DIAGRAM. CHAPTER IV CONSIDERS IN DETAIL GREATER SELECTIVITY IN DATA REQUIREMENTS AND ANALYZES THE VARIOUS ELEMENTS OF DATA THAT CAN BE PROVIDED AS WELL AS THE VARIOUS APPLICATIONS OF THIS DATA. RECOMMENDATIONS ARE MADE FOR (1) CONSIDERABLY REDUCING THE AMOUNT OF DATA THAT IS TO BE MAINTAINED IN AN UP-TO-DATE CONDITION AFTER EACH CHANGE OCCURS, AND (2) UPDATING THE REMAINDER AT MUCH LESS FREQUENT INTERVALS. CHAPTER V DEVELOPS PROCEDURES FOR UPDATING THAT DATA THAT IS AFFECTED BY A CHANGE WITHOUT RECOMPUTING THE COMPLETE SET OF DATA. IT IS BASED ON A STRICTLY MANUAL METHOD. CHAPTER VI DESCRIBES AN ALTERNATIVE METHOD OF UPDATING BASED ON THE USE OF AN ELECTRICAL NETWORK ANALYZER THAT HAS BEEN DEVELOPED UNDER THIS PROJECT TO FACILITATE THIS WORK. CHAPTER VII DISCUSSES THREE METHODS OF NETWORK BREAKDOWN WHICH MAKE IT POSSIBLE TO REDUCE A LARGE NETWORK TO A SIZE THAT IS FEASIBLE TO HANDLE NON-COMPUTER PROCEDURES. ONE OF THEM, A NEW METHOD BASED ON DATELINE CUTOFFS, IS PARTICULARLY USEFUL SINCE IT PERMITS UPDATING, ANALYSIS, AND EXPANSION OF DETAIL, IF DESIRED, FOR THAT PORTION OF THE PROJECT THAT IS TO BE PERFORMED IN THE IMMEDIATE FUTURE, BUT DOES NOT REQUIRE COMPLETE UPDATING OR A SIMILAR DEGREE OF DETAIL FOR THE REMAINDER OF THE NETWORK. /AUTHOR/

Fondahl, JW
Stanford University

1A 215264 METHODS IMPROVEMENT TECHNIQUES FOR CONSTRUCTION AND PUBLIC WORKS MANAGERS

THE RESULTS ARE PRESENTED OF SEVERAL YEARS OF INVESTIGATION BY THE CIVIL ENGINEERING-CONSTRUCTION GROUP AT STANFORD UNIVERSITY ON THE GENERAL SUBJECT OF METHODS AND TECHNIQUES FOR EFFICIENT MANAGEMENT OF CONSTRUCTION OPERATIONS. THE METHODS AND TECHNIQUES FOR MEASURING THE EFFECTIVENESS OF RESOURCE USE ARE ANALYZED. DEVELOPMENT OF A NEW METHOD BY MEANS OF METHODS IMPROVEMENT TECHNIQUES IS A FOUR-STEP PROCEDURE: (1) RECORD THE JOB AS IT IS BEING DONE, (2) ANALYZE EVERY DETAIL OF THE PRESENT METHOD, (3) DEVISE NEW METHODS, AND (4) IMPL-

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MENT THE BETTER METHOD. SPECIFICALLY DISCUSSED ARE THE FOLLOWING IDEAS: TIME-LAPSE PHOTOGRAPHY, THE CREW BALANCE CHART, AND METHODS OF ACTIVITY SAMPLING. THE COMBINATION OF GOOD METHODS AND EFFECTIVE USE OF AVAILABLE RESOURCES CANNOT FAIL TO PRODUCE AN ECONOMICAL AND SUCCESSFUL JOB. TECHNIQUES AND IDEAS ARE PRESENT TO ASSIST MANAGEMENT IN ACHIEVING THE GOALS.

Parker, HW
Stanford University 1967

1A 215272
A NON-COMPUTER APPROACH TO THE CRITICAL PATH METHOD FOR THE CONSTRUCTION INDUSTRY
THE CRITICAL PATH METHOD FOR PLANNING, SCHEDULING, AND CONTROL OF PROJECT OPERATIONS IS A NEW AND USEFUL TOOL NOW BECOMING AVAILABLE TO THE CONSTRUCTION INDUSTRY. SUCCESSFUL APPLICATIONS HAVE ALREADY PROVEN ITS VALUE. TO DATE, EXCEPT FOR THE SIMPLEST OF CASES, THE USE OF THIS TECHNIQUE HAS BEEN LARGELY DEPENDENT ON PROGRAMMED SOLUTIONS BY ELECTRONIC COMPUTERS. THIS REPORT PRESENTS THE MECHANICS OF NONCOMPUTER METHODS FOR APPLYING THE CRITICAL PATH METHOD. THESE EMPLOY THE SAME INPUT DATA AND FURNISH THE SAME OUTPUT INFORMATION AS THE COMPUTER METHODS. IN ADDITION, ALTERNATE APPROACHES TO SOLUTION OF THE PROBLEM ARE PRESENTED WHICH PERMIT THE IMPORTANT SCHEDULING VARIATION PHASE TO BEGIN WITH A NORMAL ESTIMATE RATHER THAN A SET OF DATA FOR AN ARTIFICIAL CONDITION. THERE ARE THREE GOALS TOWARD WHICH THIS REPORT IS AIMED. THE FIRST IS TO PRESENT A NONCOMPUTER METHOD FOR OBTAINING THE BENEFITS OF CRITICAL PATH SCHEDULING THAT IS PRACTICAL TO APPLY TO MANY OF THE PROJECTS ENCOUNTERED BY THE CONSTRUCTION CONTRACTOR. THE SECOND IS TO DEVELOP THE POSSIBILITIES INHERENT IN A STEP-BY-STEP, MANUAL SOLUTION TO OVERCOME SOME OF THE SHORTCOMINGS OF COMPUTER PROGRAMMED SOLUTIONS. THE THIRD IS TO OFFER THE READER AN OPPORTUNITY TO UNDERSTAND THE DETAILS OF THE METHOD AND THE ASSUMPTIONS UPON WHICH IT IS BASED, BY DISCUSSING THEM AND PRESENTING A COMPLETE SOLUTION TO AN ILLUSTRATIVE PROBLEM. THE SOLUTIONS OF A COMPLEX PROBLEM BY COMPUTER METHODS, ELIMINATING TEDIOUS CALCULATIONS AND POSSIBLE ERRORS, IS A VALUABLE STEP FORWARD. THIS REPORT IS NOT INTENDED TO OPPOSE SUCH METHODS, BUT, RATHER, TO OFFER A STEPPING STONE BETWEEN CONVENTIONAL PROCEDURES AND THESE MORE SOPHISTICATED PRACTICES. THE NEED FOR SUCH A STEPPING STONE IS JUSTIFIED ON TWO BASES. FIRST, MANY POTENTIAL USERS FIND IT INCONVENIENT TO USE ELECTRONIC COMPUTERS OR ARE NOT YET "COMPUTER CONSCIOUS." SECOND, THE COMPUTER APPROACHES ARE NOT COMPLETELY SATISFACTORY IN ALL RESPECTS. IT IS ANTICIPATED THAT A BROADER ACQUAINTANCE WITH, AND USE OF, THE CRITICAL PATH METHOD, MADE POSSIBLE BY NON-COMPUTER METHODS, WILL LEAD EVENTUALLY TO AN EVEN WIDER EMPLOYMENT OF COMPUTER TECHNIQUES AS WELL AS THE DEVELOPMENT OF IMPROVEMENTS IN THEM. /AUTHOR/

Fondahl, JW
Stanford University 1962

1A 215293
CONSTRUCTION EXPEDITING
EXPEDITING CONSTRUCTION PROJECTS IS MORE THAN PREPARING BAR CHARTS OR NETWORKS. IT REQUIRES PERSONNEL THAT POSSESS CERTAIN INTELLIGENCE, SPECIAL EXPERIENCE, AND UNIQUE PERSONALITY TRAITS. IN ADDITION, WHO DOES THE PLANNING? WHAT ARE THE TROUBLE SPOTS OF IMPLEMENTING A PLAN? WHAT MAKES A GOOD EXPEDITER? THESE ARE EXAMINED. THE EXPEDITING PRO-

CEDURE IS PERHAPS THE MOST IMPORTANT SINGLE PHASE OF THE CONSTRUCTION PROGRAM. CONSTRUCTORS WERE SURVEYED FOR THEIR VIEWS OF EXISTING PRACTICES. THE RESULTS SUGGESTED TWO AREAS OF FURTHER STUDY IN ADDITION TO POINTING OUT SOME EXISTING PROBLEMS. /AUTHOR/

Monsey, A *Am Soc Civil Engr J Construction Div* June 1970

1A 215317
INSTRUCTIONS FOR THE EXECUTION OF CONCRETE PAVEMENTS BY MECHANICAL METHODS
THE PRESENT INSTRUCTIONS ARE EXAMINED BY STUDYING THE "TECHNICAL CONTROL" BY MEANS OF STATISTICAL ANALYSIS AND THE "RECEIVING CONDITIONS" WITH APPLICATION OF REDUCTION OF THE PRICES IN THE STRETCHES WHERE THE CONTRACTS CONDITIONS WERE NOT MET. THE WORK INCLUDES THE USUAL ITEMS OF INSTRUCTIONS FOR PAVING. /RRI/

Vicira, JC Belotti, G Lerner, JG Pinto, HM
Road Research Institute /Brazil/

ACKNOWLEDGMENT: Road Research Institute /Brazil/

1A 215322
BUILDING CONSTRUCTION GAMES-GENERAL DESCRIPTION
THE USE IS PROPOSED OF COMPUTERIZED HEURISTIC GAMES PORTRAYING SOCIAL, ECONOMIC, AND TECHNOLOGICAL DECISIONS FOR THE EDUCATION OF ENGINEERS AND PLANNERS WHO ARE ENGAGED IN WORKS DIRECTLY OR INDIRECTLY RELATED TO THE CONSTRUCTION INDUSTRY. IT ANALYZES THE VALIDITY OF SUCH GAMES BY EXAMINING THE CHARACTERISTICS OF THE CONSTRUCTION INDUSTRY WHICH CAN SUITABLY BE USED AS THE ENVIRONMENT FOR GAMING. INCLUDED IS AN EXPLANATION OF THE SELECTION OF BUILDING CONSTRUCTION PLANNING AND MANAGEMENT AS GAME MODELS. THE BASIC FEATURES IN BOTH CONSTRUCTION PLANNING GAMES AND CONSTRUCTION MANAGEMENT GAMES ARE DESCRIBED. /ASCE

Au, T Parti, EW *Am Soc Civil Engr J Construction Div* July 1969

1A 215323
PROJECT PLANNING GAME FOR FOUNDATION EXCAVATION
A COMPUTERIZED GAME USED TO SIMULATE THE COMPETITION AMONG SEVERAL SUBCONTRACTORS BIDDING AND PLANNING FOR THE FOUNDATION OF A BUILDING CONSTRUCTION PROJECT SUBJECTED TO THE IMPOSED CONSTRAINTS OF THE ENVIRONMENT IS DESCRIBED. THE ENTIRE PROCESS INCLUDES THREE PERIODS REPRESENTING THREE DIFFERENT TYPES OF DECISIONS, NAMELY: (1) CONTRACT BARGAINING; (2) PRELIMINARY ENGINEERING INVESTIGATIONS; AND (3) PLANNING AND SCHEDULING. THE GAME WILL BE PLAYED ACCORDING TO COMPUTERIZED PROCEDURE COMPOSED OF A COLLECTION OF SUBROUTINES WHICH HAS A PRESCRIBED SEQUENCE OF ACCESS. THE PERFORMANCE OF THE PLAYERS IS EVALUATED ON THE BASIS OF A SCORING SYSTEM REFLECTING THE CONSEQUENCE OF THE DECISIONS MADE BY THE PLAYERS. /ASCE/

Au, T Parti, EW *Am Soc Civil Engr J Construction Div* July 1969

1A 215324
CONSTRUCTION MANAGEMENT GAME-DETERMINISTIC MODEL
A CONSTRUCTION MANAGEMENT GAME IN WHICH THE MARKET DEMANDS ARE PREDETERMINED IS PRESENTED. THE GAME IS PROGRAMMED FOR COMPUTERS TO SIMULATE THE COMPETITION FOR THE MARKET BY FIVE GENERAL CONTRACTORS WHO ARE REQUIRED TO MAKE MANAGERIAL DECISIONS AT 12 SUCCESSIVE TIME PERIODS FOR A TOTAL SIMULATED OF 3 YEARS. THE DECISIONS INCLUDE THE EVALUATION OF AVAILABLE INFORMATION, CHOICE OF JOBS TO BID, SELECTION OF SUBCONTRACTORS, THE DETERMINA-

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TION OF PROFIT LEVEL, AND THE EXPANSION AND CONTRACTION OF CAPITAL. AT THE BEGINNING OF EACH PERIOD, JOB AVAILABLE FOR BIDDING WILL BE GENERATED BY THE COMPUTER, AND AT THE END OF TIME PERIOD, EACH COMPANY WILL SUBMIT ITS DECISIONS AS INPUT TO THE COMPUTER. AFTER THE DECISIONS ARE PROCESSED ACCORDING TO THE PROGRAMMED GAME MODEL, THE COMPUTER WILL OUTPUT THE CONTRACT AWARDS, THE COST OF PERFORMING WORK, AND A STATEMENT OF EARNINGS FOR EACH GENERAL CONTRACTOR. THE COMPANY WHICH SHOWS THE LARGEST RELATIVE GAIN AT THE END OF 3 YRS WILL BE THE WINNER. /ASCE/

Au, T Bostleman, RL Parti, EW *Am Soc Civil Engr J Construction Div*
July 1969

1A 215330

COMPUTER SPEEDS MONITORING OF FILL AND BASE CONSTRUCTION

EARTHWORK AND BASE CONSTRUCTION IS MONITORED IN MINNESOTA BY THE COMPUTER. THE NEW COMPUTER PROGRAM BY ITS SPEED, IS HELPING TOWARD COMPLIANCE WITH MOISTURE, DENSITY, AND GRADATION SPECIFICATIONS AND TESTING RATES. FIELD DATA ARE COLLECTED ON EMBOSSED PLASTIC CARDS WITH BASIC PREPUNCHED DATA AND OPTICAL MARKER IN INPUT FORM. THE INPUT FORMS ARE MARKED IN THE FIELD AND SUBMITTED TO THE CENTRAL OFFICE ONCE A WEEK. THEY SHOW ALL FIELD TEST DATA AND APPLICABLE SPECIFICATIONS. THEY ARE SCANNED BY AN OPTICAL MARKED PAGE READER WHICH READS INPUT FORM AND PUNCHES A CODED CARD FOR EACH TEST. THE PUNCHED CARDS ARE THEN INSERTED INTO THE COMPUTER WHICH SORTS THE DATA, COMPARES THE TEST RESULTS TO THE SPECIFICATIONS AND PRINTS A REPORT. DATA ARE THEN STORED ON A MASTER TAPE FOR FUTURE REFERENCE. DURING THE 1966 CONSTRUCTION SEASON, THE PROGRAM WAS TRIED ON AN EXPERIMENTAL BASIS ON SEVERAL SELECTED PROJECTS TO DETERMINE THE FEASIBILITY OF USING THE SYSTEM STATE-WIDE. BY THE END OF 1966 THE SYSTEM WAS READY TO GO STATE-WIDE BUT IT WAS INITIATED GRADUALLY BECAUSE OF THE PROBLEM INVOLVED IN TRAINING PERSONNEL. ABOUT THREE FOURTHS OF ALL THE STATE CONSTRUCTION PROJECTS ARE NOW INCLUDED IN THE PROGRAM. THE PROGRAM HAS RESULTED IN A LARGE SAVINGS IN MAN HOURS IN THE MATERIALS OFFICE. IT HAS BEEN DETERMINED THAT: (1) THE PROGRAM IS FEASIBLE, (2) THE IMPLEMENTATION OF THE PROGRAM SUBSTANTIALLY REDUCED THE COST OF MONITORING FIELD CONSTRUCTION, PREPARING MATERIALS CERTIFICATES AND HAS RELEASED ENGINEERING PERSONNEL FOR MORE MEANINGFUL WORK, (3) THE PROGRAM MADE IT POSSIBLE TO CERTIFY EMBANKMENT AND BASE ITEMS ALMOST IMMEDIATELY UPON THE COMPLETION OF THE WORK, AND (4) THE BASIC PROGRAM CAN BE ADAPTED TO OTHER AREAS SUCH AS BITUMINOUS CONSTRUCTION, CONCRETE CONSTRUCTION AND LABORATORY TESTING TO PROVIDE DATA FOR THE DEVELOPMENT OF STATISTICAL SPECIFICATIONS AND TO DETERMINE THEIR FEASIBILITY

Roads and Streets Apr. 1969

1A 215346

THE COMPUTER AS A CONSTRUCTION TOOL.

THE REAL POTENTIAL OF THE COMPUTER IN CONSTRUCTION LIES IN ITS ABILITY TO COMMUNICATE: TO RECORD, RECALL, CALCULATE AND SELECTIVELY DISSEMINATE INFORMATION. AS THE FIRST STEP IN EFFECTIVELY COMMUNICATING WITHIN THE LIMITATIONS OF AVAILABLE DATA PROCESSING EQUIPMENT, IT IS NECESSARY TO ESTABLISH A COMPREHENSIVE DATA BASE IN WHICH ALL COMPONENTS OF CONSTRUCTION ARE DEFINED AND BROKEN DOWN INTO THEIR FUNDAMENTAL WORK-ITEMS UNITS. THE PROBLEMS OF DETAILED QUANTITY SURVEYING WERE ACKNOWLEDGED AT THE BEGINNING OF THE PROJECT AND A TECHNIQUE DEVELOP-

ED WHICH WOULD MAKE IT PRACTICAL TO TAKE OFF PROJECT REQUIREMENTS AT ANY STAGE OF THE DESIGN/ CONSTRUCTION CYCLE. ONCE DESIGN DECISIONS ARE RECORDED AND STORED WITHIN THE MEMORY OF THE COMPUTER, ALMOST ANY DESIRED TYPES OF OUTPUTS ARE AVAILABLE. CONCLUSIONS OF THE STUDY INDICATE THAT THE DEVELOPMENT OF A CONSTRUCTION MANAGEMENT INFORMATION SYSTEM IS NOT ONLY FEASIBLE, BUT ALSO POTENTIALLY VERY SIGNIFICANT TO THE TOTAL CONSTRUCTION PROCESS. THE IMPROVEMENT IN COMMUNICATIONS AND THE INCREASED CONTROL DURING DESIGN AND CONSTRUCTION, WHICH THIS SYSTEM MAKES POSSIBLE WILL ASSIST THE CONSTRUCTION ENGINEER TO TURN OUT BETTER PROJECTS AT LESS COST.

Early, WC *Military Engineer* Sept. 1970

1A 215348

CONSTRUCTION CONTROL OF RIGID PAVEMENT ROUGHNESS

RESULTS OF A 2-YEAR STUDY OF CAUSE-EFFECT RELATIONSHIPS INVOLVED IN ROUGHNESS OF CONCRETE PAVEMENTS ARE REPORTED. DATA WERE DERIVED BOTH FROM ANALOG OBTAINED IN EACH WHEELPATH WITHIN HOURS AFTER CONCRETE PLACEMENT ON RANDOMLY SELECTED PAVEMENTS, AND FROM QUALITATIVE OBSERVATIONS OF PAVING METHODS. SAMPLED CONSTRUCTION CONSISTED OF 184 SECTIONS OF 1-AND 2-LANE PAVEMENT BUILT UNDER 62 DIFFERENT CONTRACTS WITH 8 DIFFERENT FORM-TYPE FINISHING MACHINES AND 3 DIFFERENT SLIPFORM PAVERS. STATISTICAL ANALYSIS WAS HELD TO A MINIMUM BY UNCONTROLLED INTERACTIONS, BUT 5 FACTORS WERE FOUND TO BE COMMON AND OUTSTANDINGLY SIGNIFICANT IN RELATION TO ROUGHNESS THROUGHOUT THE CONTRACTS STUDIED: (A) BACKING UP OF THE LAST FINISHING MACHINE, (B) ABSENCE OF A FLOAT, (C) USE OF LESS THAN 3 SCREEDS, (D) USE OF A CROWN SECTION AS COMPARED TO A UNIFORMLY SLOPING SECTION, AND (E) LANE-AT-A-TIME PAVING. NINE OTHER CONSTRUCTION PHENOMENA PRODUCING ROUGHNESS, COMMON TO MANY PROJECTS BUT FOUND LESS FREQUENTLY THAN THESE FIVE, ARE ALSO COVERED IN SOME DETAIL. /AUTHOR/

Haviland, JE Rider, RW *Highway Research Record, Hwy Res Board*
1970

ACKNOWLEDGMENT:

1A 215357

RAPID TEST METHODS FOR FIELD CONTROL OF HIGHWAY CONSTRUCTION

RESEARCH WAS CONDUCTED TO DETERMINE THE STATE OF THE ART IN THE DEVELOPMENT, NEED, AND USE OF RAPID TEST METHODS. THE FIRST PHASE COMPRISES A LITERATURE SURVEY OF CURRENT PRACTICES IN QUALITY CONTROL AND ACCEPTANCE TESTING, ALONG WITH A STUDY USING STATISTICAL METHODS TO ASSESS THE TIME LIMITS FOR RAPID TESTS. THE SECOND PHASE IS CONCERNED WITH THE DEVELOPMENT AND EVALUATION OF NEW RAPID TEST METHODS OR PRINCIPLES TO SELECT THOSE WORTHY OF FURTHER INVESTIGATION. THIRTY-EIGHT STATE HIGHWAY DEPARTMENTS PARTICIPATED IN THE STUDY, AND INTERVIEWS WERE CONDUCTED WHEN APPROPRIATE. THE SECOND PHASE OF THE STUDY APPLIED TO RAPID TEST METHODS FOR ASPHALT CONTENT DETERMINATION, COMPACTION CONTROL, GRADATION OF SEVERAL TYPES OF AGGREGATE, DENSITY OF BASE COURSE MATERIALS AND SOILS, AND MOISTURE CONTENT. THE RESULTS OF ALL TESTS ARE APPENDED. IN ADDITION TO 226 TEXTUAL REFERENCES, THE REPORT CONTAINS AN ANNOTATED BIBLIOGRAPHY OF 105 REPORTS AND ARTICLES ON RAPID TEST METHODS. /AUTHOR/

Author: JD Brown, FR Busching, HW Chisman, JA Moore, JH ...
Schwartz, AE *Highway Research Board Nchrp Reports*

SYSTEM CONSTRUCTION, MANAGEMENT & QUALITY CONTROL 1A

1A 215365

RESEARCH NEEDS IN CONCRETE PAVEMENT CONSTRUCTION

A SUMMARY IS PRESENTED OF THE WORK OF HRB'S RIGID PAVEMENT COMMITTEE OVER THE PERIOD 1965--1969 IN ASSESSING RESEARCH NEEDS FOR CONCRETE PAVEMENT CONSTRUCTION. EXISTING RESEARCH NEEDS ARE RANKED, AND RESEARCH RESULTING FROM PREVIOUS ASSESSMENTS IS DESCRIBED. REQUIREMENTS WERE RANKED IN THE FOLLOWING ORDER OF IMPORTANCE: CONCRETE FINISHING, JOINT DESIGN TO SIMPLIFY CONSTRUCTION, SKID RESISTANCE, DEVICES FOR DETERMINING THE PROPERTIES OF PLASTIC CONCRETE, CURING AND METHODS OF CONTROL, CONCRETE PROPERTIES AND ENVIRONMENTAL CONTROLS TO FACILITATE EXTENSION OF THE PAVING SEASON AND OVERCOME THE ADVERSE EFFECTS OF WEATHER, AND PAVEMENT CRACKING.

Highway Res Circular, Hwy Res Board Aug. 1970

1A 215371

STATISTICAL QUALITY CONTROL OF HIGHWAY CONSTRUCTION AND MATERIALS

EXISTING LOCAL PRACTICES USED IN ESTABLISHING AND ENFORCING HIGHWAY SPECIFICATIONS AND CONSTRUCTION PROCESSES ARE REVIEWED AND COMPARED WITH PROCEDURES BASED ON STATISTICAL QUALITY CONTROL CONCEPTS. IN ORDER THAT STATISTICAL QUALITY CONTROL CONCEPTS MAY BE PROPERLY USED WHERE APPLICABLE, THE FIRST PART OF THIS REPORT CONSIDERS THE GENERAL THEORY UNDERLYING THE USE OF STATISTICAL CONTROL METHODS AND THE DEVELOPMENT OF DIFFERENT TYPES OF ACCEPTANCE PLANS WHICH MAY BE USED IN THE HIGHWAY CONSTRUCTION INDUSTRY. THE SECOND PORTION OF THE REPORT IS CONCERNED WITH ANALYZING AND COMPARING KENTUCKY'S CURRENT SPECIFICATION REQUIREMENTS WITH TYPICAL QUALITY CONTROL REQUIREMENTS ESTABLISHED USING BASIC STATISTICAL THEORY. SPECIFICATIONS USED BY SOME OTHER AGENCIES WHICH ARE BASED ON STATISTICAL PRINCIPLES ARE PRESENTED TO ILLUSTRATE THE USE BEING MADE OF THIS TYPE OF ACCEPTANCE PLAN. /AUTHOR/

Venable, JB

Kentucky Department Highways Dec. 1970

1A 215373

HIGH RISE "SYSTEMS BUILDING" IN THE HUDSON VALLEY

THE USE OF "SYSTEMS BUILDING" TECHNIQUES IS DISCUSSED FOR AN URBAN RENEWAL PROJECT IN POUGHKEEPSIE, N. Y. THE PROJECT CONSISTS OF A CENTRAL 18-STORY BUILDING SURROUNDED BY SMALLER BUILDINGS PROVIDING ABOUT 1000 DWELLING UNITS. ALSO CONSTRUCTION IS DESCRIBED OF THE CENTRAL BUILDING WHICH COMBINES CAST-IN-PLACE ELEVATOR AND STAIRWELL CORES AND SHEAR WALLS WITH PRECAST CONCRETE ELEMENTS, SOME OF WHICH WERE CAST ON-SITE. PRECASTING OPERATIONS ARE DESCRIBED AND ERECTION PROCEDURES DISCUSSED. IN THE LATTER, CAST-IN-PLACE WORK AND PRECAST FLOOR ERECTION PROCEEDED TOGETHER FLOOR BY FLOOR FOLLOWED SHORTLY BY ERECTION OF PRECAST EXTERIOR PANELS. SHEAR WALLS AND FLOOR PANELS WERE ERECTED AT A RATE OF ONE FLOOR PER WEEK. /ACIIP/

Corbetta, RH Wilson, RE *Am Concrete Inst Journal & Proceedings* Jan. 1971

1A 215399

CONSTRUCTION PRACTICES

DURING THE 1920'S THE DEFENSE DEPARTMENT PIONEERED THE GENERAL DEVELOPMENT AND APPLICATION OF STATISTICAL-BASED PROCESS CONTROL AND ACCEPTANCE CONCEPTS TO INDUSTRIAL PRODUCTS. THE FIRST USE OF THE METHODOLOGY BY HIGHWAY ENGINEERS WAS A RECORD SAMPLING PROGRAM. A LONG SLOW PERIOD OF ADOPTION

FOLLOWED. ONLY IN RECENT YEARS HAS REALISTIC PROGRESS BEEN MADE IN THE USE OF STATISTICAL METHODS. NOW, A TOTAL OF 36 STATES HAVE ACTIVELY BEEN ENGAGED IN SOME FORM OF STUDY OR APPLICATION OF STATISTICALLY ORIENTED SPECIFICATION, FOR CONTROL AND ACCEPTANCE OF CONSTRUCTION, AND MORE THAN 1/3 OF THESE STATES ARE USING A STATISTICALLY DESIGNED SPECIFICATION, AS THEIR STANDARD OR PROVISIONAL SPECIFICATION. A NUMBER OF PLANS HAVE PROVED SOUND; YET THE GENERAL CONSENSUS SEEMS TO BE THAT THE APPLICATION OF STATISTICAL CONCEPTS TO HIGHWAY USE IS NOT FEASIBLE AT THIS TIME.

Deyoung, CE *Highway Research Board Special Reports* 1971

1A 215418

CONSTRUCTION METHODS IMPROVEMENT BY TIME-LAPSE MOVIE ANALYSIS

CONSTANT AND SYSTEMATIC IMPROVEMENT IN CONSTRUCTION METHODS IS AN AREA FOR POSSIBLE COST REDUCTION THAT CONSTRUCTION CONTRACTORS CANNOT AFFORD TO OVERLOOK. THE DETAILS OF DAILY OPERATIONS, INCLUDING SELECTION OF METHODS, TOOLS, AND SIZING OF CREWS, ARE OFTEN DELEGATED TO THE CRAFT FOREMAN. IT IS PROPOSED THAT CONSTRUCTION MANAGEMENT SHOULD ASSUME MORE RESPONSIBILITY FOR THE DEVELOPMENT AND USE OF IMPROVED PROCEDURES. THE USE OF TIME-LAPSE MOVIES FOR ANALYSIS OF OPERATIONS IS SUGGESTED AS AN ADDITIONAL TECHNIQUE BESIDES THE USES OF STOP-WATCH TIME STUDIES AND COST ACCOUNTING DATA. THE ADVANTAGES OF THIS TECHNIQUE ARE DISCUSSED. AN ACTUAL EXAMPLE INVOLVING ERECTION OF TUBULAR METAL FALSEWORK FOR AN ELEVATED FREEWAY STRUCTURE IS USED TO ILLUSTRATE A MOVIE ANALYSIS STUDY. BOTH EQUIPMENT AND PROCEDURES ARE DESCRIBED. /AUTHOR/

Fondahl, JW *Highway Research Board Proceedings* 1962

1A 215449

CONSTRUCTION OF EMBANKMENTS

THE STATE OF THE ART, AS EMBODIED IN THE AVAILABLE LITERATURE AND IN ADVANCED PRACTICE, IS REVIEWED. THE REPORT OPENS WITH A BRIEF CHARACTERIZATION OF EMBANKMENT FAILURES AND LOADS. THE NEXT FIVE CHAPTERS DEAL WITH SPECIFIC DESIGN AND CONSTRUCTION QUESTIONS: (1) SUBSURFACE INVESTIGATIONS (ROUTE LOCATION, SOIL SURVEYS, EMBANKMENT SOILS); (2) FOUNDATION PREPARATION (MINIMAL PREPARATION, SOFT FOUNDATIONS, SIDEHILL FILLS, CUT--FILL TRANSITIONS, DRAINAGE PROVISIONS); (3) FILL DESIGN (DESIGN CONSIDERATIONS, PREPARATION OF PLANS AND SPECIFICATIONS); (4) PROCEDURES AND REQUIREMENTS FOR PLACEMENT OF FILL (ROLLED EARTH, ROCK, AND HYDRAULIC FILLS); AND (5) QUALITY CONTROL PROCEDURES. THE MISCELLANEOUS TOPICS ADDRESSED ARE SPECIAL MATERIALS, BURIED STRUCTURES AND BRIDGE APPROACHES, ECOLOGICAL CONSIDERATIONS, INTRAAGENCY COMMUNICATIONS, AND FIELD INSTRUMENTATION. CURRENT RESEARCH IN EMBANKMENT CONSTRUCTION AROUND THE WORLD IS SUMMARIZED IN A TABLE, AND AREAS WHERE FURTHER RESEARCH IS REQUIRED ARE DESCRIBED.

Hrb Nchrp Synthesis of Hwy Practice 1971

1A 215456

DEVELOPMENT AND TRIAL USE OF ACCEPTANCE SAMPLING PLANS FOR COMPACTED EMBANKMENTS

THE PURPOSE WAS TO DEVELOP AND PUT IN TRIAL USE STATISTICALLY BASED ACCEPTANCE SAMPLING PLANS FOR COMPACTED EMBANKMENTS BASED ON THE EXISTING VARIABILITY IN ACCEPTABLE CONSTRUCTION. THE FIRST PHASE OF THIS RESEARCH INDICATED THAT THE TRIAL SPECIFICATIONS SHOULD HAVE THE FOLLOWING CHARACTERISTICS: (1) DECISIONS SHOULD BE BASED ON THE AVERAGE OF A NUM-

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BER OF IN-PLACE DENSITY TESTS; (2) SAMPLE LOCATIONS SHOULD BE DETERMINED BY RANDOM NUMBERS; (3) SPECIFICATIONS SHOULD PROVIDE AN INCENTIVE FOR THE CONTRACTOR TO PRODUCE UNIFORM COMPACTION; AND (4) SPECIFICATIONS SHOULD CALL FOR THE SAME AVERAGE DEGREE OF COMPACTION AS IS ACCEPTED UNDER THE CURRENT SPECIFICATIONS. SPECIFICATIONS INCORPORATING THESE CHARACTERISTICS WERE DEVELOPED AND USED ALONG WITH CURRENT HIGHWAY DEPARTMENT SPECIFICATIONS ON 3 CONSTRUCTION PROJECTS. THE LOT ACCEPTANCE PLAN USED A SAMPLE SIZE OF 3 TO 5 TESTS. A NUCLEAR MOISTURE-DENSITY INSTRUMENT WAS USED AND RESULTED IN A TESTING AND CALCULATION TIME OF FROM 40 TO 90 MIN PER LOT. A COMPARISON OF THE CURRENT SPECIFICATIONS THAT ARE BASED ON REPRESENTATIVE SAMPLING WITH A SPECIFIED MINIMUM DENSITY INDICATED THAT (1) THE AVERAGE LOT TEST RESULTS FOR THE REPRESENTATIVE SAMPLING DEVIATED FROM THE RANDOM TEST RESULTS DEPENDING ON THE JUDGEMENT OF THE INSPECTOR, (2) OF THE 60 LOTS ACCEPTED UNDER THE CURRENT SPECIFICATIONS, 2 LOTS WOULD HAVE BEEN REJECTED UNDER THE TRIAL SPECIFICATIONS, AND (3) 9 OF THE 67 LOTS ACCEPTED BY THREE TRIAL SPECIFICATIONS HAD ONE OR MORE TESTS BELOW THE CURRENT SPECIFICATION LIMITS, INDICATING THAT THEY COULD HAVE BEEN REJECTED BY THE CURRENT SPECIFICATIONS. /AUTHOR/

Jorgenson, JL *Highway Research Record, Hwy Res Board* 1971

1A 215457

DEVELOPMENT AND TRIAL USE OF ACCEPTANCE SAMPLING PLANS FOR ASPHALT CONSTRUCTION

THE RESEARCH ON VARIABILITY IN ASPHALT CONSTRUCTION IN NORTH DAKOTA BROUGHT TO LIGHT MANY CHARACTERISTICS OF CURRENT ACCEPTABLE ASPHALT CONSTRUCTION. THEY ARE (1) SINGLE TEST RESULTS EXHIBITED A LARGE VARIABILITY CAUSING MANY OF THE MEASUREMENTS TO BE OUTSIDE THE SPECIFICATIONS; (AVERAGE TEST RESULTS ARE RECOMMENDED); (2) THE CURRENT GRADATION BAND WAS ONLY PARTIALLY EFFECTIVE IN CONTROLLING AGGREGATE GRADATION; (TARGET VALUES SHOULD BE CHOSEN EITHER AT THE CENTER OF THE BAND OR IN 2 OR 3 STANDARD DEVIATIONS FROM THE CURRENT SPECIFICATION LIMITS; AND (3) PAYMENTS TO THE CONTRACTOR WERE INDEPENDENT OF THE QUALITY OF HIS WORK; (SPECIFICATIONS SHOULD REQUIRE THE CONTRACTOR TO BEAR A GREATER RESPONSIBILITY FOR THE QUALITY OF HIS WORK, SUBSTANDARD WORK WOULD NOT BE PERMITTED OR THE PRICE COULD BE ADJUSTED).

Jorgenson, JL *Highway Research Record, Hwy Res Board* 1971

1A 215478

CHANGED SOIL AND ROCK CONDITIONS IN CONSTRUCTION

THE OBJECT OF THE CHANGED CONDITIONS CLAUSE IN CONSTRUCTION CONTRACTS IS TO MINIMIZE THE GAMBLE IN BIDDING ON SOIL AND ROCK WORK BY PAYING THE CONTRACTOR FOR UNEXPECTED SOIL AND ROCK CONDITIONS. FOUR CATEGORIES OF CLAIMS APPEAR: (1) REAL DIFFERENCES, WHICH COULD NOT HAVE BEEN ANTICIPATED; (2) FORESEEABLE CHANGES CAUSED BY THE SPECIFIED CONSTRUCTION; (3) PSEUDO OR PREVENTABLE CHANGES CAUSED BY FAULTY CONSTRUCTION METHODS AND; (4) MISTAKEN CHANGES, WHICH ARE COSTS BLAMED ON THE SOIL BUT WHICH ARE THE RESULT OF OTHER JOB CONDITIONS. ONLY THE FIRST CATEGORY DESERVES COMPENSATION. THE DIAGNOSIS OF CHANGED CONDITIONS REQUIRE IMMEDIATE EXPERT EVALUATION TO DETERMINE THE TRUE CONDITIONS AS WELL AS TO PREVENT THE CHANGE FROM GENERATING A CATASTROPHE. QUICK ACTION NOT ONLY PROVIDES THE BASIS FOR A VALID CLAIM BUT ALSO MINIMIZES THE ULTIMATE COST TO BOTH THE CONTRACTOR AND THE OWNER. /ASCE/

Sowers, GF *Am Soc Civil Engr J Construction Div* Nov. 1971

1A 215484

SOME EQUIPMENT MANAGEMENT PROBLEMS ON HIGHWAY CONSTRUCTION JOBS

WITH THE DEVELOPMENT OF IMPROVED EQUIPMENT FOR HIGHWAY CONSTRUCTION, NEW PROBLEMS IN EQUIPMENT MANAGEMENT HAVE DEVELOPED. THE LARGEST SINGLE SOURCE OF DELAY (OTHER THAN WEATHER) COMMON TO ALL CLASSES OF EQUIPMENT INVOLVES THE REPAIR AND MAINTENANCE OF THE EQUIPMENT ITSELF. APPROXIMATELY 30 PERCENT OF ALL DELAYS (AVERAGE FOR ALL JOBS EXCLUDING WEATHER) IS ATTRIBUTABLE TO THIS CAUSE. ALTHOUGH COSTLY, ACQUISITION OF NEW EQUIPMENT IS EXCELLENT INSURANCE OF DEPENDABLE MECHANICAL PERFORMANCE AND ORDINARILY WILL AVOID MUCH OF THE "DOWN" TIME COMMON TO OLDER EQUIPMENT. HOWEVER, NEW EQUIPMENT WILL NOT INSURE TOP JOB PERFORMANCE, SINCE MANY CONTRACTORS WITH OLDER EQUIPMENT CAN OUTPERFORM OTHERS HAVING NEWER AND BETTER EQUIPMENT SIMPLY BY FOLLOWING BETTER JOB MANAGEMENT PRACTICES. THE PROBLEM OF KEEPING EQUIPMENT IN SATISFACTORY REPAIR IS A CRITICAL ONE DUE TO A SHORTAGE OF CAPABLE AND CONSCIENTIOUS OPERATORS AND DEPENDABLE MECHANICS FOR SERVICING AND REPAIRING OF EQUIPMENT. OTHER DELAYS WHICH AFFECT VARIOUS JOBS TEND TO FALL IN CERTAIN WELL DEFINED CATEGORIES, DEPENDING UPON THE PARTICULAR CLASS OF WORK. SUPPLY OF MATERIAL TO ASPHALT PLANTS, HAULING UNIT PROBLEMS ON PAVING AND POWER SHOVEL JOBS, AND PUSHER PROBLEMS ON SCRAPER GRADING WARRANT SPECIAL ATTENTION.

Farrell, FB *Highway Res Abstracts Hwy Res Board* Nov. 1953

1A 215488

EARTHWORK COMPACTION SPECIFICATIONS AND CONSTRUCTION CONTROL PROCEDURES

IN 1935 THE OHIO HIGHWAY DEPARTMENT ADOPTED AN EARTHWORK SPECIFICATION WHICH REQUIRED MOISTURE AND DENSITY CONTROL OF THE COMPACTION OF EMBANKMENTS AND SUBGRADES. DURING THE 20 YEARS OF OPERATION UNDER THIS SPECIFICATION, THE DEPARTMENT HAS HAD EXCELLENT SUCCESS IN APPLYING MOISTURE AND DENSITY CONTROL, RESULTING IN EMBANKMENTS AND SUBGRADES OF IMPROVED STABILITY. THE IMPROVED EARTHWORK CONSTRUCTION HAS PRODUCED STABLE EMBANKMENTS IN WHICH SLIDES, SETTLEMENTS, AND LOCAL FAILURES SELDOM OCCUR. SUBGRADES ARE NOW CONSTRUCTED WITH SUFFICIENT STABILITY TO ADEQUATELY SUPPORT TODAY'S HEAVY TRAFFIC. WITHOUT MOISTURE-DENSITY CONTROL FOR SUBGRADES, IT WOULD NOT BE POSSIBLE TO BUILD THE STABLE ROADS NOW NEEDED. /AUTHOR/

Craig, HR *Highway Res Abstracts Hwy Res Board* July 1956

1A 215507

SYSTEM FOR CONTROL OF CONSTRUCTION QUALITY

A METHODOLOGY IS PROPOSED FOR DEFINING AND OPTIMIZING THE QUALITY CONTROL TASKS REQUIRED ON REGULATED HEAVY CONSTRUCTION PROJECTS. THE SYSTEM RECEIVES INPUT IN THE FORM OF OBJECTIVES OF THE OWNER, DESIGNER AND CONSTRUCTOR, TOGETHER WITH SOCIAL PRESSURES IN THE FORM OF BUILDING CODES AND CONSTRUCTION PERMIT STIPULATIONS. A QUALITY CONTROL MATRIX IS PRESENTED AS A DEVICE FOR DIGESTING AND PRESENTING THESE REQUIREMENTS. A LINEAR RESPONSIBILITY CHART IS OFFERED AS A CONVENIENT TECHNIQUE FOR DESCRIBING THE DELEGATION OF RESPONSIBILITY AND AUTHORITY. MANAGEMENT TOOLS IN THE FORM OF A QUALITY CONTROL MANUAL, PROCEDURES, INSPECTION MANUALS, AND SUBSYSTEM FLOW DIAGRAMS ARE SUGGESTED FOR USE IN CARRYING OUT THE DAY-TO-DAY BUSINESS OF ADMINISTERING THE QUALITY CONTROL EFFORT. /AUTHOR/

SYSTEM CONSTRUCTION, MANAGEMENT & QUALITY CONTROL 1A

Parsons, RM *Am Soc Civil Engr J Construction Div* Vol. 98 No. co1, Mar. 1972, pp 21-36

1A 215515

END-RESULT SPECS GET CAUTIOUS OK ON EXPERIMENTAL ASPHALT JOB

ACCEPTANCE OF ASPHALT PAVEMENT HAS BEEN STRICTLY ON THE BASIS OF END RESULTS ON A RECENT OVERLAY PROJECT IN ILLINOIS. THE EXPERIMENTAL SPECIFICATIONS AND JOB CONTROL PROCEDURES HAVE GIVEN THE CONTRACTORS VIRTUALLY A FREE HAND IN ESTABLISHING JOB MIXES, SCHEDULING HOTMIX PRODUCTION, AND IN DECIDING ON EQUIPMENT AND CONSTRUCTION METHODS. STATE INSPECTORS HAVE SAMPLED AND TESTED ONLY THE MATERIAL IN PLACE ON THE ROADWAY, OFFICIALLY IGNORING PRODUCTION PROCEDURES. ACCEPTANCE WAS BASED ON ASPHALT CONTENT AND AGGREGATE GRADATION IN THE MIX ON THE ROADWAY, DENSITY, PAVEMENT THICKNESS AND SURFACE SMOOTHNESS. IN ADDITION TO UPPER AND LOWER LIMITS, UNIFORMITY WAS A BIG FACTOR IN ACCEPTANCE. THE END-RESULT TESTING DID PERMIT SOME INCREASE IN PRODUCTION.

Roads and Streets Vol. 113 No. 12, Dec. 1970, pp 61-2, 3 Tab, 1 Phot

1A 215529

WHIRLING IN EVOLUTION AND IN FERMENT

CONSTRUCTION MANAGEMENT (CM) IS DESCRIBED PRIMARILY AS THE DELIVERY OF A SOPHISTICATED, ORGANIZED BUILDING TEAM OF A QUALITY PROJECT IN MINIMUM TIME AND WITHIN BUDGET. ALTHOUGH STILL UNDER DEBATE AS TO WHAT SERVICES CONSTITUTE CM-AND ALSO WHO IS BEST QUALIFIED TO BE A CONSTRUCTION MANAGER, THE MAJOR SERVICES ARE PLANNING AND PROGRAMMING; CONSULTATION ON DESIGN ESTIMATION REVIEW, INSPECTION, AND APPROVAL; PROCUREMENT, LABOR RELATIONS, ETC. CONTRACT LETTING AND COORDINATION; AND COST AND MANAGEMENT CONTROL. BASICALLY CM STRESSES THE TEAM WORK APPROACH. THE GENERAL SERVICES ADMINISTRATION (GSA) AND ITS PUBLIC BUILDING SERVICE (PBS) HAVE BEEN INSTRUMENTAL IN DEVELOPING A CM PROTOTYPE. THREE MAJOR CONTRACTS HAVE BEEN LET: A \$37 MILLION FEDERAL LAW ENFORCEMENT TRAINING FACILITY AT BELTSVILLE, MARYLAND; AT AN ESTIMATED COST OF \$97 MILLION, 3 SOCIAL SECURITY PAYMENT CENTERS IN PHILADELPHIA, CHICAGO, AND SAN FRANCISCO; AND A \$35 MILLION SMITHSONIAN INSTITUTE AIR AND SPACE MUSEUM IN WASHINGTON, D. C. THROUGH THE USE OF PROJECT MANAGERS, GSA HAS ATTEMPTED TO REDEFINE THE RESPONSIBILITIES SO THAT THE PROJECT MANAGERS ARE RESPONSIBLE FOR WORKING WITH CLIENT AGENCIES ON SPACE NEEDS AND FINANCING, ETC.; PBS WOULD LIKE TO SEE THE PROJECT MANAGERS TAKING MORE OF A UNIFIED STAND AND ASSUMING MORE RESPONSIBILITY. THE OTHER FIRMS SUCH AS TISHMAN REALITY AND CONSTRUCTION CO., NEW YORK CITY, HAVE CONTRIBUTED TO THE CONCEPT OF CM BY PREPARING AND MONITORING CONSTRUCTION SCHEDULES, ASSISTING IN THE DRAFTING OF BID DOCUMENTS, COORDINATING CONSTRUCTION WORK, FURNISHING MONTHLY COMPUTERIZED COST REPORTS, REVIEWING BILLING AND APPROVING PAYMENTS.

Engineering News-record Vol. 188 No. 18, May 1972, pp 14-9, Phot

1A 215533

CONSTRUCTION, MAINTENANCE, IMPLEMENTATION, AND MANAGEMENT

THIS VOLUME IS ONE OF A MULTIVOLUME SET OF PUBLICATIONS WHICH PROVIDES DETAILED INFORMATION ON THE RESEARCH AND DEVELOPMENT PROGRAM OF THE FEDERAL HIGHWAY ADMINISTRATION (FHWA). THIS VOLUME WHICH DEALS WITH THE CONSTRUCTION, MAINTENANCE, IMPLEMENTATION, AND MANAGEMENT ASPECTS OF THE FEDERALLY COORDINATED PROGRAM OF RESEARCH AND

DEVELOPMENT IN HIGHWAY TRANSPORTATION (FCP), IS ORGANIZED BY PROJECT, TASK AND STUDY. EACH PROJECT IS COMPOSED OF A DETAILED DESCRIPTION, INCLUDING FLOW CHARTS TO SHOW THE INTERRELATION OF THE PROJECT'S ELEMENTS, MILE-STONE AND TIME PHASE CHARTS THAT SHOW THE PLANNED SCHEDULE FOR THE MANY STUDIES THAT COMPRISE A PROJECT. THE PROJECTS ARE COVERED UNDER ONE OF FOUR CATEGORIES: EFFICIENCY IN CONSTRUCTION AND MAINTENANCE OPERATIONS, IMPLEMENTATION OF RESEARCH AND DEVELOPMENT FINDINGS, DEMONSTRATION PROGRAM, AND RESEARCH AND DEVELOPMENT MANAGEMENT AND COORDINATION.

Federal Highway Administration /US/ Vol. 6 Mar. 1972, 63 pp

1A 215543

CONCEPT OF STRUCTURAL CONTROL

IN AN IDEAL SITUATION, COMPLETELY SAFE STRUCTURES CAN BE DESIGNED IF EXACT INFORMATION IS KNOWN CONCERNING LOADS AND STRENGTHS INVOLVED DURING THE LIFE TIME OF THESE STRUCTURES, AND EXACT METHODS OF STRUCTURAL ANALYSIS ARE AVAILABLE. IN THE REAL WORLD, UNCERTAINTIES EXIST IN THIS INFORMATION AS WELL AS IN THE METHOD OF ANALYSIS. TO ACCOUNT FOR THESE UNCERTAINTIES, VARIOUS FACTORS OF SAFETY HAVE BEEN USED IN THE DESIGN OF STRUCTURES. THE OBJECTIVE HEREIN IS TO PRESENT THE CONCEPT OF STRUCTURAL CONTROL AS AN ALTERNATIVE APPROACH TO THE SAFETY PROBLEMS OF STRUCTURAL ENGINEERING. PERTINENT POINTS OF THE CONTROL THEORY ARE REVIEWED ALONG WITH CERTAIN PIONEERING WORK IN THIS DIRECTION. THE PRACTICALITY OF THIS CONCEPT IS ILLUSTRATED WITH AN EXAMPLE USING ANALOG PARALLEL LOGIC DEVICES. MORE WORK IS NEEDED IN ORDER TO APPLY THE CONCEPT OF STRUCTURAL CONTROL TO COMPLICATED STRUCTURES SUCH AS EXTREMELY TALL BUILDINGS OR LONG BRIDGES SUBJECTED TO UNCERTAIN DYNAMIC LOADS SUCH AS WIND AND EARTHQUAKE EXCITATIONS.

Yao, JT *Am Soc Civil Engr J Structural Div* Vol. 98 No. st 7, July 1972, pp 1567-74

1A 215557

RATIONAL QUALITY ASSURANCE

THE PAPER DESCRIBES ASPECTS OF A RATIONAL SYSTEM FOR THE APPLICATION OF STATISTICAL QUALITY-CONTROL PROCEDURES IN HIGHWAY CONSTRUCTION. NORMS FOR THE JUDGMENT OF COMPLIANCE WITH A DOUBLE SPECIFICATION LIMIT ARE DEFINED IN TERMS OF PARAMETERS THAT WILL BE MEANINGFUL TO ROAD ENGINEERS. THESE NORMS ARE FURTHER QUALIFIED IN TERMS OF A FUNDAMENTAL RELATION OF THE APPLICABLE COEFFICIENT OF VARIATION AND THE NUMBER OF OBSERVATIONS REQUIRED FOR JUDGMENT PURPOSES. CORRESPONDING JUDGMENT NORMS ARE ALSO PRESENTED FOR USE WHEN A PRODUCT THAT FAILS TO COMPLY WITH SPECIFICATIONS WHEN FIRST SUBMITTED IS CONSEQUENTLY RESUBMITTED FOR ACCEPTANCE. INFORMATION IS ALSO PRESENTED THAT IS REQUIRED FOR THE PRACTICAL APPLICATION OF THE SCHEME. THIS INCLUDES COEFFICIENTS OF VARIATION THAT ARE REPRESENTATIVE OF CURRENT PRACTICE, DESIRED FREQUENCY OF SAMPLING, AND SUGGESTED LOT SIZES. FINALLY, THE APPLICATION OF THE METHOD IS ILLUSTRATED BY MEANS OF A PROPOSED SYSTEM LOGIC AND A PRACTICAL EXAMPLE BASED ON A DOUBLE SPECIFICATION LIMIT. /AUTHOR/

Kuhn, SH Walker, RN Savage, PF Davis, RL DISCUSSER *Highway Research Record, Hwy Res Board* No. 385, 1972, pp 36-51, 11 Fig, 4 Tab, 16 Ref

1A 215581

A STUDY OF WASTE IN INDUSTRIALISED BUILDING SYSTEMS

PRODUCTIVITY IN CONSTRUCTION IS A SYSTEM-WIDE ATTRIBUTE RATHER THAN ONE LOCALIZED TO THE MANUFACTUR-

1A SYSTEM CONSTRUCTION, MANAGEMENT & QUALITY CONTROL

ING PLANT OR THE SITE. IF FAULTY MATERIALS, PROCESSES, OR PRODUCTS ARE USED AT THE PLANT, THEN THE HIGH MORTALITY IN ASSEMBLIES AT THE BUILDING SITE WILL REDUCE OVERALL PRODUCTIVITY. THE GENERALLY ALLOWED WASTE OF 7--9% IS WELL BELOW THE ACTUAL AVERAGE, WHICH IS OVER 15%. AN EIGHT-MONTH STUDY OF LARGE PRECAST CONCRETE COMPONENTS REVEALED THAT 70% OF DAMAGES OCCURED AT THE FACTORY AND THE REMAINING 30% EITHER IN TRANSIT OR AT THE SITE. THE MAIN PROBLEM IS THAT THE CONCEPT OF ACCEPTABILITY IS SO VAGUE AND RELATIVE THAT ITS INTERPRETATION IS LEFT SOLELY TO THE SKILL AND ABILITY OF THE INDIVIDUAL IN CHARGE. IN THE CASE OF BULKY COMPONENTS, SUCH AS CONCRETE SLABS, STANDARDIZATION OF QUALITY CONTROL IS RENDERED DIFFICULT. IN SYSTEM BUILDING IT IS VITALLY IMPORTANT TO LAY OUT THE PRODUCTION PROCESS IN SCHEMATIC FORM, IDENTIFY THE VARIOUS TYPES OF PRODUCTION FAULTS, RELATE THESE FAULTS TO THE STEPS IN THE PRODUCTION PROCESS, IDENTIFY THE QUALITY CONTROL CHECKS APPROPRIATE TO EACH STEP, ASSURE ADEQUATE SUPERVISION OF THE QUALITY CONTROL PROCESS (WHICH ENTAILS THOROUGH TRAINING AND GOOD TECHNOLOGICAL UNDERSTANDING), AND PROVIDE EQUIPMENT AND PROCEDURES SUITABLE FOR THE INDIVIDUAL QUALITY CONTROL OPERATIONS. EACH OF THESE REQUIREMENTS IS ILLUSTRATED, WITH PARTICULAR ATTENTION TO A SURVEY OF PRODUCTION FAULTS.

Dunung, PV *Concrete /UK/* Vol. 6 No. 9, Sept. 1972, pp 22-7, 7 Tab, 4 Phot

1A 215587

WHAT DIRECTION IN BRIDGE BUILDING?

MAJOR ADVANCES IN THE DESIGN AND CONSTRUCTION OF BRIDGES OVER THE PAST TWO MILLENIA ARE TRACED, AND THE PRINCIPAL ADVANCES SINCE WORLD WAR II ARE LISTED. TWO MAJOR CHALLENGES FACING DESIGNERS TODAY ARE (1) COMBINING AESTHETICS, ENGINEERING, AND ECONOMY INTO AN APPROPRIATE BLEND, AND (2) ADOPTING A SYSTEMS APPROACH, WITH IMPLICATIONS FOR TRAINING AND MANPOWER REQUIREMENTS, PRICING, USE OF NEW MATERIALS, AND CONSTRUCTION TECHNOLOGY.

Bartlett, RG *Highway Research Board Special Reports* No. 132, 1972, pp 3-5

1A 215588

SYSTEMS BUILDING: FOUNDATIONS

A SURVEY OF EUROPEAN HIGH-RISE CONCRETE PREFABRICATION PLANTS DETERMINED THAT NO RESEARCH ON THE FOUNDATION SUBSYSTEM HAS BEEN UNDERTAKEN BECAUSE IT WAS CONSIDERED THAT THE FOUNDATION PROBLEMS WERE UNIQUE FOR EACH SITE. ON THE OTHER HAND, WORK HAS BEEN DONE TO REDUCE FOUNDATION SITES TO A LIMITED SET OF SUBSYSTEM TYPES BEST SUITED FOR VARIOUS FOUNDATION SOIL CONDITIONS ON A WORLDWIDE BASIS. ACCORDING TO THE CLOSED-SYSTEM APPROACH, A SINGLE FIRM SHOULD HANDLE THE DESIGN, CONSTRUCTION, AND POSTCONSTRUCTION MANAGEMENT. BY CONTRAST, THE OPEN SYSTEM WITH MODULAR COORDINATION PERMITS WIDE INTERCHANGEABILITY OF COMPONENTS OR SUBSYSTEMS BY VARIOUS MANUFACTURERS. LARGER AND LARGER COMPONENTS ARE BEING PREFABRICATED: IN THE SAN FRANCISCO BAY AREA, 900-FOOT CONTINUOUS CASTING BEDS FOR PRESTRESSED CONCRETE PILES WERE USED FOR THE SAN MATEO--HAYWARD BRIDGE. THE MOVE TO LARGER PREFABRICATION IN URBAN AREAS HAS BEEN PRIMARILY FOR WATER CROSSINGS, WHERE WATER TRANSPORT TO THE SITE PERMITS LARGE COMPONENTS. A BRIDGE BETWEEN SIBERIA AND ALASKA HAS BEEN PROPOSED FOR WHICH A BRIDGE PIER 300 FEET HIGH WOULD BE PREFABRICATED AT A SITE SUCH AS SEATTLE, TOWED TO THE BRIDGE SITE, PLACED UPRIGHT, AND SUNK INTO THE FOUNDATION SOILS. FROM A SYSTEMS STANDPOINT, COMPUTER SOFTWARE IS

INCREASINGLY BEING USED TO DETERMINE THE MOST ECONOMICAL COMBINATIONS OF DECK SPANS AND OTHER PRECAST COMPONENTS. GREATER ATTENTION SHOULD BE GIVEN TO MOBILE OR RELOCATABLE BRIDGES.

Wigginton, WB *Highway Research Board Special Reports* No. 132, 1972, pp 6-8, 4 Fig

1A 215592

DESIGN, MANUFACTURE, TRANSPORTATION, AND ERECTION OF SYSTEMS BRIDGES

THE SECTION ON DESIGN DEALS WITH STANDARDIZATION OF DETAILS AND SECTIONS, STABILIZATION OF DESIGN CONCEPTS, FLEXIBILITY OF DESIGN TO PERMIT OTHER THAN THE INTENDED USE, THE EUROPEAN APPROACH TO CONTRACTING, LOAD FACTORS, AND MARKET AGGREGATION TO SPUR INNOVATION. THE SECTION ON MANUFACTURING ADDRESSES POTENTIAL INNOVATIONS IN SUBSTRUCTURES, PIER CAPS, BEARINGS, GIRDERS, DECKS, EXPANSION JOINTS, DRAINS, AND AUTOMATION. THE SECTION ON TRANSPORTATION NOTES THAT WITH MINOR MODIFICATIONS THE EXISTING METHODS ARE ADEQUATE. SHIPPERS MUST BE CONVERSANT WITH DIFFERING STATE REGULATIONS, AND SHIPMENTS MUST BE COORDINATED AMONG THE VARIOUS GROUPS RESPONSIBLE FOR TRANSPORTATION, COVER DESIGN, SHOP QUALITY CONTROL, AND ERECTION. THE FINAL SECTION SPECIFIES A NUMBER OF WAYS TO KEEP FIELD WORK TO A MINIMUM.

Hanson, TA Elliott, AL Whitlock, JO Holesapple, JC Elasser, HB *Highway Research Board Special Reports* No. 132, 1972, pp 42-50

1A 215610

GENERAL PROBLEMS, MEANING AND SCOPE OF CONTROL-SESSION 1

THE REPORTS INCLUDED ARE: (1) SPECIFIC PROBLEMS OF PAVEMENT QUALITY CONTROL IN FRANCE, J. BONITZER; (2) RISK IN SPECIFICATION, CONTROL AND ACCEPTANCE OF ROAD MATERIALS, D. H. MATHEWS, R. HARDMAN; (3) ASSESSMENT AND ACCOUNTING OF BUILDING OPERATIONS IN THE FIELD OF ROAD CONSTRUCTION USING STATISTICALLY GUARANTEED CHARACTERISTIC VALUES, J. NAGEL; (4) STATISTICAL QUALITY CONTROL IN BITUMINOUS ROAD CONSTRUCTION, A. SCHUHBAUER; (5) QUALITY ASSURANCE FOR HIGHWAY CONSTRUCTION IN THE UNITED STATES OF AMERICA, W. J. HALSTEAD, T. F. MCMAHON; (6) QUALITY CONTROL OF ROAD PAVEMENTS IN THE NETHERLANDS, C. VAN DE FLIET, J.A.C. BROUWERS, H.J.J.H. SPAN, K. WESTER; AND (7) CONTROL OF ROAD CONSTRUCTION WORK IN BELGIUM, H. HONDERMARC, A. DOYEN. A SUMMARY OF DISCUSSIONS IS ALSO INCLUDED.

Halstead, WJ
Oecd, Paris /France/ 1972, pp 13-56, Figs, Tabs, Refs

1A 215672

MAKE A PROFIT ON QUALITY

FOUR PAPERS DESCRIBE MEANS OF CONTROLLING THE QUALITY OF CONCRETE PAVEMENT CONSTRUCTION INCLUDING THE APPLICATION OF STATISTICAL PROCEDURES. ALSO DISCUSSED ARE THE RESPONSIBILITIES OF QUALITY CONTROL. VIEWPOINTS OF BOTH OWNERS AND CONTRACTORS ARE PRESENTED. THE FOUR PAPERS ARE: (1) K.H. MCGHEE, STATISTICAL CONCEPTS IN THE QUALITY CONTROL OF PAVING CONCRETE; (2) J. HODE KEYSER, QUALITY ASSURANCE IN ROAD CONSTRUCTION: HOW PROFITABLE CAN IT BE?; (3) BRUCE B. CLOUD, QUALITY CONTROL--THE CONTRACTORS' RESPONSIBILITY; (4) HARRY S. CURLIN, REPORT OF THE CHAIRMAN OF THE COMMITTEE OF CONTRARY OPINION. /HRIS/

McGhee, KH Keyser, JH Cloud, BB Curlin, HS
American Concrete Paving Association Tech Rpt No. 16, 1973, 43 pp, Figs, Tabs, 12 Ref

1A 215674

PROJECT PLANNING AND SCHEDULING: UNIFIED APPROACH

ESSENTIAL LOGICAL DETAILS ARE EXPLAINED FOR A PROCEDURE THAT INTEGRATES TWO IMPORTANT NETWORK-BASED PROJECT MANAGEMENT TECHNIQUES: (1) RESOURCE ALLOCATION; AND (2) TIME-COST TRADE-OFF ANALYSIS. IN THE RESEARCH PROJECT UPON WHICH THE PAPER IS BASED, THESE TECHNIQUES WERE ALSO INTEGRATED WITH BASIC CRITICAL PATH NETWORKING, RESOURCE LEVELING, AND CASH FLOW ANALYSIS. ALL WERE DEVELOPED IN THE CONTEXT OF AN INTERACTIVE MAN-COMPUTER SYSTEM. THE PROCEDURE RETAINS PROPERTIES OF NETWORKS ANALOGOUS TO THE "CRITICAL PATH" AND "FLOAT" WHILE OPERATING WITHIN RESOURCE CONSTRAINTS. A NEW "INTERVAL APPROACH" TO TIME-COST TRADE-OFF ANALYSIS ALSO OVERCOMES MANY THEORETICAL AND PRACTICAL PROBLEMS OF EARLIER OPTIMIZATION TECHNIQUES. HUMAN INPUT FORMS AN INTEGRAL PART OF THE SYSTEM AS A SOURCE OF MANAGEMENT INSIGHT, JUDGEMENT, INTUITION, QUALITATIVE ANALYSIS, AND PRACTICAL EVALUATION. A STEP-BY-STEP EXAMPLE ILLUSTRATES THE BASIC CONCEPTS. /ASCE/

Paulson, BC *Am Soc Civil Engr J Construction Div* Vol. 99 N No. 01, July 1973, pp 45-58, 8 Fig, 9 Ref

1A 215680

MDC CREATES A DISCIPLINE FOR CONSTRUCTION MANAGEMENT

A PROJECT AND MANAGEMENT INFORMATION SYSTEM IS DESCRIBED THAT CAN MAXIMIZE THE BENEFITS OF PROJECT AND CONSTRUCTION MANAGEMENT. THE SYSTEM IS DERIVED FROM TECHNIQUES USED IN THE AEROSPACE INDUSTRY TO PLAN, SCHEDULE AND CONTROL PROJECTS. THEY ARE BASICALLY COMPUTERIZED, MODULAR, NETWORK BASED SYSTEMS THAT CAN BE GEARED TO TOTAL PROGRAM MANAGEMENT, MULTIPROJECT SCHEDULING OR TO INDIVIDUAL PROJECTS. THE SYSTEMS WERE DESIGNED WITH THE PURPOSE OF MAKING EFFECTIVE USE BY MANAGEMENT OF TIME, COST AND MANPOWER. THE SYSTEM IS COMPRISED OF 3 SUBSYSTEMS, ONE CONTAINS PROGRESS RELATIVE TO PROPOSED SCHEDULES, ANOTHER COMPARES BUDGET AND ACTUAL COST INFORMATION AND A THIRD PROVIDES INFORMATION THAT RELATES MANPOWER NEEDS TO TIME AND COST DEVELOPMENTS. THIS INTERLOCKING NETWORK OF SUBSYSTEMS GIVES CONTINUOUS AND ACCURATE PROJECTION OF PHYSICAL AND FINANCIAL REQUIREMENTS. A CLEAR PICTURE OF THE TOTAL PROGRAM AND PROGRESS ON A PROJECT-BY-PROJECT BASIS, AND A REVIEW OF ALL PROJECTS ON A "BY-EXCEPTION" BASIS THAT ZEROS IN ON PROJECTS OR PHASES OF PROJECTS THAT FACE POTENTIAL OPERATING OR FISCAL PROBLEMS. THE APPLICATION OF THIS SYSTEM IN A VARIETY OF CONSTRUCTION PROJECTS BY PUBLIC AND PRIVATE AGENCIES IS BRIEFLY REVIEWED. THE SEASONED PROFESSIONAL TALENT RESPONSIBLE FOR THE DEVELOPMENT OF THIS INFORMATION SYSTEM IS REVIEWED.

Engineering News-record Vol. 191 No. 8, Aug. 1973, pp 17-20, 1 Fig, 1 Phot

1A 215708

QUALITY CONTROL IN HIGHWAY CONSTRUCTION

THE DEVELOPMENT OF A COMPREHENSIVE SCHEME FOR THE APPLICATION OF QUALITY CONTROL TO ROAD CONSTRUCTION IS DESCRIBED. ATTENTION IS GIVEN TO THE SETTING UP OF A SYSTEM FOR DETERMINING JUDGEMENT NORMS FOR THE MAGNITUDE AND VARIABILITY IN REGARD TO LOWER, HIGHER AND DOUBLE SPECIFICATION LIMITS FOR BOTH PROCESS AND ACCEPTANCE CONTROL. THE JUDGEMENT SYSTEM CONSISTS OF THE COMPARISON OF WORK AFTER COMPLETION (IN THE CASE OF ACCEPTANCE CONTROL) OR DURING PRODUCTION (IN THE CASE OF PROCESS CONTROL) WITH A SO-CALLED STANDARD PRODUCT. THE JUDGEMENT NORMS ENABLE DECISIONS TO BE MADE ON WHETHER THE WORK

COMPLIES WITH THE REQUIRED STANDARDS. BY USING VALID STATISTICAL RELATIONS THE REQUIRED NUMBER OF OBSERVATIONS, AS WELL AS THE JUDGEMENT NORMS ARE DETERMINED. JUDGEMENT NORMS ARE ALSO DEVELOPED FOR THE REQUIREMENTS WHICH MUST BE MET WHEN WORK IS RESUBMITTED AFTER INITIAL REJECTION AS WELL AS FOR THE EARLY ACCEPTANCE OR REJECTION OF WORK OF EXCEPTIONALLY HIGH OR LOW QUALITY. A PROCEDURE HAS BEEN DEVELOPED FOR STUDYING THE RELATION BETWEEN THE JUDGEMENT NORMS AND THE COSTS AND VALUE OF FINISHED WORK SO THAT THE FACTORS AFFECTING THE INHERENT PROFIT CAN BE OPTIMIZED. RECOMMENDATIONS REGARDING DATA AND OTHER REQUIREMENTS FOR THE PRACTICAL APPLICATION OF THE PROPOSED SCHEME ARE MADE FOLLOWING A COMPREHENSIVE STUDY OF LOCAL AND OVERSEAS PRACTICE. RELEVANT ASPECTS ARE: THE FREQUENCY OF TESTING, THE SIZE OF THE PRODUCT OR LOT SUBMITTED FOR JUDGEMENT AS WELL AS THE INHERENT VARIABILITY OF DIFFERENT PRODUCT CHARACTERISTICS. RECOMMENDATIONS ARE ALSO MADE REGARDING THE INITIAL INTRODUCTION OF THE SCHEME IN PRACTICE THE APPROACH IS ILLUSTRATED BY MEANS OF AN EXAMPLE. (A)

Kuhn, SH

Nat Inst Road Research /S Africa/ R&d Rpt No. csir, 1972, 48 pp, Figs, Tabs, 48 Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/IRRD 203 139, 3C33235479

1A 215716

STEEL FIBROUS SHOTCRETE

THE LARGEST CONTRACT EVER AWARDED FOR THE APPLICATION OF STEEL FIBROUS SHOTCRETE WAS RECENTLY COMPLETED NEAR PENAWAWA IN WHITMAN COUNTY, WASHINGTON, BY CORAL CORPORATION OF GLADSTONE, OREGON. THE FIBROUS CONCRETE WAS USED TO STABILIZE A SECTION OF RELOCATED CAMAS PRAIRIE RAILROAD TRACK THAT HAS BEEN THREATENED BY FALLING ROCK FROM AN ADJACENT BASALT CUT FOR THE PAST 5 YEARS. COMPOSITION OF THE SHOTCRETE MIXTURE USED WAS PORTLAND CEMENT, WATER, FINE AGGREGATE, STEEL WIRE REINFORCEMENT, AND ACCELERATOR ADMIXTURE. BEFORE THE SHOTCRETE WAS APPLIED HOLES WERE DRILLED INTO THE SLOPE WITH A PNEUMATIC DRILL FOR 114 ROCK BOLTS. AFTER THE BOLTS WERE IN PLACE, STRESSED AND GROUTED, THE FIBROUS CONCRETE WAS SHOT ONTO THE SLOPE WITH A REED GUNCRETE MACHINE TO WHICH THE CONTRACTOR MADE SEVERAL MODIFICATIONS. THE MODIFICATIONS WERE MADE PRIMARILY TO PREVENT "BALLING" AS THE MIX WAS DIRECTED INTO THE GUNCRETE HAPPER. THE RESULTING PRODUCTION FIGURES WERE APPROXIMATELY 10 CUBIC YARDS PER HOUR, ALMOST 8 CUBIC YARDS PER HOUR BETTER THAN PREVIOUS EXPERIENCES WITH FIBROUS SHOTCRETE. APPLICATION BEGAN AT THE BOTTOM OF THE SLOPE AND PROGRESSED UPWARD A SEGMENT AT A TIME IN PLANNED SEQUENCE.

Kaden, RA *Western Construction* Vol. 49 No. 4, Apr. 1974, 3 pp, 3 Phot

1A 215747

QUALITY CONTROL IN ASPHALTIC CONCRETE ROAD CONSTRUCTION

THE FUNCTION OF QUALITY CONTROL IN ASPHALTIC CONCRETE AND CONSTRUCTION IS TWOFOLD-(1) CONTROL OF AN ASPHALT PLANT AND (2) PAVING OPERATIONS. THE BATCH TYPE OF HOT-MIX PLANT IS CONSIDERED TO GIVE CLOSER CONTROL OF QUALITY THAN THE CONTINUOUS TYPE, AND OTHER FACTORS AFFECTING THE PRODUCTION OF A UNIFORM HIGH QUALITY ASPHALTIC CONCRETE ARE DISCUSSED. THESE INCLUDE-(1) SELECTION AND CONTROL OF OPTIMUM ASPHALT CONTENT; (2) TESTING AND INSPECTION OF AGGREGATES; (3) COLD FEEDING PROPORTIONING; (4) DRYER OPERATION (5) HOT BIN GRADATION; (6) HOT AGGREGATE PROPORTIONING; (7) TEMPERATURE CONTROL; (8) MIX-

1A SYSTEM CONSTRUCTION, MANAGEMENT & QUALITY CONTROL

ING TIME; (9) MIXING TEMPERATURE AND (10) MIXTURE SAMPLING AND TESTING. PAVING OPERATIONS ARE ALSO DESCRIBED UNDER THE MAIN HEADINGS OF (1) GENERAL (2) HAULING EQUIPMENT (3) CONTROL OF SPREADER OPERATOR; (4) TEMPERATURE CONTROL; (5) CONTROL OF ROLLING OPERATIONS; (6) CONTROL OF FIELD DENSITY; (7) CONTROL OF JOINTS; (8) CONTROL OF TRAFFIC AND (9) CONTROL OF FINISHED SURFACE.

Bijlani, HU Gupta, OP *Indian Highways* No. 244, Dec. 1970, pp 84-92, 2 Tab

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

1A 215872

AN INVESTIGATION OF NUCLEAR METHODS OF DETERMINING MOISTURE CONTENTS AND COMPACTED DENSITIES OF SOILS AND AGGREGATES

RESULTS ARE PRESENTED OF LABORATORY AND FIELD TESTING OF A PORTABLE NUCLEAR GAUGE FOR THE MEASUREMENT OF IN-PLACE MOISTURE CONTENT AND DENSITY OF EARTHEN STRUCTURES. BOTH LABORATORY AND FIELD EVALUATIONS HAVE BEEN DIRECTED TOWARD DETERMINING A PRACTICAL AND ACCURATE METHOD OF TEST OPERATION TO CONSTRUCTION CONTROL AND INSPECTION. ATTENTION WAS NOT DIRECTED TOWARD EVALUATING DETAILS OF MACHINE OPERATION, BUT RATHER ON HOW TO OBTAIN MEANINGFUL RESULTS. UPON RECEIPT OF THE NUCLEAR EQUIPMENT FROM THE MANUFACTURER THE FOLLOWING STEPS WERE TAKEN: (1) FAMILIARIZATION OF PERSONNEL WITH THE SCALER AND GAUGES, (2) THE NUCLEAR EQUIPMENT WAS BRIEFLY TESTED IN THE FIELD IN COMPARISON WITH THE CONVENTIONAL METHOD, RESULTS INDICATING THAT LABORATORY CALIBRATION WOULD BE REQUIRED TO OBTAIN GOOD CORRELATION, (3) CALIBRATION CURVES WERE DETERMINED BY TESTING VARIOUS SOILS AND AGGREGATES COMMON TO IDAHO. ALSO, SPECIFIC FACTORS INFLUENCING MACHINE ACCURACY WERE DISCOVERED AND EVALUATED, I.E., LEVEL SURFACE FOR THE D/M GAUGES, AIR GAPS BETWEEN GAUGE AND SURFACE, WARM UP TIME, (4) AT THE COMPLETION OF CALIBRATION AND OPERATING PROCEDURE TESTS, FIELD EVALUATION WAS STARTED, (5) A CONSTRUCTION PROJECT WITH A LARGE QUANTITY OF EARTHWORK WAS SELECTED FOR FIELD TRIALS. A STATISTICAL METHOD OF SAMPLE SELECTION WAS USED. DUPLICATE NUCLEAR AND CONVENTIONAL TESTS WERE MADE AT EACH OF 42 RANDOMLY SELECTED TEST SITES, AND (6) STATISTICAL ANALYSIS WAS MADE OF TEST DATA TO DETERMINE CORRELATION OF THE TWO METHODS. /AUTHOR/

Anderson, F Larsen, J
Idaho Department of Highways, Bureau of Public Roads /US/ Jan. 1968

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4723074 68)CFSTI PB 178 422, 1C34021208

1A 215936

DEVELOPMENT OF NUCLEAR METHODS FOR Q.C. OF HIGHWAY EMBANKMENT CONSTRUCTION

THE EXTENSIVE LABORATORY AND FIELD TESTING CONDUCTED IN AN EFFORT TO PROPERLY DESIGN, CALIBRATE, AND USE THE NUCLEAR METHOD FOR COMPACTION CONTROL IN MICHIGAN IS DESCRIBED. THE STUDY INCLUDES INVESTIGATION OF ALL BASIC METHODS OF USING NUCLEAR DENSITY GAGES: BACKSCATTER, DIRECT TRANSMISSION, AIR-GAP, AND DIRECT READING, AND RECORDING CHART READOUT TECHNIQUES. ALSO INCLUDED IS AN INVESTIGATION OF THE APPLICABILITY OF RANDOM SAMPLING AND STATISTICAL CONTROL OF COMPACTION. FIELD TESTING OF THE GAGE WAS PERFORMED BOTH UNDER CAREFULLY CONTROLLED CONDITIONS AND UNDER NORMAL FIELD CONDITIONS BY ASSIGNING GAGES DIRECTLY TO CONSTRUCTION PERSONNEL. THE BASIC CONCLUSIONS ARE: (1) ALTHOUGH THE BASIC PRINCIPLES OF NUCLEAR RADIATION USED IN

THE GAGES ARE SOUND, AS EVIDENCED BY RESULTS OF CAREFULLY CONTROLLED LABORATORY TESTS, THE GAGE HAS NOT BEEN SATISFACTORY WHEN USED UNDER FIELD CONDITIONS. THE PRIMARY PROBLEM APPEARS TO BE THE SENSITIVITY OF THE GAGE TO THE SURFACE LAYERS UPON WHICH IT IS PLACED. THIS NOT ONLY TENDS TO GIVE FALSE DENSITY MEASUREMENTS BUT CAN NEGATE ATTEMPTS TO OBTAIN BY CONVENTIONAL DENSITY MEASURING METHODS. SURFACE EFFECTS HAVE BEEN LESS APPARENT WHEN TESTING UNIFORM SANDS. (2) WHEN SPECIAL SURFACES WERE PREPARED FOR THE GAGES THE TIME REQUIRED PER TEST APPROACHED THAT REQUIRED FOR THE CONVENTIONAL TEST, NOW THAT THE SPEEDY MOISTURE METER IS USED IN THE LATTER METHOD. WITH LITTLE OR NO TIME SAVINGS, THE HIGH INITIAL AND OPERATING COST OF THE EQUIPMENT CANNOT BE JUSTIFIED. AND (3) EVEN WHEN USING NEW EQUIPMENT, CONSIDERABLE MAINTENANCE WAS REQUIRED RESULTING IN SERIOUS CONSTRUCTION DELAYS. /AUTHOR/

Mainfort, RC
Michigan Dept State Highways, Bureau of Public Roads /US/ 61 E-22

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4601492 70)NTIS PB 195708, 1C34022241

1A 216231

AN EVALUATION OF THE MOISTURE AND DENSITY ROAD LOGGER UNIT

THE CONSTRUCTION CONTROL CAPABILITIES OF THE ROAD LOGGER AND THE FEASIBILITY OF USING THIS EQUIPMENT TO FIELD CALIBRATE THE SMALLER, PORTABLE TYPE NUCLEAR DENSITY GAGES BEING USED ON A LIMITED BASIS BY THE TEXAS HIGHWAY DEPARTMENT ARE BEING STUDIED. THE RESULTS OF THE CORRELATION STUDY INDICATED REASONABLY GOOD CORRELATION BETWEEN THE ROAD LOGGER AND CONVENTIONAL MEASUREMENTS OF MOISTURE CONTENT AND WET DENSITY, HOWEVER, IN MOST CASES, THE ROAD LOGGER VALUES EXCEEDED THOSE OF THE CONVENTIONAL TESTS. IN THE MORE UNIFORM BASE MATERIALS THAT WERE TESTED, SUBSTANTIAL AGREEMENT OF DRY DENSITY VALUES COULD BE OBTAINED BY APPLYING A CORRECTION FACTOR TO THE ROAD LOGGER MEASUREMENTS OF MOISTURE CONTENT. EVEN THOUGH CORRELATION TO SOME EXTENT WAS OBTAINED BETWEEN COUNT-RATIO OF THE PORTABLE NUCLEAR GAGE AND ROAD LOGGER WET DENSITY, THIS METHOD OF CALIBRATION WAS ONLY PARTIALLY SUCCESSFUL. DIFFERENCES IN SAMPLE SIZE ACTUALLY INVESTIGATED AND VARIATIONS OF WET DENSITY IN THE COMPACTED MATERIALS APPARENTLY CONTRIBUTED TO THE OBSERVED SPREAD IN TEST RESULTS. THIS SPREAD IN TEST RESULTS MADE IT DIFFICULT TO ESTABLISH ACCURATE REFERENCE CURVES FOR USE WITH THE SMALLER GAGES.

Bingham, JM White, JR
Texas State Department of Highways & Public Transp Oct. 1965

1A 216264

EVALUATION OF A CONTINUOUS-LOGGING NUCLEAR MOISTURE-DENSITY MEASUREMENT SYSTEM (LANE-WELLS ROAD LOGGER)

EVALUATION OF A LANE-WELLS ROAD LOGGER AS A REPLACEMENT FOR CONVENTIONAL MOISTURE CONTENT AND DRY DENSITY MEASUREMENTS IN HIGHWAY CONSTRUCTION WAS BEGUN IN 1965 WITH ONE UNIT. THE EVALUATION CONSISTED OF CORRELATION STUDIES ON ACCURACY AND REPEATABILITY, AND GENERAL DEVELOPMENT OF MULTI-PROJECT OPERATING PROCEDURES TO FIT CONSTRUCTION PRACTICES IN SASKATCHEWAN. THE EVALUATION PROGRAM WAS EXPANDED IN 1966 TO THREE UNITS WITH EACH UNIT RESPONSIBLE FOR CONTRACT COMPACTION CONTROL OF SUBGRADE, GRANULAR SUB-BASE AND BASE COURSE, AND ASPHALTIC CONCRETE SURFACE COURSE ON SEVERAL PROJECTS. IN ADDITION, THE UNIT'S ABILITY TO

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PROVIDE TIGHT CONTROL TO ESTABLISH UNIFORMITY OF COMPACTION WAS ASSESSED AND FOUND SATISFACTORY. THE TWO-YEAR EVALUATION PROGRAM INDICATED THAT WHEN PROPERLY USED, THE ROAD LOGGER MEASUREMENTS ARE AS ACCURATE AS CONVENTIONAL TEST MEASUREMENTS. THE VOLUME OF DATA, THE MANNER IN WHICH IT IS PRESENTED, AND THE SPEED AT WHICH IT IS OBTAINED HAVE BROUGHT THE POSSIBILITY OF QUALITY CONTROL OF COMPACTION PROCESSES, INCLUDING SOILS SELECTION, TO THE POINT WHERE IT IS A PRACTICAL PROCEDURE. THE MAIN DISADVANTAGES OF THE ROAD LOGGER METHOD ARE THE INITIAL COST OF THE DATA AND THE ADDITIONAL TRAINING REQUIRED BY TECHNICIANS TO PROPERLY INTERPRET THE DATA. /AUTHOR/

Culley, RW
Saskatchewan Dept Hwys, Regina /Canada/ Mar. 1967

1A 216489
METHODS OF STATISTICAL CONTROL USED FOR THE MANUFACTURE OF BITUMINOUS MATERIALS (IN FRENCH)
THE GROWING IMPORTANCE OF STATISTICAL CONTROL IN ROAD CONSTRUCTION IS STRESSED, AND A SERIES OF TESTS CARRIED OUT BY M. TESSONNEAU ON THE CONSTRUCTION SITE OF THE AUXERRE-AVALON MOTORWAY SECTION IS REVIEWED. TEST RESULTS ARE PRESENTED, AND THE APPLICATION OF INDUSTRIAL METHODS OF CONTROL TO ROAD CONSTRUCTION WORKS IS DISCUSSED. EMPHASIS IS PLACED ON THE NEED FOR FURTHER STUDIES BEFORE APPLYING STATISTICAL CONTROL TO ROAD CONSTRUCTION ON A GENERAL BASIS. /LCPC/A/RRL/

Bull Liaison Labs Routiers /France/ Apr. 1968

ACKNOWLEDGMENT: Road Research Laboratory /UK/

1A 216589
QUALITY CONTROL IN CONCRETE ROAD CONSTRUCTION /IN FRENCH/
THE CONDITIONS NECESSARY TO ENSURE THE PRODUCTION OF HIGH-QUALITY CONCRETE ARE: PRELIMINARY CONTROL OF INGREDIENTS AND CONTINUOUS CONTROL DURING MANUFACTURE BY RECORDING PRODUCTION PARAMETERS. RECENT TESTS ON CONSTRUCTION SITES SHOW THAT IT IS POSSIBLE TO RECORD THE TEMPERATURE OF CEMENT AND WATER, TO RECORD THE WEIGHT OF AGGREGATES, CEMENT AND WATER IN A BATCH, AND TO EVALUATE THE CONSISTENCY OF CONCRETE AND REGULARITY OF PRODUCTION BY RECORDING THE ENERGY CONSUMPTION OF THE MIXER. RESULTS SHOW THAT IF CARE IS TAKEN IN OPERATING AND MAINTAINING THE EQUIPMENT, IT IS POSSIBLE TO OBTAIN A HIGH DEGREE OF REGULARITY IN PRODUCTION. TESTS CARRIED OUT ON SAMPLES SHOW A WIDE DISPERSION IN MEASUREMENTS ON FRESH CONCRETE. THIS DISPERSION DECREASES FOR RESULTS OF MECHANICAL TESTS ON HARDENED CONCRETE. /LCPC(A)/RRL/

Parey, C *Bull Liaison Labs Routiers /France/ Dec. 1969*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

1A 216726
INSPECTION OF WELDED STRUCTURAL STEEL
THE JOB OF THE WELDING INSPECTOR IS OUTLINED. HE SHOULD ASSIST THE STRUCTURAL ENGINEER AND THE CONTRACTOR WHEREVER POSSIBLE TO PRODUCE A JOB IN THE MOST EFFICIENT AND ECONOMICAL WAY. HE MUST ASSURE THE CLIENT THAT THE WELDING HAS BEEN PROPERLY PERFORMED IN COMPLIANCE WITH THE STRUCTURAL DESIGN AND APPLICABLE CODES. A THOROUGH KNOWLEDGE IS NECESSARY OF THE AMERICAN WELDING SOCIETY CODE AND SPECIFICATIONS, THE AMERICAN INSTITUTE OF STEEL CONSTRUCTION CODE AND SPECIFICATIONS, AND FABRICATION AND ERECTION PRACTICES. A WELDING INSPECTION CHECKLIST IS PRESENTED OF: (1) INSPECTION BEFORE WELD-

ING IS STARTED, (2) INSPECTION DURING WELDING, AND (3) INSPECTION AFTER WELDING. A REVIEW OF THE TYPE OF STEEL SPECIFIED AND PROPER ELECTRODES FOR THAT STEEL SHOULD BE MADE. THE INSPECTOR SHOULD CHECK DRAWINGS AND PROCEDURES BEFORE WELDING, AND SHOULD CHECK JOINT PREPARATION AND FIT-UP. WELD QUANTITY AND QUALITY ARE CHECKED. IN WELDED BUILDINGS, THE PREPONDERANCE OF JOINTS ENCOUNTERED ARE FILLET WELDS FOR SHEAR, BUTT BELTS OF BEAM FLANGES TO COLUMNS, AND EITHER BUTT OR FILLET WELDS FOR COLUMN SPLICES. VISUAL INSPECTION IS USUALLY SATISFACTORY FOR THESE CONNECTIONS.

Julicher, AJ *Civil Engineering Asce June 1968*

1A 216730
THE CONSTANT DRY WEIGHT METHOD--A NO-WEIGHING FIELD COMPACTION TEST
THE SEARCH FOR A QUICKER METHOD OF MEASURING COMPACTION IN THE FIELD CONTINUES. THE BEST KNOWN, AND MOST DISCUSSED TODAY, IS THE NUCLEAR METHOD, BUT COMPACTION CONTROL IS STILL ALMOST SOLELY BASED ON THE FIELD MEASUREMENT OF DENSITY, WHICH IS GENERALLY OBTAINED BY MEANS OF THE SAND CONE OR RUBBER BALLOON TEST. THE CONSTANT DRY WEIGHT FIELD COMPACTION TEST DESCRIBED IS A FIELD ADAPTION OF THE PROCTOR TEST (ASTM DESIGNATION D698-58T). IN THE TEST METHOD REPORTED, THE PERCENT COMPACTION IS ASCERTAINED BY COMPARING THE IN SITU VOLUME OF A SOIL SAMPLE WITH THE VOLUME OF THE SAME SAMPLE IN THE PROCTOR MOULD, AFTER STANDARD COMPACTION AT APPROXIMATELY OPTIMUM MOISTURE CONTENT. THE ACCURACY AND PRECISION OF THE RESULTS OBTAINED FROM THE CONSTANT DRY WEIGHT COMPACTION TESTS ARE ANALYZED AND ITS ROLE IN STATISTICAL QUALITY IS EVALUATED. THE USE OF THIS TEST METHOD TO SUPPLEMENT NUCLEAR PROBE TESTING IN THE DETERMINATION OF PERCENT COMPACTION IS ALSO DISCUSSED. /AUTHOR/

Schonfeld, R
Ontario Dept Hwys, Downsview /Canada/ Sept. 1968

1A 216909
COMPACTION MEASUREMENTS BY NUCLEAR DEVICES
STUDY WAS CONDUCTED TO DEVELOP METHODS, PROCEDURES, AND CALIBRATION CURVES FOR USING NUCLEAR DEVICES TO MAKE FIELD DENSITY AND MOISTURE MEASUREMENTS. THE NUCLEAR ASPHALT DENSITY GAUGE MEASUREMENTS WERE COMPARED WITH THE SPECIFIC GRAVITIES OF CORES CUT FROM BITUMINOUS PAVEMENTS. ANALYSIS OF DATA COLLECTED INDICATED A STANDARD ERROR ESTIMATE OF 0.04. THE DATA INDICATE THAT A SUBSTANTIAL PORTION OF THE VARIATION IS NOT EXPLAINED BY THE ESTIMATING EQUATIONS. THE NUCLEAR ASPHALT DENSITY GAUGE IS NOT RECOMMENDED FOR CONSTRUCTION CONTROL OF BITUMINOUS PAVEMENT DENSITY. THE NUCLEAR SOIL DENSITY GAUGE MEASUREMENTS WERE COMPARED TO THE WET UNIT WEIGHTS MEASURED BY THE SAND CONE METHOD IN THE FIELD AND A CALIBRATED BOX MOLD IN THE LABORATORY. THE STANDARD ERRORS OF ESTIMATE WERE 4 TO 5 PCF FOR ALL ANALYSES. VERY GOOD CORRELATIONS WERE OBTAINED IN THE LIMITED LABORATORY STUDY. DATA INDICATE THAT THE NUCLEAR DENSITY GAUGE MEASUREMENTS ARE AFFECTED BY VARIATIONS IN MATERIAL COMPOSITION AND THAT A SEPARATE CALIBRATION CURVE FOR EACH SOIL IS NECESSARY. THE SURFACE NUCLEAR SOIL DENSITY GAUGE AND MEASUREMENT PROCEDURES ARE NOT RECOMMENDED FOR CONSTRUCTION COMPACTION CONTROL FOR EMBANKMENT OR SUBGRADE SOILS. IF THIS TYPE OF GAUGE IS USED, IT IS RECOMMENDED THAT THE AIR GAP PROCEDURE BE USED AND THAT SEPARATE CALIBRATION CURVES BE ESTABLISHED FOR EACH SOIL. THE NUCLEAR SOIL MOISTURE GAUGE MEASUREMENTS WERE COMPARED TO MOISTURE CONTENTS DETERMINED BY

1A SYSTEM CONSTRUCTION, MANAGEMENT & QUALITY CONTROL

OVEN DRYING. THE STANDARD ERRORS OF ESTIMATE WERE 1.0 PCF OR LESS. DATA INDICATE THAT A SINGLE CALIBRATION CURVE FOR THE DETERMINATION OF MOISTURE CONTENT BY THE NUCLEAR GAUGE WOULD BE SATISFACTORY FOR MOST SOILS.

Holman, FL Eiland, EN McCullough, WF
Alabama State Highway Department June 1969

1A 216911 QUALITY ASSURANCE IN HIGHWAY CONSTRUCTION-PART 5-SUMMARY OF RESEARCH FOR QUALITY ASSURANCE OF AGGREGATE

A REVIEW OF THE EVALUATION BY STATISTICAL TECHNIQUES OF HIGHWAY AGGREGATE CHARACTERISTICS IS PRESENTED AS A CONDENSED COMPILATION OF BOTH HISTORICAL DATA AND DATA FROM DESIGNED QUALITY-MEASUREMENT PROJECTS IN WHICH THE DEGREE OF CONFORMANCE TO SPECIFICATIONS WAS STATISTICALLY ESTIMATED. REPORTS FROM NINE STATES ON PROJECTS IN WHICH RESEARCH DATA HAVE BEEN OBTAINED ARE ABSTRACTED AND SUMMARIZED IN THIS COMPILATION TO ILLUSTRATE TRENDS IN GRADATION ANALYSIS, SAMPLING AND TESTING PROCEDURES, SAND EQUIVALENT ANALYSIS AS AN ALTERNATE TO GRADATION ANALYSIS, AND SOUNDNESS TESTS FOR AGGREGATE QUALITY. SPECIFICATIONS FOR BASE COURSE AGGREGATE USUALLY CONTAIN LIMITS FOR GRADATION, PLASTICITY, SOUNDNESS, AND AMOUNT OF DELETERIOUS MATERIAL. THE DEGREE OF CONFORMANCE TO GRADATION SPECIFICATIONS WAS FOUND TO VARY FROM STEP TO STEP IN THE PROCESSING. ANALYSIS OF VARIANCE WAS APPLIED DURING CONSTRUCTION TO DETERMINE CAUSES OF THE VARIATION AND TO LOCATE CONDITIONS NEEDING CORRECTIVE ACTION. FOR AGGREGATE CONTROL, THE SAND-EQUIVALENT TEST RATHER THAN GRADATION IS PREFERRED IN SOME STATES, AND STATISTICAL RESEARCH, CONDUCTED TO ASCERTAIN WHETHER THE SAND-EQUIVALENT TEST IS INFORMATIVE AND REPRODUCIBLE, HAS CONFIRMED ITS USEFULNESS, ALTHOUGH THE AMOUNT OF DATA AT PRESENT IS RATHER LIMITED. STATISTICAL RESEARCH ON SALT-SOUNDNESS DETERMINATION INDICATED THAT DRYING TIME DID NOT NEED TO BE CHANGED; THAT SODIUM SULPHATE TESTING COULD BE DISCONTINUED, AS MAGNESIUM SULPHATE TESTING IS SATISFACTORY; AND THAT IT IS POSSIBLE TO PLACE ACCEPTANCE OF FINE AGGREGATE SOURCES ON A SOUND STATISTICAL FOUNDATION. IN STATISTICALLY-ORIENTED RESEARCH ON AGGREGATE GRADATION FOR BITUMINOUS MIXTURES, INFORMATION SIMILAR TO THAT FOR BASE COURSES WAS DEVELOPED, AND INDICATED THAT VARIATION FROM THE SPECIFICATIONS DIFFERS ACCORDING TO THE POINT OF SAMPLING. THE RESEARCH ALSO INDICATED THAT SAMPLING AT THE HOT BINS WAS PREFERRED FOR PROCESS CONTROL, WHEREAS SAMPLING AT THE COMPACTED BITUMINOUS LAYER WAS BEST FOR ESTABLISHING UNIFORMITY OF THE MIXTURE. DATA INDICATED THAT AGGREGATE USED IN PORTLAND CEMENT CONCRETE HAD A SMALLER STANDARD DEVIATION THAN THE AGGREGATE USED IN BITUMINOUS MIXTURES OR IN BASE COURSES, BUT THAT STATISTICAL ANALYSIS PROVIDED INFORMATION FOR EARLY DETECTION OF UNDESIRABLE GRADATION OR UNDESIRABLE QUALITY. THE USE OF STATISTICALLY DESIGNED CONTROL CHARTS IS HIGHLY RECOMMENDED FOR CONTROL OF THE CHARACTERISTICS OF AGGREGATE BY SOME STATES.

Kelley, JA *Public Roads, Us Bureau Public Roads* Oct. 1969

1A 216917 STATISTICAL QUALITY CONTROL OF HIGHWAY CONSTRUCTION MATERIALS

THE GREAT INCREASE IN HIGHWAY CONSTRUCTION WORK WHICH WAS EXPERIENCED DURING THE 1950'S AND EARLY 1960'S RESULTED IN RAPID ADVANCEMENT OF CONSTRUCTION METHODS. WITH EMPHASIS BEING PLACED UPON HIGH

PRODUCTION. TESTING AND CONTROL PROCEDURES DID NOT KEEP PACE AND THIS RESULTED IN A SLIGHT REDUCTION IN OVERALL QUALITY. HOWEVER, THE HIGHWAY INDUSTRY WAS CHALLENGED AND, THROUGH READJUSTMENT OF CONTROL PROCEDURES, IMPROVEMENT IN QUALITY WAS MADE. TO DATE, SPECIFICATIONS HAVE BEEN OF THE ABSOLUTE TYPE WITH CONSIDERABLE RELIANCE BEING PLACED UPON THE EXPERIENCE OF THE ENGINEER AND HIS ABILITY TO SELECT REPRESENTATIVE SAMPLES. THIS SYSTEM HAS DRAWBACKS, PARTICULARLY UNDER THE STRESS OF AN INCREASING TEMPO OF CONSTRUCTION AND LACK OF TRAINED INSPECTORS. IN AN ATTEMPT TO IMPROVE SPECIFICATIONS, IT WAS SUGGESTED THAT THE HIGHWAY ENGINEER CONSIDER ADOPTING STATISTICAL QUALITY CONTROL (SQC) PROCEDURES. THE FIRST STEP IN THIS DIRECTION WAS TAKEN BY THE UNITED STATES BUREAU OF PUBLIC ROADS WHO HELD WORKSHOPS ON QUALITY CONTROL THROUGHOUT THE NATION IN THE FALL OF 1963. AT THESE WORKSHOPS THE BUREAU PROPOSED THAT THE STATE HIGHWAY DEPARTMENTS RESEARCH THE SUBJECT OF USING STATISTICAL CONTROL METHODS. IN THE SPRING OF 1964, THE CALIFORNIA DIVISION OF HIGHWAYS SUBMITTED A RESEARCH PROPOSAL INTENDED TO DETERMINE THE CONTROL LIMITS TO BE USED IN STATISTICAL SPECIFICATIONS FOR NINE CONSTRUCTION ITEMS. THE RESEARCH HAS BEEN COMPLETED ON THESE NINE ITEMS AND EIGHT INTERIM REPORTS CONTAINING THE FINDINGS RELATIVE TO THESE CONSTRUCTION ITEMS HAVE BEEN COMPLETED, AND ARE LISTED IN BIBLIOGRAPHY. /AUTHOR/

Sherman, GB Watkins, RO
California Division Highways May 1968

1A 217019 RECOMMENDATIONS FOR CAST-IN-PLACE NONREINFORCED CONCRETE PIPE

A GENERAL VIEW IS GIVEN OF PRESENT KNOWLEDGE TOGETHER WITH RECOMMENDATIONS FOR DESIGN, CONSTRUCTION, AND TESTING PROCEDURES. CONSTRUCTION SPECIFICATIONS ARE CONTAINED IN "SPECIFICATIONS FOR CAST-IN-PLACE NONREINFORCED CONCRETE PIPE." /AUTHOR/

Am Concrete Inst Journal & Proceedings Apr. 1969

1A 217823 CONSTRUCTION SPECIFICATIONS FOR VOLCANIC CINDERS USED AS ROAD-SURFACING AGGREGATE

A STUDY WAS CONDUCTED TO DETERMINE PARAMETERS THAT INFLUENCE THE PERFORMANCE OF VOLCANIC CINDERS WHEN USED AS A WEARING SURFACE FOR UNPAVED FOREST ACCESS ROADS. THE SAFETY DEPLETION OF GOOD, HIGH-TYPE AGGREGATE SOURCES HAS BROUGHT ABOUT RENEWED INTEREST IN OTHER AGGREGATE TYPES, MAKING THIS STUDY PARTICULARLY TIMELY. A LITERATURE REVIEW, CORRESPONDENCE, AND PERSONAL INTERVIEWS WERE CONDUCTED TO DETERMINE EXISTING USE AND PERFORMANCE OF CINDERS. A ROAD RATING SYSTEM WAS DEVELOPED, SIMILAR TO THE AASHO ROAD TEST METHOD, TO DETERMINE WHICH WERE "GOOD ROADS" AND WHICH WERE "POOR ROADS" BASED ON A 0 TO 5 NUMERICAL RATING SCALE. THIRTY OF THE RATED ROADS AND THE CORRESPONDING CINDER PITS WERE SAMPLED AND THE MATERIAL WAS TESTED IN THE LABORATORY. THE PHYSICAL PROPERTIES OF THE CINDERS WERE THEN STATISTICALLY CORRELATED WITH THE ROAD RATING. IT WAS FOUND THAT DENSITY, GRADATION, DURABILITY, AND PLASTICITY WERE THE MOST SIGNIFICANT INDEPENDENT VARIABLES. BASED ON THESE RESULTS, SPECIFICATIONS FOR UNTREATED CINDER SURFACE COURSES HAVE BEEN DEVELOPED. THESE INCLUDE (1) A MINIMUM OF 100 PERCENT COMPACTION RELATIVE TO AASHO T 99; (2) GRADATION LIMITS OF 100 PERCENT PASSING THE 1-IN. SIEVE, 80 TO 95 PERCENT PASSING THE 3/4-IN., 35 TO 60 PERCENT PASSING THE NO. 40, AND 3 TO

12 PERCENT PASSING THE NO. 200; (3) A PLASTIC INDEX VALUE BETWEEN 2 AND 10; AND (4) A MAXIMUM LOS ANGELES ABRASION VALUE OF 50 PRIOR TO PROCESSING. IN MOST CASES THIS WILL REQUIRE CRUSHING OF THE HARDER (PURPLE, GRAY, AND BLACK) CINDERS. /AUTHOR/

Hendrickson, LG Lund, JW *Highway Research Record, Hwy Res Board* 1970

1A 217849

QUALITY ASSURANCE IN HIGHWAY CONSTRUCTION

QUALITY ASSURANCE IS RELATED TO THE QUESTIONS WHAT TO DO, HOW TO ORDER IT, HOW TO ASSURE GETTING WHAT WAS ORDERED. SPECIFICATIONS WRITTEN TO ANSWER THE SECOND QUESTION HAVE HERETOFORE NOT PERMITTED THE THIRD TO BE ANSWERED QUANTITATIVELY. ENGINEERING JUDGMENT CAN USUALLY ASSURE A GOOD PRODUCT, BUT "SUBSTANTIAL COMPLIANCE" IS DIFFICULT TO DEFINE LEGALLY OR CONTRACTUALLY; FURTHERMORE, TRUE VARIATIONS IN MATERIALS OR CONSTRUCTION CAN REMAIN UNKNOWN WITHOUT PROPER SAMPLING AND INTERPRETATIVE METHODS. NEW TEST METHODS AVAILABLE FOR QUALITY CONTROL ARE SURVEYED. MEANS OF INCLUDING STATISTICAL QUALITY CONTROL IN SPECIFICATIONS AND TESTS, THE DIFFERENCES BETWEEN PRODUCTION AND ACCEPTANCE TESTING, AND FEDERAL AND STATE EFFORTS TO PROMOTE STATISTICAL CONCEPTS IN QUALITY CONTROL ARE DISCUSSED. THE IMPACT ON CONTRACTOR--STATE RELATIONS IS TREATED BRIEFLY. DETAILED TREATMENT IS GIVEN IN SEPARATE ARTICLES TO STATISTICAL QUALITY ASSURANCE FOR EMBANKMENTS AND BASE COURSES, PORTLAND CEMENT, BITUMINOUS CONSTRUCTION, AND HIGHWAY AGGREGATES.

McMahon, TL Halstead, WJ Baker, WM Granley, EC Kelley, JA *Public Roads, Us Bureau Public Roads* 70

1A 217911

DEGRADATION OF LIMESTONE AGGREGATES DURING CONSTRUCTION

THERE IS GROWING EVIDENCE THAT THE STABILITY OR STRENGTH OF GRANULAR BASES IS NOT DIRECTLY RELATED TO GRADATION, DENSITY, OR PERCENTAGE OF THEORETICAL SOLID VOLUME. UNDER THESE CIRCUMSTANCES, QUESTION ARISES AS TO THE IMPORTANCE OF CONTROLLING GRADATION AND COMPACTION IN CONSTRUCTION. THE SAME EVIDENCE INDICATES THAT THE HARDNESS OR STRENGTH OF THE AGGREGATE PARTICLES MAY BE THE CONTROLLING FACTOR. EVEN SO, IF OVERSTRESSED THE BEARING POINTS WILL CRUSH UNTIL SUFFICIENT BEARING AREAS ARE PRODUCED TO WITHSTAND THE STRESS; THIS IS ACCOMPANIED BY VOLUME CHANGE AND DEGRADATION. IT CAN BE INFERRED THAT LOAD-INDUCED DEGRADATION PROCEEDS TO A STABLE STAGE. IT HAS BEEN ARGUED AT TIMES THAT GRADATION AND DENSITY ARE REDUNDANT REQUIREMENTS, AND THAT GRADATION REQUIREMENTS SHOULD BE WAIVED IF THE DENSITY IS ACHIEVED IN THE END PRODUCT. INDEED, THE POINT OF TESTING AND ACCEPTANCE WITH RESPECT TO DENSITY IS ON THE ROAD FOLLOWING COMPACTION. IF GRADATION CONTROL IS DEFERRED TO THIS POINT AND DENSITY IS ACHIEVED, A DILEMMA EXISTS. IF NEITHER DENSITY OR GRADATION REQUIREMENTS ARE MET IN THE END PRODUCT, UPSTREAM CONTROL OF THE GRADATION WOULD HAVE FOREWARNED OF THE PROBLEM. THE PRESENT STUDY WAS UNDERTAKEN TO DETERMINE WHETHER AND TO WHAT EXTENT CERTAIN PROPERTIES (PARTICULARLY GRADATION) OF KENTUCKY LIMESTONES USED IN BASE CONSTRUCTION CHANGED DURING THE CONSTRUCTION PERIOD. TWELVE CONSTRUCTION PROJECTS WERE USED IN THE PROGRAM. SAMPLES OF DENSE GRADED AGGREGATE WERE TAKEN AT THE PUGMILL, BEFORE SPREADING ON THE ROAD. AFTER SPREADING, AND AFTER COMPACTION. LABORATORY GRADATION ANALYSIS WAS PERFORMED ON ALL SAMPLES; LESS FREQUENTLY,

LARGER SAMPLES WERE TAKEN AT THE PUGMILL AND AFTER SPREADING AND SUBJECTED TO A SPECIFIC GRAVITY TEST, A DEGRADATION TEST, AND ATTERBERG LIMIT ANALYSIS. ANALYSIS-OF-VARIANCE COMPUTER PROGRAMS WERE WRITTEN. ON THE WHOLE THE KENTUCKY LIMESTONES--WHICH ARE VERY HARD, HIGH-QUALITY AGGREGATES--EXHIBITED NO SIGNIFICANT DEGRADATION UNDER CURRENT CONSTRUCTION PRACTICES.

Deen, RC Southgate, HF

Kentucky Department Highways Mar. 1972, pp 1-13, 10 Tab, 24 Ref

1A 218516

DATA STRUCTURE FOR A CONSTRUCTION COMPANY MANAGEMENT SYSTEM

THE OBJECT OF THIS PAPER IS TO OUTLINE A DATA STRUCTURE FRAMEWORK THAT WOULD MAKE POSSIBLE THE INTEGRATION OF THE VARIOUS DATA INVOLVED IN DATA PROCESSING INTO A MANAGEMENT INFORMATION SYSTEM FOR A CONSTRUCTION COMPANY. THE SCOPE OF CONSIDERATION OF A CONSTRUCTION COMPANY SYSTEM IS LIMITED TO THE FOUR BASIC OPERATIONS OF ACCOUNTING, PAYROLL, CPM, AND ESTIMATING. CPM IS ENVISAGED AS BOTH AN UPDATING AND MONITORING TOOL FOR THE ACTUAL CONSTRUCTION OPERATIONS, AS WELL AS A PLANNING AND SCHEDULING TOOL. THE DATA STRUCTURES IN THE FOUR OPERATIONS ARE DESCRIBED WITH EMPHASIS ON THE HIERARCHICAL ARRANGEMENT OF THE DATA. THE INTERACTION BETWEEN THE DATA STRUCTURES ON A COMPANY-WIDE BASIS IS DISCUSSED IN TERMS OF THE COMPANY ACTIVITIES OF BIDDING AND PRE-PROJECT PLANNING, PROJECT CONTROL, AND GENERATION OF HISTORICAL DATA. THE DATA STRUCTURE PRESENTED DEALS ONLY WITH THE FORMAT OF THE DATA, AND DOES NOT DEPEND IN ANY WAY ON THE CONTENTS OF THE DATA. THE VALUE OF THE SYSTEM TO THE USER DEPENDS EXCLUSIVELY ON HIS ABILITY TO FORMULATE HIS PARTICULAR REQUIREMENTS WITHIN THE CONTEXT OF THE STRUCTURE. /AUTHOR/

Froemming, AP Fenves, SJ *Highway Research Record, Hwy Res Board* 1969

1A 219351

AUTOMATIC BATCH PLANTS

A BRIEF HISTORY IS PRESENTED OF NEW YORK STATE'S EXPERIENCE WITH AUTOMATIC BATCH PLANTS. EMPHASIS IS BEING PLACED ON QUALITY ASSURANCE PROGRAMS BECAUSE OF: (1) THE ENORMOUS INCREASE IN THE HIGHWAY CONSTRUCTION PROGRAM WHICH REQUIRES THE ADOPTION OF BUSINESS PROCEDURES FOR ALL ACTIVITIES SO THAT DOCUMENTATION MUST BE PROVIDED WHICH PERMITS A COMPLETE REVIEW AND AUDIT BY PROGRAM MANAGEMENT, (2) THE INCREASE IN TECHNOLOGY PROVIDING A MORE SCIENTIFIC UNDERSTANDING OF THE DESIRABLE PROPERTIES OF MATERIALS, AND (3) THE SHORTAGE OF MANPOWER FOR INSPECTION, REQUIRING A QUALITY CONTROL SYSTEM, MAY BE HANDLED BY AN INSPECTOR WITH LIMITED TECHNICAL CAPACITY. THE DEPARTMENT'S SPECIFICATIONS, TOGETHER WITH NEW PROCEDURES FOR PLANT INSPECTION, DEFINE THE CURRENT APPROACH TO QUALITY CONTROL AT BATCH PLANTS WHICH INVOLVE: (1) THAT THE GRADATION OF EACH OF THE SIZES IN THE BINS BE KEPT WITHIN SPECIFIC RANGES, AND (2) THAT THE PROPORTIONING EQUIPMENT BE AUTOMATED SO AS TO ASSURE THAT THIS OPERATION WILL BE UNIFORM. IT IS REQUIRED THAT ALL BATCH WEIGHTS BE RECORDED. AS OF DECEMBER, 1968, 180 BITUMINOUS CONCRETE MIX PLANTS AND 143 PORTLAND CEMENT CONCRETE PLANTS HAVE AUTOMATIC PROPORTIONING AND RECORDING SYSTEMS. GENERAL CONSIDERATIONS, TO ALL PLANTS ARE: (1) THE SCALE AND CONTROL SYSTEM, (2) THE INTERLOCKING OVER AND UNDERWEIGHT CONTROLS, AND (3) THE RECORDING. THE RECORDER TELLS WHAT KIND OF MIX WAS PRODUCED AND PRODUCES A PERMANENT RECORD OF THE PROPORTIONAL CHARACTER-

1A SYSTEM CONSTRUCTION, MANAGEMENT & QUALITY CONTROL

ISTICS OF THE MATERIAL AND THE TOTAL WEIGHT OF THE BATCH. THE NEED FOR DOCUMENTATION, MAXIMUM USE OF NEW TECHNOLOGY AND EQUIPMENT, AND CONSERVATION OF MANPOWER IS PROVIDED BY: (1) AUTOMATIC RECORDING WHICH SUPPLIES THE REQUIRED DOCUMENTATION, (2) AUTOMATIC WEIGHING WITH INTERLOCKING OVER AND UNDERWEIGHT CONTROLS ILLUSTRATING AN ADVANTAGEOUS USE OF NEW MODERN EQUIPMENT AND ASSURES A HIGHER LEVEL OF PRODUCT UNIFORMITY, AND (3) THE NECESSARY PLANT INSPECTION REQUIRED FOR COMPLETE ENFORCEMENT OF THE QUALITY ASSURANCE PROGRAM CAN BE DONE BY ONE TECHNICIAN.

Mcalpin, GW *American Highways* Apr. 1969

1A 219891

CHECKLIST FOR SAFETY AT HIGHWAY WORKSITES

THE POTENTIAL HAZARDS TO TRAFFIC AT THE WORKSITE ARE ANALYZED AND DISCUSSED. TO ASSURE GREATER SAFETY, THE BUREAU OF PUBLIC ROADS PREPARED A GUIDE PROGRAM COVERING: (1) QUANTITY AND CONDITION OF WARNING AND REGULATORY SIGNS BEING USED, (2) RESTRICTION OF SIGHT DISTANCE OF PERMANENT SIGNS BY TEMPORARY SIGNS, (3) SHAPE, SIZE AND COLORING OF SIGNS, AND THEIR LEGIBILITY AND APPROPRIATENESS, (4) PROCEDURES FOR REMOVING OR COVERING SIGNS WHEN NOT NEEDED, (5) LOCATION OF SIGNS WITH RESPECT TO ROADWAY AND OPERATIONS IN PROCESS, (6) QUANTITY AND CONDITION OF BARRICADES, FLASHERS, LIGHTS, REFLECTORS, CONES, BARRELS, AND SO FORTH, (7) COMPETENCY AND COURTESY OF FLAGMAN AND CONDITION OF THEIR EQUIPMENT, (8) USE OF PILOT CARS, (9) SCHEDULING OF CONSTRUCTION OPERATIONS TO MINIMIZE INTERFERENCE WITH TRAFFIC, AND (10) PROTECTION AFFORDED WHEN CONSTRUCTION ACTIVITY IS SUSPENDED, PARTICULARLY AT NIGHT. IT IS RECOMMENDED THAT TRAFFIC CONTROL PLANS SHOULD BE AN INTEGRAL PART OF THE PROJECT PLANS AND SPECIAL PROVISIONS, AND MAJOR TRAFFIC CONTROL DEVICES SHOULD BE ITEMIZED. THE CONTRACTING AGENCY SHOULD INSIST ON A PRE-CONSTRUCTION CONFERENCE WITH REPRESENTATIVES OF THE CONTRACTOR, THE LAW ENFORCEMENT AGENCY, AND, WHEREVER APPROPRIATE, THE UTILITY COMPANIES WHICH MAY BE INVOLVED.

Mcgarry, TF *Constructor* Nov. 1966

1A 229908

THE SAND EQUIVALENT TEST FOR QUALITY CONTROL OF QUARRY PRODUCTS

THE USE OF STATISTICAL QUALITY CONTROL IN INDUSTRY HAS LONG BEEN RECOGNIZED AS AN IMPORTANT ADJUNCT TO EFFICIENT OPERATION, BUT IN THE EQUALLY COMPETITIVE FIELD OF ROAD CONSTRUCTION LITTLE IS MADE OF STATISTICAL TECHNIQUES AS AN AID TO SPECIFICATION WRITING AND THE CONTROL OF MATERIAL QUALITY. PAVEMENT MATERIALS ARE CUSTOMARILY SPECIFIED IN TERMS OF PLASTICITY INDEX AND MECHANICAL GRADING; HOWEVER THESE TESTS ARE NOT CONVENIENT FOR THE CONTROL OF PRODUCTION AND THE SAND EQUIVALENT TEST HAS FOUND EXTENSIVE USE IN THIS REGARD. TO EVALUATE THE CONTROL ACHIEVED BY THIS TEST, RESULTS FOR MATERIALS SUPPLIED BY SOME MELBOURNE QUARRIES OVER A PERIOD HAVE BEEN CORRELATED WITH PLASTICITY INDEX AND GRADING RESULTS. AFTER ALLOWING FOR THE EFFECT ON THE SAND EQUIVALENT TEST OF MOISTURE IN THE SAMPLE THE TEST WAS FOUND TO BE A SATISFACTORY INDICATOR OF QUALITY. THE EFFECT OF TEMPERATURE AND THE INFLUENCE OF THE VARIOUS ROCK TYPES GRADING, AND CLAY CONTAMINATION ON THE TEST WAS ALSO INVESTIGATED. THE PAPER CONCLUDES WITH THE DEVELOPMENT OF A TENTATIVE METHOD OF QUALITY CONTROL FOR QUARRY AND PLANT MIXED PRODUCTS USING THE SAND EQUIVALENT TEST. /AUTHOR/

Head, BL Raper, LR Kneipp, H DISCUSSEER Ackhurst, CA DISCUSSEER Proffitt, AT DISCUSSEER Hanks, JN DISCUSSEER Aus-

tralian Road Research Board Proc

1A 230583

QUALITY CONTROL ANALYSIS, PART 2, SOIL AND AGGREGATE BASE COURSE

AN ATTEMPT HAS BEEN MADE TO DETERMINE THE EXTENT OF VARIABILITY OF SOIL AND AGGREGATE BASE COURSE CHARACTERISTICS USING DATA COLLECTED FROM COMPLETED PROJECT FILES. ON THE BASIS OF THIS VARIABILITY, NUMERICAL LIMITS HAVE BEEN ESTABLISHED USING STATISTICAL QUALITY CONTROL TECHNIQUE. THE HISTORICAL DATA TEND TO FOLLOW NORMAL DISTRIBUTION. UNSTABILIZED AGGREGATE BASE COURSE HAS LESS VARIABILITY THAN STABILIZED BASE COURSES AND THE SIGMAS ARE CONSIDERABLY DIFFERENT FOR DIFFERENT CONTRACTORS.

Louisiana Department Highways

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4721183 66)1C33020631, 1C62020484, PB-173 925 \$ 3.00

1A 230596

AN APPRAISAL OF SAND DRAIN PROJECTS DESIGNED AND CONSTRUCTED BY THE NEW YORK STATE DEPARTMENT OF PUBLIC WORKS

FOUR SAND DRAIN PROJECTS WERE INVESTIGATED TO DETERMINE THE EFFECTIVENESS OF THE SAND DRAIN TREATMENT IN STABILIZING THE SOFT FOUNDATION SOILS AND IN REDUCING POST-CONSTRUCTION SETTLEMENTS. TWO SAND DRAIN INSTALLATIONS WERE MADE PRIMARILY TO STABILIZE SOFT MARL AND CLAY. THE RESULTS INDICATED THAT THE DESIGN METHOD CORRECTLY PREDICTED PERFORMANCE. TWO INSTALLATIONS WERE MADE PRIMARILY TO STABILIZE DEEP DEPOSITS OF ORGANIC CLAY. IN THE FIRST CASE, WHERE A CLOSED END MANDREL /DISPLACEMENT/ METHOD WAS USED, POST-CONSTRUCTION SETTLEMENT OF 1.5 FEET FAR EXCEEDED THE DESIGNERS EXPECTATIONS. IN THE SECOND CASE, WHERE A HOLLOW-SHAFT FLIGHT AUGER /MINIMUM DISPLACEMENT/ METHOD WAS USED FOR INSTALLATION OF DRAINS, POST-CONSTRUCTION SETTLEMENT WAS SMALL AND WERE EQUAL TO DESIGN EXPECTATIONS. THE INVESTIGATION OF ALL FOUR SITES INDICATED THAT THE SUBSURFACE INVESTIGATION, TESTING, AND FOUNDATION DESIGN METHODS USED BY THE DEPARTMENT TO PREDICT THE STRENGTH AND SETTLEMENT ARE REASONABLY ACCURATE. /AUTHOR/

Moore, LH Grosert, T
New York State Dept Transportation

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4854054 66)

1A 230615

STUDY OF EMBANKMENT SETTLEMENT AND STABILITY
THE DESIGN SELECTED FOR STABILIZING THE EMBANKMENT FOUNDATION REQUIRED PORE PRESSURE MEASUREMENTS WITHIN THE FOUNDATION SOIL DURING CONSTRUCTION. IN ADDITION TO PORE PRESSURE, THE RESEARCHERS MEASURED SETTLEMENT AND HORIZONTAL DISPLACEMENTS. FOUNDATION SOIL SAMPLES WERE ALSO TAKEN AND TESTED FOR SHEAR STRENGTH. GENERALLY, THE STRENGTH OF THE FOUNDATION SOIL INCREASED WITH CONSOLIDATION AND THE ENGINEERS WERE ABLE TO MAINTAIN A STABLE CONDITION BY CONTROLLING THE RATE OF EMBANKMENT CONSTRUCTION. THE PREDICTED AMOUNT OF SETTLEMENT /UP TO 2.75 FEET/ AGREED CLOSELY WITH THAT MEASURED. /BPR/

Nebraska Department Roads

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4654242 67)CFSTI PB 177 461, HRIS 62 020788, 1C62020891

SYSTEM CONSTRUCTION, MANAGEMENT & QUALITY CONTROL 1A

1A 230616

DETERMINATION OF EMBANKMENT DENSITY BY THE SEISMIC METHOD

THE APPLICATION OF SEISMIC TECHNIQUES FOR THE MEASUREMENT OF SOIL DENSITY IN CONSTRUCTION CONTROL WAS EXAMINED BY EXTENSIVE FIELD WORK ON ACTUAL EMBANKMENT CONSTRUCTION PROJECTS. MEASUREMENTS OF SOIL DENSITY AND SEISMIC WAVE VELOCITY WERE OBTAINED FROM TEST PLATFORMS EACH OF WHICH WAS TESTED AT THREE STATES OF COMPACTION, LOOSE, INTERMEDIATE & HIGHLY COMPACT. A SIMPLE LINEAR RELATIONSHIP BETWEEN VELOCITY AND DENSITY WAS EXPECTED. THE RAW FIELD DATA SHOW THAT: /1/ INDIVIDUAL SOILS CANNOT BE GROUPED TO AFFORD SIMPLE CORRELATION OF VELOCITY WITH DENSITY. /2/ THE RELATION BETWEEN VELOCITY AND DENSITY FOR A GIVEN SOIL IS OF A PARABOLIC-NOT LINEAR-CHARACTER IN THE RANGE OF INTEREST, AND /3/ THE ELASTIC CONSTANTS OF SOILS ARE FAR MORE VARIABLE THAN ORIGINALLY SUPPOSED, AND FAR MORE IMPORTANT THAN SMALL CHANGES IN DENSITY. THE THEORY OF WAVE PROPAGATION IN ELASTIC BODIES WAS INVESTIGATED WITH REGARD TO DEGREE OF CORRESPONDENCE WITH FIELD DATA ON COMPACTED SOILS. DENSITY MEASUREMENTS BY THREE DIFFERENT METHODS WERE STUDIED IN RELATION TO SCATTER IN VALUES IN EXCESS OF THE RANGE OF PRECISION KNOWN FOR THE METHODS. AN ENTIRELY NEW APPROACH TO COMPACTION EMERGED, BASED UPON THE SOIL RESPONSE TO DYNAMIC WAVE PROPAGATION. THE COMPACTION PROCESS IS A PROCESS OF DENSIFICATION ONLY IN THE VERY EARLY STAGES. DENSITY CHANGES WITH FURTHER COMPACTION DIMINISH RAPIDLY WHILE THE ELASTIC MODULI BECOME SUBSTANTIALLY INCREASED. THE REPORT DISCUSSES THE UTILITY OF A DYNAMIC APPROACH TO EMBANKMENT PERFORMANCE AND VIEWS THE LATTER AS A CONSEQUENCE OF THE PRESENCE OR ABSENCE OF AN ELASTIC SOIL REPOSE TO DYNAMIC STRESSES IMPOSED IN SERVICE.

Weaver, RJ Rebull, PM

New York State Dept Transportation Hpr-pr-1/1/, Dec. 1966

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4722944 66)PB 175 763, 1C62020900

1A 230681

BITUMINOUS STABILIZATION FIELD PROJECT, WADENA COUNTY

THE FINAL REPORT IS PRESENTED OF A FIELD STUDY FEATURING STABILIZATION OF SANDY SUBGRADE SOILS WITH EMULSIFIED ASPHALT (SS-1) CUT BACK ASPHALT (MC-2) AND ROAD TAR (RT-6) TO UPGRADE THEM TO SERVE AS AN ADEQUATE BASE COURSE FOR LOW TRAFFIC DENSITY ROADS. THE SUBGRADE WAS STABILIZED TO A DEPTH OF 2 TO 4 IN. AND SURFACED WITH A 1 1/2 INCH BITUMINOUS MAT AND SAND SEAL COAT RESPECTIVELY. THE RESEARCH WAS RATHER INCONCLUSIVE PARTLY DUE TO SOMEWHAT POOR CONSTRUCTION CONTROL OF THE SOIL MOISTURE CONTENT AT THE TIME OF MIXING AND THE AMOUNT OF BITUMINOUS MATERIAL ADDED. LACK OF CONTROL RESULTED IN THE BASE MATERIAL REMAINING SOFT AFTER COMPACTION. ALTHOUGH CONSTRUCTION DIFFICULTIES AND THE ABSENCE OF FAILURES PRECLUDED EVALUATION OF DESIGN PROCEDURE USED BY OBSERVING THE RELATIVE PERFORMANCE OF THE VARIOUS SECTIONS SOME GENERAL CONCLUSIONS WERE DEVELOPED: (1) STABILIZATION OF SANDY SUBGRADES WITH BITUMINOUS MATERIALS AND SURFACING WITH A SEAL COAT OR BITUMINOUS MAT PROVIDES A SUITABLE ROADWAY FOR AREAS WITH SIMILAR SOIL AND TRAFFIC CONDITIONS, (2) A 4-IN. BASE AND SEAL COAT COMBINATION IS MORE ECONOMICAL THAN 2 IN. BASE 1 1/2-IN. BITUMINOUS MAT COMBINATION, AND (3) NO APPARENT BENEFITS RESULT FROM ADDITION OF MORE THAN 4 PERCENT BITUMINOUS MATERIAL. /BPR/

Korfhage, GR

Minnesota Department of Highways, Bureau of Public Roads /US/

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4651272 69)CFSTI PB 185 446, 1C62021636

1A 230759

DYNAMIC STUDIES ON THE BEARING CAPACITY OF PILES-PROJECT REPORT ON PHASE III

AN AUTOMATED PREDICTION SCHEME IS PRESENTED WHICH USES BOTH MEASURED FORCE AND ACCELERATION AT THE TOP OF THE PILE AS INPUT AND COMPUTES THE SOIL RESISTANCE FORCES ACTING ON THE PILE DURING DRIVING. THE DISTRIBUTION OF THESE RESISTANCE FORCES ACTING ALONG THE PILE IS ALSO DETERMINED. SHEAR AND DYNAMIC RESISTANCE FORCES ARE DISTINGUISHED SUCH THAT A PREDICTION OF TOTAL STATIC BEARING CAPACITY IS POSSIBLE. USING THE SHEAR FORCE PREDICTION, A STATIC LOAD VERSUS PENETRATION CURVE IS COMPUTED FOR COMPARISON WITH THE RESULT FROM A CORRESPONDING FIELD STATIC LOAD TEST. USING STRESS WAVE THEORY TWO SIMPLIFIED METHODS ARE DEVELOPED FOR PREDICTING STATIC BEARING CAPACITY FROM ACCELERATION AND FORCE MEASUREMENTS. THESE METHODS CAN BE USED DURING FIELD OPERATIONS FOR CONSTRUCTION CONTROL WHEN INCORPORATED IN A SPECIAL PURPOSE COMPUTER. THE AUTOMATED PREDICTION SCHEME AND SIMPLIFIED METHODS ARE APPLIED TO 24 DIFFERENT SETS OF DATA FROM FULL SCALE PILES. THE PILES WERE ALL OF 12 INCHES DIAMETER STEEL PIPE WITH LENGTHS RANGING FROM 33 TO 83 FEET. ALSO, 24 SETS OF DATA FROM REDUCED SCALE PILES ARE ANALYZED BY THE SIMPLIFIED METHODS. ALL PREDICTIONS ARE COMPARED WITH RESULTS FROM STATIC LOAD TESTS. CORRELATION IS VERY GOOD FOR PILES DRIVEN INTO NON-COHESIVE SOILS. FOR COHESIVE SOILS, BETTER AGREEMENT WITH STATIC LOAD MEASUREMENTS ARE OBTAINED THAN FROM EXISTING METHODS. /FHWA/

Goble, GG Rausche, F Moses, F

Case Western Reserve University, Federal Highway Administration /US/ Vol. I &

ACKNOWLEDGMENT: Federal Highway Administration NTIS PB 207228, 3C62022896

1A 230916

MEASURED PORE PRESSURES USED FOR THE CONTROL OF TWO STAGE CONSTRUCTION OF AN EMBANKMENT BECAUSE OF SOFT FOUNDATION SOIL IT WAS NECESSARY TO USE TWO STAGE CONSTRUCTION FOR A DOUBLE-TRACK RAILWAY EMBANKMENT VARYING IN HEIGHT FROM 21 TO 33 FEET. EFFECTIVE STRESS METHODS OF ANALYSIS WERE USED AND PIEZOMETERS WERE INSTALLED IN THE FOUNDATION SOIL TO INDICATE THE PORE PRESSURES. PORE PRESSURES MEASURED DURING THE FIRST-STAGE LOADING INDICATED THAT THE SECOND STAGE COULD BE ADDED TO COMPLETE THE EMBANKMENT ABOUT A YEAR AFTER THE FIRST STAGE. MEASUREMENTS OF PORE PRESSURES CONTINUED DURING THE SECOND STAGE LOADING SO THAT A CONTINUING CHECK ON STABILITY COULD BE MAINTAINED. THE EMBANKMENT WAS SUCCESSFULLY COMPLETED. /CGRA/

Delory, FA Gass, AA Wong, WW *Canadian Geotechnical Journal*

1A 231021

CURRENT SPECIFICATIONS, FIELD PRACTICES AND PROBLEMS IN COMPACTION FOR HIGHWAY PURPOSES THE CURRENT STATUS OF HIGHWAY SPECIFICATIONS AND FIELD PRACTICES FOR COMPACTION OF EMBANKMENTS, SUBGRADES AND GRANULAR BASES IS SUMMARIZED. THE INFORMATION HAS BEEN OBTAINED FROM THE PUBLISHED STANDARD SPECIFICATIONS OF THE 50 STATES AND FROM AN EXTENSIVE INTERVIEW PROGRAM WITH STATE HIGHWAY ENGINEERS. CONSTRUCTION SPECIFICATIONS AND PROCEDURES FOR EMBANKMENTS, SUBGRADES AND GRANULAR BASES ARE SUMMARIZED AND FOLLOWED BY DISCUSSIONS OF THE PROBLEMS RELATED TO THE PRACTICAL APPLICATION OF THE SPECIFICATIONS TO FIELD CONSTRUCTION.

1A SYSTEM CONSTRUCTION, MANAGEMENT & QUALITY CONTROL

QUALITY CONTROL PROCEDURES AND RELATED PROBLEMS ALSO ARE DISCUSSED. THE REVIEW INDICATES THAT THE MAJORITY OF EMBANKMENT AND SUBGRADE COMPACTION IS ACCOMPLISHED BY CONTROLLING LIFT THICKNESS AND MOISTURE CONDITIONS AND BY SPECIFYING MINIMUM DENSITY REQUIREMENTS, USUALLY AS A PERCENT OF THE MAXIMUM DENSITY DETERMINED FROM THE AASHTO T-99 TEST. THE MAJOR PROBLEMS ARE ENCOUNTERED IN SILTS, VERY WET CLAYS OF HIGH PLASTICITY AND EXPANSIVE CLAYS. CONSTRUCTION PRACTICES TO OVERCOME THESE PROBLEMS ARE NOTED. CONTROL PROBLEMS NOTED INCLUDE THE TIME REQUIRED FOR CONVENTIONAL FIELD DENSITY MEASUREMENTS AND THE DIFFICULTY IN ESTIMATING THE PROPER AASHTO T-99 MAXIMUM DENSITY FOR HETEROGENEOUS FIELD MATERIALS. THE ROLE OF STATISTICAL QUALITY CONTROL TECHNIQUES IS DISCUSSED. THE RELATION OF ENGINEERING JUDGMENT TO STATISTICAL PROCEDURES IS PRESENTED. A SUMMARY OF THE MAJOR COMPACTION PROBLEMS AS DETERMINED FROM INTERVIEWS WITH MANY HIGHWAY ENGINEERS IS ALSO INCLUDED. /AUTHOR/

Wahls, HE *Highway Research Record, Hwy Res Board*

1A 231048

THE VENEMO ASPHALT-FACED ROCK-FILL DAM

THE PAPER DESCRIBES THE DESIGN AND CONSTRUCTION OF THE VENEMO DAM, A DAM WITH AN IMPERVIOUS FRONTAL FACING OF ASPHALTIC CONCRETE AND A FILL CONSISTING OF TUNNEL SPOIL. COMPACTION FIELD TESTS ON TUNNEL SPOIL WERE CARRIED OUT AND THE COMPRESSION OF THE ROCK FILL WAS MEASURED BY MEANS OF CROSS ARMS INSTALLED IN THE FILL. A DESCRIPTION OF THE CONSTRUCTION OF THE DAM AND OF THE ASPHALTING IS GIVEN TOGETHER WITH THE RESULTS OF QUALITY CONTROL. THE PERFORMANCE OF THE DAM AFTER ONE YEAR IN SERVICE IS CHECKED BY MEASUREMENTS OF THE SEEPAGE THROUGH THE DAM AS WELL AS OF THE COMPRESSION OF THE FILL. /AUTHOR/

Kjernsli, B Torblaa, I *Norwegian Geotechnical Institute Publ*

1A 231051

MICHIGANS EXPERIENCE WITH NUCLEAR GAGES FOR MEASURING SOIL COMPACTION

MICHIGANS RESEARCH IN NUCLEAR METHODS FOR HIGHWAY FOUNDATION COMPACTION CONTROL IS DESCRIBED FROM ITS INCEPTION IN 1952 THROUGH A MAJOR FIELD EXPERIMENT IN 1955-66 DURING FREEWAY CONSTRUCTION. THE EQUIPMENT USED IS DISCUSSED AS WELL AS GAGE CALIBRATION PROCEDURES, TRAINING OF INSPECTION PERSONNEL, FIELD TESTING PROCEDURES, AND SAFETY PRECAUTIONS. THE NUCLEAR METHOD HAS PROVED SUITABLE FOR FIELD USE, IN WHICH IT SAVES TIME AND REDUCES OPERATOR FATIGUE. SPECIAL STUDIES, IN ADDITION TO DEVELOPMENT OF THE MICHIGAN COMBINATION DENSITY-MOISTURE GAGE, ARE OUTLINED, INCLUDING EVALUATION OF OTHER EQUIPMENT AND USE OF STATISTICAL CONTROL METHODS. /AUTHOR/

Mainfort, RC
Michigan Dept State Highways

1A 231172

STATISTICAL CONTROL OF DRY DENSITY

THE PAPER PRESENTS A SIMPLIFIED STATISTICAL APPROACH FOR THE CONTROL OF DRY DENSITY IN ROAD CONSTRUCTION. IN THE PROPOSED SAMPLING SCHEME A METHOD IS OUTLINED WHEREBY ENGINEERING DECISIONS CAN BE TAKEN ON THE NUMBER OF SAMPLES TO BE TESTED TO SATISFY VARIOUS ENGINEERING REQUIREMENTS SUCH AS THE ERROR IN TEST RESULTS AND THE DESIRED LIMITS OF ACCURACY FOR A SPECIFIED PROBABILITY. DECISIONS BASED ON THE SAMPLING SCHEME ARE USED, ALSO, TO DEFINE THE REQUIREMENTS FOR THE DESIGN, SPECIFICATION AND CONTROL OF DRY DENSITY IN A ROAD LAYER. BY

COMPARING THE AVERAGE DENSITY OBTAINED FROM THE SPECIFIED NUMBER OF OBSERVATIONS WITH THE SPECIFICATION DENSITY, A RELIABLE DECISION CAN BE TAKEN IMMEDIATELY ON THE ACCEPTANCE OR REJECTION OF THE COMPLETED LAYER. /AUTHOR/

Kuhn, SH Burton, RW *Csir Research Reports /South Africa/*

1A 231453

DESIGN AND CONSTRUCTION OF AGGREGATE BASE COURSES WITH CALCIUM CHLORIDE

AGGREGATE BASE COURSES ARE DEFINED AS THE USE OF WELL GRADED, SOUND AND DURABLE CRUSHED STONE, GRAVEL OR OTHER SUITABLE AGGREGATES AS FOUNDATION COURSES FOR BITUMINOUS PAVEMENTS. FINAL PERFORMANCE DEPENDS UPON DESIGN, MATERIALS AND CONSTRUCTION. THE DESIGN TREND NOW IS TOWARD THE USE OF EQUATIONS OR FORMULAS BASED ON RELATIONSHIPS BETWEEN TRAFFIC AND VARIOUS PAVEMENT DESIGNS. BETTER CONSTRUCTION CONTROL AND PRACTICES ARE ADVOCATED TO HELP ATTAIN MAXIMUM PERFORMANCE FROM THE NATURAL SUBGRADE, SUBBASE AND BASE COURSE MATERIALS AND THUS IMPROVE PAVEMENT PERFORMANCE. SEVEN EXAMPLES ARE OUTLINED OF POOR CONSTRUCTION PRACTICES OFTEN ASSOCIATED WITH AGGREGATE BASE COURSE CONSTRUCTION. IT IS POINTED OUT THAT THE USE OF CALCIUM CHLORIDE IN BASE CONSTRUCTION, WITH THE RESULTING UNIFORM MOISTURE CONTROL, PROVIDES THE FOLLOWING BENEFITS: (1) IT AIDS COMPACTION AND INCREASES DENSITY, (2) IT REDUCES OR ELIMINATES THE NEED FOR SURFACE APPLICATIONS OF WATER (3) IT PERMITS CARRYING OF TRAFFIC WITHOUT RAVELLING OR DUST, (4) IT PROVIDES A MORE STABLE PLATFORM FOR PLACING EQUIPMENT, (5) IT PERMITS USE OF MINIMUM FINES OR BINDER, AND (6) IT ACTS AS A QUALITY CONTROL INGREDIENT TO HELP INSURE DESIRED RESULTS. IT IS CONCLUDED THAT HIGH QUALITY GRADED AGGREGATE BASE COURSES HAVE A DEFINITE PLACE IN BALANCED DESIGN OF MODERN FLEXIBLE PAVEMENTS BASED ON YEARS OF ACCUMULATED PERFORMANCE, THE AASHTO ROAD TEST AND LATEST RESEARCH. THE PROPER USE OF CALCIUM CHLORIDE IN AGGREGATE BASE COURSES INSURES AN EFFECTIVE METHOD OF ACHIEVING MAXIMUM PERFORMANCE FROM QUALITY MATERIALS.

Smith, HA
Am Assoc State Highway Officials Oct. 1965

ACKNOWLEDGMENT: Calcium Chloride Institute

1A 231685

PROBLEMS OF SOIL STABILIZATION AND THE SCIENTIFIC CONTROL OF CONCRETE FOR ROAD WORKS

A DETAILED ACCOUNT IS GIVEN OF THE CLOSELY CONTROLLED CONSTRUCTION OF CONCRETE AND CEMENT-STABILIZED HOGGIN ROADS AND FOUNDATION SLABS FOR PRE-FABRICATED HOUSES ON A HOUSING SITE AT LUDON. METHODS OF CARRYING OUT AND INTERPRETING TESTS ON AGGREGATES, CONCRETE, AND STABILIZED HOGGIN ARE DESCRIBED, AND A LIST IS GIVEN OF EQUIPMENT FOR A FIELD LABORATORY.

Gauntlett, HD *J Inst Munic Engrs /UK/, Road Abstracts /UK/*

ACKNOWLEDGMENT: Highway Research Board Bibliography

1A 231725

SOIL-CEMENT CONSTRUCTION. HANDBOOK.

THE HANDBOOK PRESENTS IN PRACTICAL FORM THE COMPLETE PROCEDURES FOR BUILDING SOIL-CEMENT ROADS, STREETS, AIRPORTS, PARKING, AND STORAGE AREAS AND SHOULDERS. PROCEDURES FOR SOIL SAMPLING AND FOR INSPECTION AND FIELD CONTROL ARE INCLUDED.

Portland Cement Association

ACKNOWLEDGMENT: Highway Research Board Bibliography

SYSTEM CONSTRUCTION, MANAGEMENT & QUALITY CONTROL 1A

1A 231943

ECONOMICAL ROAD CONSTRUCTION IN MARSHY AREAS /IN GERMAN/

THE AUTHOR DESCRIBES HOW FIRM ECONOMICAL ROADS WERE BUILT UNDER THE MOST DIFFICULT SUBSOIL CONDITIONS IN THE REGION OF THE GREAT MARSH NEAR RENDSBURG IN SCHLESWIG-HOLSTEIN, AND HOW THE SPECIAL PROBLEMS WHICH AROSE WERE SOLVED. ACCORDING TO THE TENDERING, SPECIFICATION CEMENT Z.275 HAD TO BE USED TO SOLIDIFY THE SOIL, AND A GUIDE VALUE OF 140 KG/CUBED SOIL SOLIDIFICATION WAS GIVEN. THE REQUIREMENT WAS A CRUSHING STRENGTH OF 30-40 KP/SQUARED AFTER EIGHT DAYS (A CUBE OF 20 CM EDGE LENGTH AFTER STORAGE ACCORDING TO DIN 1048). SAMPLE MEASUREMENTS SHOWED THAT DURING THE CONSTRUCTION TIME THE REQUIRED MINIMUM CRUSHING STRENGTH WAS NOT ATTAINED, IN SPITE IF 180 KG/CUBED OF CEMENT BEING USED. WITH THE SUBSEQUENT USE OF PECTRACTRETE CEMENT Z375 IN A QUANTITY OF 120 KG/CUBED CRUSHING STRENGTHS WERE OBTAINED WHICH WERE GREATER THAN THE REQUIRED MINIMUM, VALUE. HUMIC CONSTITUENTS IN THE SAND WERE CHEMICALLY NEUTRALIZED THROUGH THE ADDITION OF CALCIUM CHLORIDE AMOUNTING TO 2 PER CENT OF THE CEMENT WEIGHT, THE CONSTRUCTION IS DESCRIBED IN DETAIL. /FG/RRL/

Simon, P *Strassenbautechnik, Cologne /Ger/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

1A 232001

GENERAL PROCEDURE IN INVESTIGATION, DESIGN, AND CONTROL DURING CONSTRUCTION OF EARTH AND ROCK-FILL DAMS IN NORWAY

THE METHODS OF STUDYING, CONSTRUCTING AND CONTROLLING EARTH AND ROCK-FILL DAMS RECOMMENDED BY THE NORWEGIAN GEOTECHNICAL INSTITUTE ARE DESCRIBED. SPECIAL REFERENCE IS MADE TO SELECTION OF SITES AND MATERIALS, LABORATORY MEASUREMENTS OF SOIL CHARACTERISTICS, WORK PROJECTS, STABILITY STUDIES, AND EXECUTION AND CONTROL DURING CONSTRUCTION. NUMEROUS EXAMPLES ARE APPENDED. IN PARTICULAR THE CHARACTERISTIC CURVE OBTAINED IN THE LABORATORY FOR A MORRAINE USED TO BUILD A WATERTIGHT CORE, RESULTS OF A STABILITY STUDY, AND CHARACTERISTICS OF 23 EARTH AND ROCK-FILL DAMS CONSTRUCTED IN NORWAY DURING THE LAST TEN YEARS. /LCPC/RRL/

Kjoernsli, B
Norwegian Geotechnical Inst

ACKNOWLEDGMENT: Road Research Laboratory /UK/

1A 232147

THE USE OF SLAG-TREATED MATERIALS IN THE DOMONT BY-PASS /IN FRENCH/

THE PROBLEMS OF DESIGN, APPLICATION AND CONSTRUCTION TIME RESULTING FROM THE VERY LOW QUALITY OF EXCAVATED SOILS AND THE UNEXPECTEDLY HIGH LEVEL OF THE WATER-TABLE DURING THE CONSTRUCTION OF THE DOMONT-PONCELLS BY-PASS ARE OUTLINED. GRANULATED SLAG WAS USED FOR TREATING THE SUB-BASE (FINE SAND) AND BASE COURSE (0/25 SLAG). DETAILS OF THE MATERIALS, PRODUCTION, APPLICATION AND CONTROL METHODS USED FOR EACH LAYER ARE GIVEN. THE COST OF THE MATERIALS UTILIZED IS QUOTED. /LCPC(A)/RRL/

Compere, C Lefort, M Coutant, R *Bull Liaison Labs Routiers /France/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

1A 232310

GRANULAR IMPROVED SUBGRADES, SUB-BASES AND ROADBASES /IN SPANISH/

AFTER A BRIEF OUTLINE OF ROAD CONSTRUCTION DEVELOPMENTS, FLEXIBLE AND RIGID PAVEMENTS ARE DEFINED

AND A STUDY IS MADE OF FLEXIBLE PAVEMENTS. DETAILS ARE GIVEN OF THE FLEXIBLE PAVEMENT STRUCTURE USING A PRACTICAL MODEL OF MECHANICAL BEHAVIOR, WHICH ASSUMES THAT PARTICLES ARE IDENTICAL AND SPHERICAL. THE INFLUENCE OF GRADING ON THE STRENGTH OF THE PAVEMENT IS INVESTIGATED TOGETHER WITH ITS EVOLUTION IN TIME WHEN IT CONTAINS MATERIALS WHICH ARE NOT SUFFICIENTLY HARD AND FAIL UNDER LOAD. ATTENTION IS DRAWN TO FINES CONTENT AND THE INFLUENCE OF FINES. IT SEEMS THAT THE STABILITY OF THE PAVEMENT INCREASES WITH THE VOLUME OF THE AGGREGATES. THE MECHANICAL BEHAVIOR OF AGGREGATES, THEIR MANUFACTURE, QUALITY CONTROL, AND APPLICATION ARE EXAMINED TOGETHER WITH THE INFLUENCE OF THE FINES MANUFACTURING PROCESS ON COMPACTION AND THE EQUIPMENT NEEDED. /TRRL/

Navacerrada, G
Mat, Maq Y Met Para La Constr /Spain/ No. 63, June 1969, pp 439-52, 4 Fig

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

1A 232437

STATISTICAL ANALYSIS OF DENSITY TESTS

THE PRINCIPLES OF STATISTICAL ANALYSIS ARE EXPLAINED AND USED TO MAKE A COMPARISON OF THE RELATIVE EFFECTIVENESS OF DIFFERENT TESTING AND COMPACTION METHODS FOR VARIOUS TYPES OF SUBGRADE AND BASE COURSE MATERIALS FOR ROADWAY WORK. THE NUCLEAR AND CONVENTIONAL DENSITY TESTING METHODS ARE COMPARED. THE COMPACTION OBTAINED BY SHEEPSFOOT ROLLERS, PNEUMATIC-TIRED CONSTRUCTION TRAFFIC, AND HAND OPERATED VIBRATORY-IMPACT EQUIPMENT IS ANALYZED AND COMPARED STATISTICALLY FOR VOLCANIC TUFF SUBGRADES AND VARIABLE SOIL TYPE SUBGRADES. IN THE LIGHT OF THE NORMAL DISTRIBUTION THEORY, THE MINIMUM DENSITY REQUIREMENT FOUND IN MOST SPECIFICATIONS IS SEEN TO BE UNREALISTIC. STATISTICAL ANALYSIS OF EARTHWORK CAN ALSO BE USED AS A TOOL IN KEEPING CONSTRUCTION CONTROL CHARTS TO ACHIEVE BETTER PRODUCT OR QUALITY CONTROL. /ASCE/

Pettitt, RA *Am Soc Civil Engr J Highway Div*

1A 232497

SAND DRAINS FOR EMBANKMENT ON MARL FOUNDATION

THE ENGINEERING DETAILS ARE DESCRIBED IN THE ESTABLISHMENT OF AN EMBANKMENT ON A SOFT FOUNDATION CONSISTING OF 60 FT. OF MARL AND SILT. AFTER ESTABLISHING THE SOIL PROFILE BY FIELD EXPLORATIONS, UNDISTURBED SOIL SAMPLES WERE TESTED TO DETERMINE THE STRENGTH AND CONSOLIDATION CHARACTERISTICS OF THE FOUNDATION MATERIALS. ANALYSES WERE THEN MADE OF VARIOUS DESIGN TREATMENTS, CONSIDERATION BEING GIVEN TO THE AVAILABILITY OF MATERIALS, THE RIGHTS-OF-WAY REQUIREMENTS, THE POSSIBLE CONSTRUCTION SEQUENCE AND REQUIRED TIME OF COMPLETION, AND THE OVERALL COSTS. THE USE OF SAND DRAINS WAS FOUND TO BE MOST ADVANTAGEOUS. A DESCRIPTION IS GIVEN OF THE PRECONSTRUCTION CONSIDERATION INVOLVING THE: DESIGN LAYOUT OF THE DRAINS (SPACING AND DEPTH), DIAMETER OF DRAINS, NECESSARY CONSTRUCTION CONTROL DEVICES SUCH AS PORE-PRESSURE DEVICES, SETTLEMENT PLATES AND ALIGNMENT STAKES, AND RATE OF CONSTRUCTION AND SURCHARGE. COMPARISON IS MADE BETWEEN THE ANTICIPATED AND ACTUAL BEHAVIOR OF THE OF THE EMBANKMENT AND ITS FOUNDATION DURING CONSTRUCTION. THE DATA OBTAINED FROM FIELD MEASUREMENTS ARE PRESENTED AND ARE COMPARED TO THOSE OBTAINED FROM PRECONSTRUCTION ANALYSES. COMMENTS ARE MADE CONCERNING THE EFFECTIVENESS OF SAND DRAINS AT THIS INSTALLATION AND A NOTE MADE OF THE GENERAL APPLICATION OF THE PROCEDURE OF TREATMENT. /AUTHOR/

1A SYSTEM CONSTRUCTION, MANAGEMENT & QUALITY CONTROL

Mcalpin, GW Sinacori, MN *Highway Research Board Bulletin*

1A 232498

STABILIZATION OF MARSH DEPOSIT

THE METHOD OF STABILIZATION OF MARSH DEPOSITS AT SWIMMING RIVER, RED BANK, N.J., IS PRESENTED WITH EMPHASIS ON THE USE OF VERTICAL SAND DRAINS. THE AIM OF THE DESIGN WAS TO ACCOMPLISH THE PREDICTED SETTLEMENT WITHIN A SPECIFIC CONSTRUCTION TIME AND TO INSURE STABILITY OF THE EMBANKMENT AGAINST SHEAR FAILURE AT ALL TIMES. THIS PAPER DESCRIBES CONSTRUCTION MATERIALS AND ORDER OF PROCEDURE USED IN THE STABILIZATION WORK AND SUCH CONTROL DEVICES AS PIEZOMETERS, EMBANKMENT CONTROL STAKES, AND SETTLEMENT PLATFORMS. DURING CONSTRUCTION, A SIMPLE AND QUICK METHOD OF DETERMINING THE APPROXIMATE PERCENT CONSOLIDATION ACCOMPLISHED WITHIN THE COMPRESSIBLE SOIL MASS IN EACH STAGE OF LOADING WAS USED. THE WORKABILITY IS INDICATED OF THE SAND DRAIN METHOD OF STABILIZATION AT SWIMMING RIVER WHERE HIGHLY COMPRESSIBLE SOIL IS LOCATED. SETTLEMENT OF GREAT MAGNITUDE WAS ACCOMPLISHED IN A RELATIVELY SHORT TIME WITH NO SHEAR FAILURE. THE CORRELATION BETWEEN THE PREDICTED AND ACTUAL SETTLEMENT IN MOST AREAS INDICATED THAT THIS METHOD OF STABILIZATION WITH CLOSE CONTROL OF FIELD WORK CAN BE DEPENDENT UPON TO PRODUCE SATISFACTORY AND PREDICTABLE RESULTS. DRAWINGS SHOW A TYPICAL SOIL PROFILE, LIMITS OF STABILIZATION, A TYPICAL DESIGN PLAN INCLUDING THE LAYOUT OF THE CONTROL DEVICES, A TYPICAL HALF-SECTION OF THE EMBANKMENT, DETAILS OF THE CONTROL DEVICES, A TYPICAL FIELD OBSERVATION RECORD, FIELD CONTROL CHART, AND A TYPICAL SETTLEMENTS, ETC. /AUTHOR/

Tsien, SI *Highway Research Board Bulletin*

1A 232551

COMPUTER PROGRAM TO REPORT AND EVALUATE FIELD TEST DATA FOR EMBANKMENT AND BASE CONSTRUCTION

A COMPUTER PROGRAM WAS DEVELOPED IN MONTANA TO DEVELOP AND REPORT FIELD TEST DATA, TO ASSIST IN MONITORING CONSTRUCTION PROJECTS FOR COMPLIANCE WITH MOISTURE, DENSITY AND GRADATION SPECIFICATIONS AND TESTING RATES AND TO BE STORED ON TAPE TO SERVE AS A BACK-UP FOR THE ORIGINAL FIELD TEST DATA. THIS INVOLVED A METHOD OF COLLECTING THE DATA IN SUCH A FORM THAT IT COULD BE RAPIDLY TRANSLATED INTO PUNCHED CARDS TO BE INSERTED INTO THE COMPUTER AND BE AUTOMATICALLY RECORDED AND STORED IN A USABLE FORM. IT WAS DESIRED TO ANALYZE THE TEST DATA BY COMPARING THE TEST RESULTS WITH THE PERTINENT SPECIFICATION FOR THAT PROJECT AND TO DETERMINE WHETHER OR NOT THE TEST MET REQUIREMENTS AND, IF IT DID NOT, TO DETERMINE IF THE FAILING AREA REPRESENTED BY THE TEST HAD BEEN CORRECTED AND RE-TESTED: THE DEVELOPMENT AND OPERATIONS OF THE PROGRAM ARE DESCRIBED. TWO YEARS OF EXPERIENCE WITH THE PROGRAM INDICATES THAT, WITH THE USE OF PROPER TRAINING AIDS, FIELD PERSONNEL WILL READILY ADAPT TO THE SYSTEM. IT HAS BEEN DETERMINED: (1) THE PROGRAM IS FEASIBLE AND DATA CAN BE COLLECTED WITH A LARGE NUMBER OF PEOPLE PARTICIPATING IN THE PREPARATION OF THE INPUT FORMS WITH A LOW PERCENTAGE OF ERROR, (2) THE IMPLEMENTATION OF THE PROGRAM HAS SUBSTANTIALLY REDUCED THE COST OF MONITORING FIELD CONSTRUCTION, PREPARING MATERIAL CERTIFICATES AND HAS RELEASED ENGINEERING PERSONNEL FOR MORE MEANINGFUL WORK, (3) THE PROGRAM HAS MADE IT POSSIBLE TO CERTIFY EMBANKMENT AND BASE ITEMS ALMOST IMMEDIATELY UPON COMPLETION OF THE WORK, AND (4) THE BASIC PROGRAM CAN BE ADAPTED TO OTHER AREAS SUCH AS BITUMINOUS CONSTRUCTION, CONCRETE CONSTRUCTION AND LABORATORY TESTING, AND TO PROVIDE

DATA FOR THE DEVELOPMENT OF STATISTICAL SPECIFICATIONS AND TO DETERMINE THEIR FEASIBILITY.

Fredrickson, FC Adams, RL *Am Assoc State Highway Officials Proc*

1A 232576

MODIFICATION OF NATURAL GRAVELS AND SOILS BY THE ADDITION OF SMALL AMOUNTS OF CEMENT

THIS PAPER DESCRIBES THE USE THAT THE COMMONWEALTH DEPARTMENT OF WORKS HAS MADE OF THE MODIFICATIONS OF NATURAL SOILS AND GRAVELS WITH CEMENT IN THE CONSTRUCTION OF AIRFIELD PAVEMENTS IN AUSTRALIA. PROBLEMS ASSOCIATED WITH CEMENT MODIFICATION OR STABILIZATION ARE SHRINKAGE CRACKING, CONSTRUCTION CONTROL, SPREADING OF CEMENT, CHECKING OF CEMENT CONTENT, SURFACE FINISHING, AND BITUMEN SURFACING.

Williams, HC Purdam, RK *Constructional Review /Australia/*

ACKNOWLEDGMENT: Portland Cement Association

1A 232621

AN EVALUATION OF THE ROAD LOGGER

THE LANE-WELLS ROAD LOGGER, A MOBILE TRUCK AND TRAILER MOUNTED NUCLEAR GAUGE THAT UTILIZES THE PRINCIPLE OF RADIATION BACK SCATTER TO MAKE CONTINUOUS RECORDINGS OF MOISTURE AND DENSITY AS IT IS DRIVEN OVER A TESTED SURFACE, WAS EVALUATED TO COMPARE ITS PERFORMANCE AND COST OF OPERATION TO PRESENT TESTING METHODS, TO STUDY ITS VARIABILITY, AND TO ASSESS ITS POSSIBLE ADVANTAGES AS A MEANS OF CONSTRUCTION CONTROL. A REASONABLY GOOD CORRELATION WITH THE SAND CONE METHOD OF TESTING WAS OBTAINED. THE LOGS INDICATE THAT MOISTURE AND DENSITY READINGS ARE INFLUENCED MARKEDLY BY AIR GAP SIZE, TIME CONSTANT, AND LOGGING SPEED, BUT REPEATABILITY IS GOOD. THE AMBIENT TEMPERATURE WAS FOUND TO AFFECT DENSITY READINGS IN COLD WEATHER. UTILIZATION OF THE ROAD LOGGER AS A COMPACTION CONTROL DEVICE IS FEASIBLE, BUT COST LIMITS RECOMMENDATION FOR ITS USE TO SITUATIONS WHERE THERE IS ENOUGH CONSTRUCTION WORK. THE EQUIPMENT IS NOT RUGGED ENOUGH, AND IS SUBJECT TO FREQUENT BREAKDOWNS. IT TAKES CONSIDERABLE TIME AND KNOWLEDGE TO ELIMINATE SUCH MALFUNCTIONS. /AUTHOR/

Teng, TC Curran, JW Goff, EP
Mississippi State Highway Department

1A 232653

SOME REFINEMENTS IN MEASUREMENT OF SURFACE DENSITY BY GAMMA RAY ABSORPTION

THE AASHO ROAD TEST SYSTEM OF NUCLEAR DENSITY DETERMINATION IS DESCRIBED, WITH EMPHASIS ON THE SOURCE OF ERROR THAT HAS BEEN ISOLATED AND IN SOME CASES ELIMINATED. SOME OF THE IMPORTANT CONSIDERATIONS IN THE DESIGN OF NUCLEAR SURFACE GAGES ARE DISCUSSED, AS WELL AS CALIBRATION TECHNIQUES, LICENSING, HEALTH PRECAUTIONS, AND COST. THE PRINCIPLES INVOLVED IN NUCLEAR DETERMINATION OF DENSITY ARE PRESENTED IN AN APPENDIX. CONCLUSIONS OF THE SURVEY ARE THAT: (1) THE NUCLEAR SURFACE DENSITY GAGE CAN BE USED FOR CONSTRUCTION COMPACTION CONTROL TESTING, (2) MOISTURE CONTENT MUST BE CONSIDERED WHERE PRECISE ESTIMATE OF DENSITY IS DESIRED, (3) IF THE MATERIAL BEING CHECKED EXISTS IN A THIN LAYER THE DENSITY OF THE UNDERLYING MATERIAL MUST BE TAKEN INTO ACCOUNT, AND (4) OPTIMUM SURFACE GAGE DESIGN DIMENSIONS VARY WITH THE DENSITY OF THE MATERIAL UNDER TEST, SO PROVISION SHOULD BE MADE FOR CHANGING THE SOURCE-TO-TUBE DISTANCE IN THE FIELD.

Highway Research Board Special Reports

1A 232890

EARTH DAMS AND ROADS IN THE NATIONAL FORESTS
 THE FOREST SERVICE HAS MADE PRACTICAL USE OF RECENT DEVELOPMENTS IN THE INTELLIGENT HANDLING OF SOILS IN DAMS AND ROADS. MOST OF THE DAMS ARE COMPARATIVELY SMALL AND DO NOT JUSTIFY LARGE EXPENDITURES FOR LABORATORY EQUIPMENT. THE PROBLEM HAS BEEN GETTING SATISFACTORY RESULTS AT A REASONABLE EXPENSE, AND HAS INCLUDED THE TRAINING OF ENGINEERS RESPONSIBLE FOR FIELD SUPERVISION. THE CONTROL OVER THE SELECTION OF EMBANKMENT MATERIAL AND CONSTRUCTION CONTROL OPERATIONS ARE DISCUSSED. WORK IN ROAD CONSTRUCTION IS CONFINED TO EXPERIMENTAL SECTIONS. INSTALLATION AND MAINTENANCE COSTS ARE BEING CAREFULLY DETERMINED, AS THEY WILL BE IMPORTANT FACTORS IN THE DETERMINATION OF METHOD AND EXTENT OF USE ON LOW STANDARD FOREST ROADS. /AUTHOR/

Norcross, TW Conner, CN DISCUSSEER *Highway Research Board Proceedings* Nov. 1936

1A 232976

FIELD COMPACTION CONTROL
 FIELD COMPACTION QUALITY CONTROL CAN BE DIVIDED INTO PROCESS AND ACCEPTANCE CONTROL, EACH WITH ITS OWN PHYSICAL CRITERIA AND TEST METHODS BUT SUBJECT TO SIMILAR STATISTICAL EVALUATIONS. THE DEGREE OF COMPACTION CAN USUALLY BE DETERMINED FROM DENSITY, WHICH MEANS, STATISTICALLY, DETERMINATION OF AVERAGE DENSITY AND ITS VARIABILITY. METHODS OF TESTING THE DENSITY OF BITUMINOUS-BOUND, GRANULAR, AND STABILIZED MATERIALS ARE DISCUSSED BRIEFLY FROM THE STANDPOINT OF ACCURACY AND STANDARD DEVIATION. THE PROCESS CONTROL ADVOCATED HERE EMPLOYS A BIVARIATE (BULK SPECIFIC GRAVITY AND VOIDS) STATISTICAL TEST. A DETAILED APPLICATION OF THE METHOD UTILIZING STEWART-TYPE CONTROL CHARTS IS GIVEN. ACCEPTANCE CONTROL IS BASED ON SAMPLES REPRESENTING A VERY SMALL PERCENTAGE OF THE WHOLE AND IS THEREFORE AIMED AT REFINING ESTIMATES OF PROBABLE AVERAGES AND THEIR VARIABILITY. AN IMPLICATION OF THIS IS THAT RAPID TESTS METHODS NEED TO BE DEVELOPED, SINCE STATISTICAL CONTROL REQUIRES AN ADEQUATE NUMBER OF TEST RESULTS TO SUPPLY EVIDENCE FOR MEANINGFUL DECISIONS. IT IS DESIRABLE TO HAVE MORE EVIDENCE ON THE ECONOMIC JUSTIFICATION FOR CONDUCTING SATISFACTORY CONTROL.

Kuhn, SH Marais, CP
 Nat Inst Road Research /S Africa/ July 1969

1A 233820

MEASURING INSTRUMENTS FOR STRUTTED EXCAVATIONS
 A SUMMARY IS PRESENTED OF THE EXPERIENCE GAINED BY THE NORWEGIAN GEOTECHNICAL INSTITUTE WITH FIELD INSTRUMENTATION OF STRUTTED EXCAVATIONS IN CLAY. DESCRIPTIONS ARE GIVEN OF THE INSTRUMENTS AND TECHNIQUES WHICH HAVE BEEN USED TO MEASURE STRUT LOADS, EARTH AND WATER PRESSURE, SETTLEMENT, HEAVE AND DEFORMATION, AND INFORMATION IS PRESENTED CONCERNING COST, ACCURACY AND RELIABILITY OF THESE INSTRUMENTS. SEVERAL JOBS ARE BRIEFLY DISCUSSED WHERE INSTRUMENTATION AND OBSERVATION WERE SUCCESSFULLY EMPLOYED TO CONTROL CONSTRUCTION PROCEDURES AND TO OBTAIN IMPORTANT DESIGN DATA. /RRL/A/
 REFERENCES: PROC. AMER. SOC. CIV. ENGRS, 1965, 91 /SM1/, 111-41.

Bjerrum, L Kenney, TC Kjaernsli, B
 Norwegian Geotechnical Inst 1965

ACKNOWLEDGMENT: Road Research Laboratory /UK/

1A 234447

AN INVESTIGATION OF PORE WATER PRESSURE IN COMPACTED COHESIVE SOILS
 THE PHENOMENON OF PORE-WATER PRESSURE IN COMPACTIVE COHESIVE SOILS IS INVESTIGATED TO SHOW HOW IT CAN BE ACCURATELY MEASURED, AND TO INDICATE HOW IT CAN BE APPLIED ADVANTAGEOUSLY IN SOIL MECHANICS. A COMPACTIVE COHESIVE SOIL IS COMPOSED OF DISCREET MINERAL GRAINS IN CONTACT WITH EACH OTHER SURROUNDED BY POOR FLUID. THE SOLID PARTICLES CONSTITUTE THE SOIL SKELETON, WHICH DETERMINES THE MECHANICAL PROPERTIES OF THE MASS SUCH AS VOLUME CHANGE UNDER LOAD AND SHEARING STRENGTH. BOTH THEORY AND EXPERIMENT SHOW THAT THE CURVATURE OF A MENISCUS IS INDEPENDENT OF THE PRESSURE OF THE AIR IN CONTACT WITH IT, BUT THAT THE PRESSURE IN THE WATER IS CHANGED BY EXACTLY THE CHANGE IN AIR PRESSURE. IF CAPILLARY PRESSURE IS DEFINED AS THE PRESSURE IN THE MENISCUS WHEN AIR PRESSURE IS ATMOSPHERIC, AND THE AIR IS CONSIDERED TO BE CONTINUOUS, THEN THE PRESSURE IN THE WATER IN THE PORES WILL ALWAYS BE THE ALGEBRAIC SUM OF AIR PRESSURE AND CAPILLARY PRESSURE. THE MAGNITUDE OF AIR PRESSURE AFTER EQUILIBRIUM IS REACHED CAN BE CALCULATED BY BOYLE'S LAW OF COMPRESSIBILITY OF IDEAL GASES AND HENRY'S LAW OF SOLUBILITY OF AIR IN WATER. THE EQUATION FOR THE FINAL AIR PRESSURE IS DERIVED AFTER MAKING A DETAILED ANALYSIS OF THE EFFECTS OF VAPOR PRESSURE IN THE PORES OF THE SOIL AND OF THE MAGNITUDE OF THE RATE OF SOLUBILITY OF AIR IN WATER. THE PORE-WATER PRESSURE IN AN UNSATURATED SOIL AFTER COMPRESSION WITHOUT DRAINAGE IS THE ALGEBRAIC SUM OF THE FINAL AIR PRESSURE DETERMINED FROM BOYLE'S AND HENRY'S LAWS AND THE CAPILLARY PRESSURE RESULTING FROM THE CURVATURE OF THE MENISCI. THE PRINCIPLE OF EFFECTIVE STRESS, THAT IS, STRESS ON THE SOIL SKELETON, IS AFFECTED BY THE THEORY OF PORE-WATER PRESSURE. THE MEASUREMENT OF PORE-WATER PRESSURES IN UNSATURATED COHESIVE SOILS WAS ACCOMPLISHED BY MEANS OF A SIMPLE NO-FLOW DEVICE USING A COMPOUND BOURDON GAUGE, A SMALL SCREW PISTON, AND SARAN AND COPPER TUBING COMPLETELY FILLED WITH DEAERED WATER EXCEPT FOR A SMALL PLUG OF MERCURY WHICH ACTED AS A NULL INDICATOR. IN ORDER TO OBTAIN THE RELATIONSHIP BETWEEN PORE-WATER PRESSURE AND VOLUME CHANGE UNDER SEALED CONDITIONS, A TRIAXIAL COMPRESSION MACHINE WAS CONSTRUCTED AND RUBBER SHEATHS TO ENVELOPE THE SOIL SPECIMENS WERE MADE. TRIAXIAL TESTS WITH PORE-PRESSURE MEASUREMENTS WERE MADE ON AN ALLUVIAL SANDY CLAY AND ON A RESIDUAL SILT. THE IMPLICATIONS OF PORE-PRESSURE THEORY ON CONSTRUCTION CONTROL ARE SHOWN BY A PLOT OF THE COMPACTION CURVE USING VOID RATIO VERSUS WATER VOID RATIO IN LIEU OF THE USUAL DRY DENSITY VERSUS WATER CONTENT VALUES. AN EXPLANATION FOR THE SHAPE OF THE COMPACTION CURVE IS HYPOTHESIZED IN THE LIGHT OF THE PORE-PRESSURE THEORY. A NEW METHOD WAS DEVELOPED TO FACILITATE THE CONTROL OF DRY DENSITY AND WATER CONTENT IN THE CONSTRUCTION OF COMPACTED EMBANKMENTS OF COHESIVE SOILS. THIS METHOD IS DESCRIBED AND A NUMERICAL EXAMPLE GIVEN. THE METHOD PROVIDES THE EXACT RATIO OF FIELD DRY DENSITY TO LABORATORY MAXIMUM DRY DENSITY WITHOUT REQUIRING DETERMINATION OF THE WATER CONTENT. THE PROCEDURE ALSO PROVIDES FOR THE RAPID DETERMINATION OF THE APPROXIMATE DIFFERENCE BETWEEN FILL WATER CONTENT AND LABORATORY OPTIMUM WATER CONTENT TO A SATISFACTORY DEGREE OF PRECISION FOR ROUTINE CONTROL PURPOSES.

Hilf, JW
 Bureau of Reclamation /US/ Oct. 1956

1A SYSTEM CONSTRUCTION, MANAGEMENT & QUALITY CONTROL

1A 235271

DETERMINATION OF THE EFFECTIVENESS OF LANDSLIDE PREVENTIVE ENGINEERING WORKS IN THE KUSHIBAYASHI LANDSLIDE AREA, USING THE ELECTRICAL RESISTIVITY METHOD

REPEATED TESTING OF THE EFFECTIVENESS OF LANDSLIDE-PREVENTIVE ENGINEERING WORKS, BOTH DURING THEIR CONSTRUCTION AND AFTER THEIR COMPLETION, CAN GIVE DATA THAT WILL BE USEFUL IN THREE WAYS: (1) TO KNOW THE EFFECTIVENESS OF EACH STATE OF CONSTRUCTION AS IT IS COMPLETED; (2) TO MAKE ANY CHANGES NECESSARY IN THAT STAGE OR IN THE NEXT STAGE; (3) TO IMPROVE THE DESIGN OF FUTURE PROJECTS. SUCH TESTING, USING THE ELECTRICAL RESISTIVITY METHOD, WAS CARRIED OUT AT VARIOUS STAGES OF LANDSLIDE-PREVENTIVE ENGINEERING WORKS AT KUSHIBAYASHI, OGOTO-CHO, OTSU CITY, SHIGA PREFECTURE. THE RESULTS WERE HIGHLY USEFUL, ESPECIALLY IN CONNECTION WITH PROBLEMS OF SUBSURFACE DRAINAGE. /RRL(A)/

Yamaguchi, S Takada, Y Takeuchi, A Nakagawa, A *Disaster Prevention Res Inst Bul /Jap/* Aug. 1970

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

1A 235570

NUCLEAR RADIATION IN CONSTRUCTION CONTROL OF EARTH AND ROCKFILL DAMS

IN RECENT YEARS NUCLEAR RADIATION TECHNIQUES HAVE BEEN WIDELY USED IN SOIL INVESTIGATION IN ORDER TO DETERMINE CERTAIN CHARACTERISTIC PROPERTIES OF SOILS. PRINCIPALLY THE DEVELOPMENT IN THIS FIELD HAS BEEN CONCENTRATED ON METHODS FOR DETERMINING THE MOISTURE CONTENT IN SOILS AND THE DENSITY CONDITIONS IN SITU AND IN COMPACTED EMBANKMENTS, WHEREAS VERY LITTLE ATTENTION HAS BEEN DEVOTED TO THE POSSIBILITY OF APPLYING THE NEW TECHNIQUE TO OTHER FIELDS OF SOIL AND ROCK MECHANICS. IN CONNECTION WITH THE DESIGN AND CONSTRUCTION OF SEVERAL EARTH AND ROCKFILL DAMS THE SWEDISH STATE POWER BOARD HAS DEVELOPED THE NUCLEAR RADIATION TECHNIQUE FOR SOLVING MANY PROBLEMS IN CONSTRUCTION CONTROL. THE EXPERIENCE THUS OBTAINED HAVE RESULTED IN RELIABLE AND SIMPLE METHODS FOR DETERMINING SETTLEMENTS IN EARTH AND ROCKFILL EMBANKMENTS AND FOR CONTROLLING THE EFFECT OF GROUTING IN SOIL AND ROCK. THESE APPLICATIONS OF THE NUCLEAR METHOD ARE BRIEFLY DESCRIBED. /AUTHOR/

Bernell, L Sherman, KA *Intl Conf Soil Mech & Fdn Eng Proc* Sept. 1969

1A 236379

THE INTEGRATED CIVIL ENGINEERING PROJECT

The underlying principle of ICEP is that in order to obtain a constructed facility that best meets the specified criteria, it is essential to integrate the components of the project. These components range from project conception to project completion and include establishment of the need of a facility, financing, planning site investigation, design construction, surveillance, operation, maintenance, and alteration. The execution of ICEP is to evaluate each important prediction made during the course of the project and use this evaluation to improve the economy and performance of the present facility and future facilities. Critical predictions include predictions of dimensions, properties, forces, and performance. Four case studies are presented to illustrate key points in the ICEP approach. They are: (1) Behavior of an earth embankment retaining oil; (2) behavior of floating and pile-supported foundations, and their effects on adjacent structures during construction; (3) the use of a preload to increase the shear strength of a soft site; and (4) a field test to determine the necessity of sand drains in hydraulic fill. /ASCE/

Lambe, TW *ASCE Journal of Soil Mechanics & Foundations Div* Vol. 98 No. SM6, Proc Paper 8991, June 1972, pp 531-556, 17 Fig., 2 Tab., 8 Ref.

1A 236544

THE THRESHOLD OF THE SEVENTIES; THE EAST 63RD STREET

THE EAST 63RD STREET TUNNEL IS PLANNED AS A 3,140 FT. LONG TRACK, TWO-LEVEL TUNNEL STRUCTURE: THE TWO UPPER LEVEL TRACKS FOR SUBWAY USE AND THE TWO LOWER LEVEL TRACKS FOR LONG ISLAND RAILROAD USE. GEOLOGICAL STUDIES FOR TUNNEL WORK UNDER QUEENS, WELFARE ISLAND, AND MANHATTAN REVEALED THAT: QUEENS IS UNDERLAIN WITH A HARD ROCK FORMATION (BROOKLYN INJECTION GNEISS); UNDER WELFARE ISLAND THE ROCK IS FORDHAM GNEISS AND BROOKLYN INJECTION GNEISS WITH SOME GRANODIORITE; AND UNDER MANHATTAN THE ROCK IS OF MANHATTAN SCHIST. THE CONSTRUCTION SCHEDULE PERMITTED 34 MONTHS TO COMPLETE THE TRACK AND SIGNAL INSTALLATION AND A TOTAL OF 39 MONTHS FOR ALL WORK. THE CONSTRUCTION METHODS USED FOR THE WELFARE ISLAND TUNNEL ARE DESCRIBED IN DETAIL TO ILLUSTRATE SHAFT AND TUNNEL EXCAVATION PROBLEMS. THE QUALITY OF THE ROCK IMPROVED WITH LOWER ELEVATIONS IN ONE INSTANCE.

Casey, EF *N Am Rapid Excav & Tunneling Conf Proc* Vol. 1 June 1972, pp 419-37, 7 Fig, 2 Phot

1A 236558

TUNNEL EXCAVATION GRAND COULEE THIRD POWERPLANT

A 3,600,000 KILOWATT THIRD POWERPLANT WAS ADDED TO GRAND COULEE DAM BY AWARDING CONTRACTS FOR (1) MODIFYING THE EXISTING POWER FACILITIES, INCLUDING TUNNEL EXCAVATION WITHIN THE DAM AND TUNNEL CONSTRUCTION CONNECTING THE DAM TO THE 230 KILOVOLT SWITCHYARD; (2) EXCAVATING THE FOREBAY DAM AND THE THIRD POWERPLANT STRUCTURE; (3) INSTALLING THE PENSTOCKS, CONSTRUCTING THE FOREBAY DAM AND THE POWERPLANT STRUCTURE, INCLUDING CONNECTING THE LATTER'S TUNNEL WITH THE FOREBAY DAM'S STRUCTURE TO THE GALLERY SYSTEM; AND (4) EXCAVATING AND GRADING FOR A 500 KILOVOLT CABLE SPREADING YARD AND A 500 KILOVOLT SWITCHYARD, AND FINALLY CONSTRUCTING AN EXTRA HIGH VOLTAGE (EHV) CABLE TUNNEL. TUNNEL EXCAVATION THROUGH CONCRETE (COMPRESSIVE STRENGTH OF OVER 7,000 PSI AND A MODULUS OF ELASTICITY OF 6,000,000 PSI) WAS ACHIEVED BY DRILLING OPENINGS INTO THE FINISHED FACE OF EXISTING GALLERIES IN THE DAM. STRUCTURAL VIBRATIONS WERE DETECTED BY TRANSDUCING ACCELEROMETERS, TRANSMITTED BY PREAMPHIFYING EQUIPMENT, AND RECORDED BY TRACING PEN ON CALIBRATED PAPER. PARTICLE ACCELERATION WAS MEASURED IN TWO DIRECTIONS, VERTICAL AND HORIZONTAL, NORMAL TO THE DAM AXIS. TUNNEL EXCAVATION THROUGH ROCK (COARSE TO FINE-GRAINED GRANITE WITH A COMPRESSIVE STRENGTH OF ABOUT 20,000 PSI, MODULUS OF ELASTICITY 4.5 TO 6.0 X 10 TO THE 6TH PSI, AND SPECIFIC GRAVITY OF 2.57 TO 2.63) WAS ACCOMPLISHED BY DRILLING FROM A MODIFIED END OF A DUMP TRUCK AND WITH A CUSTOM DRILL JUMBO. SPECIFICATIONS PROVIDED FOR ROCKBOLTING AND/OR STRUCTURAL STEEL SUPPORTS. WITH THE EXCEPTION OF USING A RESISTANCE IGNITED FIRING SCHEME IN THE EHV TUNNEL, BLASTING METHODS WERE THE SAME FOR BOTH TUNNEL EXCAVATIONS---HANDTIMED SAFETY FUSES, BLASTING CAPS, AND CARTRIDGE EXPLOSIONS.

Duck, DJ *N Am Rapid Excav & Tunneling Conf Proj* Vol. 1 June 1972, pp 765-83, 13 Fig, 5 Tab

1A 236585

THE MECHANICAL MOLE-A BREAK THROUGH: IN INCLINED SHAFT MINE CONSTRUCTION

THE TUNNEL BORING MACHINE OR MECHANICAL MOLE OFFERS GREATER PRODUCTION RATES, HIGHER SAFETY AND A BETTER, CLEANER BORE. THE DESIGN AND OPERATION OF THIS MACHINE WHICH HAS BEEN USED ON AN

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INCLINE IS REVEIUED. THE BODY OF THE MACHINE IS SUPPORTED BY FOUR HORIZONTAL LEGS AT THE SPRINGLINE AND TWO VERTICAL LEGS AT THE INVERT OF THE TUNNEL. EACH HORIZONTAL LEG IS ACTUATED BY TWO DOUBLE ACTING HYDRAULIC CYLINDERS THAT TELESCOPE THE LEG TO AND FROM THE TUNNEL WALL. THE EIGHT HORIZONTAL CYLINDERS EXERT A TOTAL OUTWARD HOLDING FORCE OF APPROXIMATELY 2,100,000 LB. AT A HYDRAULIC SYSTEM PRESSURE OF 5000 PSI. DETAILS ARE GIVEN OF THE WHEEL AND DRIVE ASSEMBLY, POWER UNIT, OPERATORS CONTROLS, AND THE CONVEYOR SYSTEM. IN THE CONSTRUCTION PROJECT DESCRIBED HERE, THE DETERMINING FACTOR IN DESIGNING THE VARIOUS PHASES OF THE OPERATION WAS SAFETY. IMPORTANT PLANNING CONSIDERATIONS WERE GIVEN TO CAVING GROUND, HIGH CONCENTRATION OF EXPLOSIVE METHANE GAS AND FLOODING GROUND WATER. GROUND SUPPORT, METHANE GAS PROTECTION, GROUND WATER PROTECTION, LINE AND GRADE CONTROL, MUCK REMOVAL, HAULAGE RAIL, AND VENTILATION ARE ASPECTS OF THE CONSTRUCTION PROCEDURE WHICH ARE REVIEWED. PRODUCTION RATES HAVE BEEN ABOVE ENGINEERING FORECASTS. THE POSSIBILITY OF USING THE MACHINE FOR OTHER MAJOR CONSTRUCTION PROJECTS SUCH AS RAPID TRANSIT, WATER TRANSPORT AND STORAGE IS ENVISAGED.

Brickle, EW Mcguire, EJ *N Am Rapid Excav & Tunnelling Conf Proc* Vol. 2 June 1972, pp 1185-96, 5 Fig

1A 236639

PENNDOT'S RESPONSE TO EROSION CONTROL

PENNSYLVANIA DEPARTMENT OF TRANSPORTATION (PENNDOT) HAS BEEN ENGAGED IN POST-CONSTRUCTION EROSION CONTROL ACTIVITIES FOR MANY YEARS THROUGH THE USE OF SEEDING, MULCHING AND PLANTINGS, PROPER LANDSCAPE MANAGEMENT, AND DITCH PAVING. MENTION WAS MADE OF EROSION CONTROL DURING ACTUAL EARTH-MOVING ACTIVITIES IN THE PENNDOT CONSTRUCTION SPECIFICATIONS; HOWEVER, THIS WAS NOT ENFORCED, EXCEPT POSSIBLY WHEN THE PROJECT WAS IN CLOSE PROXIMITY TO A PUBLIC WATER SUPPLY. IN EARLY 1970 THE FEDERAL HIGHWAY ADMINISTRATION ISSUED A MEMORANDUM REQUIRING THAT ALL FEDERAL AND FEDERAL-AID CONTRACTS BE STRENGTHENED TO INCLUDE SPECIFIC TEMPORARY POLLUTION CONTROL PROVISIONS IN CONTRACT DOCUMENTS AND TO PROVIDE FOR DIRECT PAYMENT FOR THIS WORK. FROM THIS MEMORANDUM, PENNSYLVANIA ADOPTED A PROVISION FOR TEMPORARY PROJECT WATER POLLUTION CONTROL (SOIL EROSION) FOR PROJECTS LET SINCE OCTOBER 1, 1970. THE PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL RESOURCES PREPARED A DRAFT OF PROPOSED EROSION CONTROL REGULATIONS PRINTED ON FEBRUARY 26, 1972, AND PUBLIC HEARINGS WERE SCHEDULED IN MAY 1972. THE PENNSYLVANIA ENVIRONMENTAL QUALITY BOARD ADOPTED THE REGULATIONS IN SEPTEMBER 1972. THIS REGULATION REQUIRES THAT A PERMIT BE SECURED FROM THE PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL RESOURCES FOR ANY EARTHMOVING ACTIVITY IN EXCESS OF 25 ACRES WITH THE EXCLUSION OF FARMING ACTIVITIES. IN CUMBERLAND COUNTY, A RESEARCH PROJECT ON EROSION CONTROL IS BEING CONDUCTED JOINTLY BY PENNDOT, THE PENNSYLVANIA DEPARTMENT OF AGRICULTURE, AND THE U. S. GEOLOGICAL SURVEY BEFORE, DURING, AND AFTER THE CONSTRUCTION OF INTERSTATE 81. THE EROSION CONTROL METHODS USED ON HIGHWAY CONSTRUCTION PROJECTS IN PENNSYLVANIA ARE OUTLINED. OTHER RESEARCH PROJECTS AND STUDIES CURRENTLY UNDER WAY ARE ALSO DISCUSSED. ASIDE FROM WATER POLLUTION, THE PENNDOT POLLUTION CONTROL PROGRAM INVOLVES OTHER FORMS OF POLLUTION, E.G., AIR, LAND, AESTHETIC, AND SOCIAL. /AUTHOR/

Huber, HH *Highway Research Board Special Reports* No. 135, 1973, pp 123-8, 3 Fig, 1 Tab, 2 Ref

1A 236643

SOIL AS AN ENGINEERING CONSTRUCTION MATERIAL /IN JAPANESE/

BECAUSE OF THE GREAT DISTANCES AND VARIED CLIMATIC CONDITIONS, MANY SOIL TYPES OCCUR IN AUSTRALIA, AND THEIR PROPER USAGE AS CONSTRUCTION MATERIALS REQUIRES A KNOWLEDGE OF HOW TO DEAL WITH SOIL VARIABILITY. TERRAIN EVALUATION AND SOIL RECOGNITION METHODS HAVE BEEN HIGHLY DEVELOPED FOR THESE PURPOSES, AS WELL AS THE VARIOUS METHODS OF SOIL STABILIZATION. RECENTLY, NEW METHODS OF STATICAL ANALYSIS (BAYESIAN PROBABILITY) HAVE BEEN STUDIED AS A MEANS OF IMPROVING CONSTRUCTION CONTROL AND ASSISTING RECOGNITION OF THE CRITICAL FACTORS INVOLVED IN ANY PARTICULAR SOIL CONSTRUCTION WORK. NEWLY DEVELOPED TECHNIQUES FOR THE TESTING AND EVALUATION OF SOIL AND STABILIZED SOIL FOR USE AS PAVEMENT MATERIAL, AND IN EARTHEN EMBANKMENT CONSTRUCTION, ARE DESCRIBED WITH PARTICULAR REFERENCE TO CURRENT AUSTRALIAN RESEARCH, BOTH IN THE LABORATORY AND AS CONTROLLED LONG-TERM FIELD TRIALS. THE RESULTS OF THIS EXPERIENCE ARE NOW BEING INCORPORATED IN PRACTICAL CONSTRUCTION MANUALS. /CSIRO/

Ingles, OG

Public Works Res Inst, Cm /Japan/ Vol. 13 No. 7, 1971, pp 359-61

ACKNOWLEDGMENT: Commonw Scient Indus Res Org /Austral/

1A 238272

HIGHWAY CONTRACT ADMINISTRATION-ITS PROBLEMS AND TREATMENT

CONTRARY TO VIEWS OF MOST CONTRACTORS, LAWYERS WORKING AT THE VARIOUS LEVELS OF GOVT. LEARN FROM ALMOST THEIR FIRST EXPERIENCE WITH PUBLIC CONTRACTS, THAT THE SOVEREIGN HAS NO SPECIAL ADVANTAGE IN THE FORMULATION OF THE WRITTEN DOCUMENT. ONLY THOSE OF THE UNINFORMED PUBLIC EXCLAIM THAT THEY WOULD RATHER REPRESENT THE GOVERNMENT IN ANY CONTRACT QUESTION. IN FACT, THE COURTS IN NEW YORK STATE HAVE HELD THAT THE STATE HAS A DEFINITE DUTY AND RESPONSIBILITY IN MAKING CONTRACTS WITH ITS CITIZENS. THE COURTS UNANIMOUSLY DECLARE THAT IN PERFORMING THAT DUTY, THE STATE MUST SET A STANDARD FOR FAIRNESS, JUSTICE, EQUITY, HONESTY AND PLAIN FRANK STATEMENT OF ITS PURPOSE, WITHOUT SUBTERFUGE OR CIRCUMLOCUTION, AND SHALL BE BEYOND ALL CRITICISM AS BEING IN ANY WAY POSSIBLE OF DECEPTION. COURTS IN OTHER STATES HAVE EXPRESSED THEMSELVES SIMILARLY. IN FACE OF THIS ADMONISHMENT BY THE COURTS, THE DUTY OF THE GOVERNMENT LAWYER BECOMES CLEAR. HE SHOULD AND MUST APPROACH THE PREPARATION AND ADMINISTRATION OF SUCH CONTRACTS WITHIN THE STRICT STANDARDS THAT ARE IMPOSED UPON HIM. HIGHWAY CONSTRUCTION CONTRACT ADMINISTRATION POSES MANY PROBLEMS, BOTH ENGINEERING AND LEGAL. IN MEETING THESE PROBLEMS, THE CARE USED IN FORMING THE LANGUAGE OF THE INSTRUMENT IS OF THE UTMOST IMPORTANCE. THE USUAL CASE FINDS THE CONTRACTOR PRESENTED WITH A CONTRACT THAT IS WRITTEN BY REPRESENTATIVES OF THE GOVERNMENT AND FOR THAT REASON, WHEN THE LANGUAGE IS IN DOUBT, THE COURTS CONSTRUE THE WORDS MOST STRONGLY AGAINST THE PARTY WHO WRITES THEM, THE SOVEREIGN. /AUTHOR/

Corwin, SC *Highway Research Record, Hwy Res Board* 1965

1A 238346

CHANGED CONDITIONS CLAUSE IN HIGHWAY CONSTRUCTION CONTRACTS

THE USUAL CHANGED CONDITIONS CLAUSE IS IN TWO PARTS. THE FIRST PART PROVIDES THAT SHOULD THE CONTRACTOR ENCOUNTER OR THE STATE DISCOVER, DURING THE PROGRESS OF THE HIGHWAY CONSTRUCTION WORK SUB-SURFACE AND/OR LATENT CONDITIONS AT THE SITE

1A SYSTEM CONSTRUCTION, MANAGEMENT & QUALITY CONTROL

MATERIALLY DIFFERING FROM THOSE INDICATED ON THE DRAWINGS OR IN THE SPECIFICATIONS, THE ATTENTION OF THE ENGINEER SHALL BE CALLED IMMEDIATELY TO SUCH CONDITIONS BEFORE THEY ARE DISTURBED. THE SECOND PART PROVIDES THAT SHOULD THE CONTRACTOR ENCOUNTER, OR THE STATE DISCOVER, UNKNOWN CONDITIONS OF AN UNUSUAL NATURE DIFFERING MATERIALLY FROM THOSE ORDINARILY ENCOUNTERED, THIS TOO SHOULD BE CALLED TO THE ATTENTION OF THE ENGINEER. ACTUALLY, THE CHANGED CONDITIONS CLAUSE IS AN EXPRESS PROMISE ON THE PART OF THE STATE TO PAY A CONTRACTOR ADDITIONAL COMPENSATION TO COVER INCREASED COST IF CONDITIONS ARE ENCOUNTERED DURING THE PROGRESS OF THE WORK SUCH AS THOSE DESCRIBED IN THE CLAUSE. SEVERAL CASES ARE CITED WHICH DEAL WITH THE ECONOMIC PURPOSE OF THE CLAUSE. HOWEVER, IT HAS ALSO BEEN HELD THAT IT IS THE RESPONSIBILITY OF THE BIDDER TO MAKE A CAREFUL INSPECTION OF THE SITUS OF THE WORK IN THE CASE OF BLAUNER CONSTRUCTION COMPANY V U.S., /94 CT, /CL, 503-1941/. THERE DOES NOT APPEAR TO BE MUCH CASE LAW RESPECTING THE SCHEDULED QUANTITIES OF THE WORK TO BE DONE AND THE MATERIALS TO BE FURNISHED. CASES ON NOTIFICATION OF THE ENGINEER BY THE CONTRACTOR ARE CITED. THE CHANGED CONDITIONS CLAUSE IS APPARENTLY NOT NEEDED IN HIGHWAY CONSTRUCTION CONTRACTS BECAUSE THE FEELINGS OF THE COURTS APPEAR TO BE THAT JUSTICE AND EQUITY DO NOT REQUIRE A STATE TO REIMBURSE A CONTRACTOR FOR INCREASED EXPENSE UNLESS THE MISTAKE WAS DUE TO THE ACT OF THE STATE. ON THE OTHER HAND, SHOULD THE CONTRACT BE EASIER TO PERFORM THAN ANTICIPATED, NO ONE WOULD REQUIRE THE HOLDER OF PROFITABLE CONTRACT TO SURRENDER A PORTION OF HIS LEGITIMATE PROFITS /WESTON V STATE NY, 186 NE 197/.

Lindas, LI *Am Assoc State Highway Officials Proc* pp 1-20, Dec. 1966

1A 238435

LEGAL ASPECTS OF QUALITY CONTROL

THE DESIGNER, THE ENGINEER OR ARCHITECT, THE CONTRACTOR, AND SUB-CONTRACTOR-AND SOMETIMES EVEN THE OWNER-ARE LEGALLY RESPONSIBLE FOR DIFFERENT PARTS OF QUALITY CONTROL OF CONSTRUCTION. THE RESPONSIBILITY IS DETERMINED PRIMARILY BY CONTRACT TERMS AND IS DELINEATED BY WHAT THE COURTS HAVE SAID IN LITIGATED DISPUTES. THE ENGINEER IS RESPONSIBLE IN CASES OF NEGLIGENCE OR WHERE HE HAS UNDERTAKEN WORK FOR WHICH HE IS NOT QUALIFIED. HE IS NOT LIABLE FOR MISTAKES OF JUDGEMENT IF HE EXERCISES THE SKILL AND DILIGENCE REASONABLY EXPECTED OF A PROFESSIONAL. TESTS AND INSPECTIONS MUST FOLLOW TRADE PRACTICES AND MUST BE PROMPT. CLAIMS MUST BE MADE PROMPTLY. IN GENERAL, INSPECTION AND ACCEPTANCE AT COMPLETION ARE FINAL AND CONCLUSIVE. WARRANTY AND GUARANTY ARE SO CLOSELY RELATED TO QUALITY CONTROL THAT THEY CAN BE TREATED AS ONE AND THE SAME. MATTERS OF QUALITY CONTROL IN ENGINEERED CONSTRUCTION ARE PROBABLY AMONG THE TOP PROBLEMS ENGAGING THE ATTENTION OF THOSE IN THE LEGAL PROFESSION WHO DEVOTE THEIR TIME TO THE CONSTRUCTION INDUSTRY.

Jarvis, RB *Civil Engineering Asce* Oct. 1965

1A 238686

PRE-BIDDING MEASURES TO MINIMIZE CONTROVERSIES IN HIGHWAY CONSTRUCTION

THE STANDARD PUBLIC IMPROVEMENT CONTRACT THAT IS LET BY THE DEPARTMENT OF PUBLIC WORKS OF THE STATE OF NEW YORK IS EXAMINED. THE PUBLIC IMPROVEMENT CONTRACT IS NOT THE RESULT OF THE USUAL BARGAIN AND EXCHANGE OF TWO CONTRACTING PARTIES, THE LANGUAGE IS SOLELY THAT OF THE STATE. THEREFORE, THE RELATIONSHIP OF THE CONTRACTOR AND THE STATE MUST

BE VIEWED IN THE LIGHT OF PRE-BIDDING PRACTICES. THESE PRACTICES AND PROCEDURES CAN BE MODIFIED TO REDUCE THE INCIDENCES OF CONTROVERSY AND LITIGATION AND MAKE COMPETITIVE BIDDING A COMPETITION OF EXCELLENCE RATHER THAN A CONTEST OF SPECULATION. THE FOLLOWING RECOMMENDATIONS ARE MADE AND EXISTING CONDITIONS DISCUSSED: (1) A FAIRER AND MORE EQUITABLE CONTRACT SHOULD BE TENDERED TO THE CONTRACTOR BY HAVING BORING INFORMATION AND THE WORK-UP DATA MADE PART OF THE CONTRACT AND EXCULPATORY CLAUSES DELETED, (2) AN INTENSIVE INVESTIGATION SHOULD BE MADE OF THE SUBSURFACE CONDITIONS PRIOR TO THE LETTING OF THE CONTRACT, (3) THE DESIGN, PLANS AND SPECIFICATIONS SHOULD BE PREPARED WITH GREATER CARE, (4) THE JOB SITE SHOULD BE SUBSTANTIALLY CLEAR OF BUILDINGS AND OTHER OBSTRUCTIONS PRIOR TO THE LETTING OF THE CONTRACT, (5) A CHANGED CONDITIONS CLAUSE SHOULD BE INCLUDED IN THE CONTRACT, AND (6) THE EXCAVATION OF ROCK AND EARTH SHOULD BE PRICED SEPARATELY.

Berman, MT *Highway Research Record, Hwy Res Board* 1969

1A 238687

SETTLEMENT PROCEDURES: HIGHWAY CONTRACTORS' CLAIMS

UNDERSTANDING AND COOPERATION ARE DISCUSSED AS KEYS TO A SUCCESSFUL FEDERAL-STATE RELATIONSHIP FOR FEDERAL-AID REIMBURSEMENT OF CONTRACTORS' CLAIMS. THE STATE'S RESPONSIBILITY IN THE RESOLUTION OF CONSTRUCTION CLAIMS IS DISCUSSED. THE ADMINISTRATION SHOULD NOT BE LIABLE FOR A CLAIM WHICH IS ATTRIBUTABLE ENTIRELY TO NEGLIGENCE OR OTHER CULPABLE ACTION ON THE PART OF THE STATE PERSONNEL IN ADMINISTRATION OF A CONTRACT. IT IS EMPHASIZED THAT THE MEASURE OF A STATE'S SUCCESS ON THE PARTICULAR CLAIM FOR FEDERAL REIMBURSEMENT IS NECESSARILY THE EXTENT TO WHICH SUCH CLAIM IS SUPPORTED BY ADEQUATE DOCUMENTATION. PARTICULAR ATTENTION SHOULD BE GIVEN TO THE FOLLOWING CATEGORIES OF DOCUMENTATION OF A CONSTRUCTION CLAIM: (1) THE FACTS GIVING RISE TO A CLAIM, (2) THE LEGAL BASIS FOR PAYING THE CLAIM, (3) THE PRESENTATION OF AN AUDITABLE CLAIM, AND (4) ARGUMENT PRESENTED FROM STRENGTH RATHER THAN WEAKNESS. ALTHOUGH THE FEDERAL HIGHWAY ADMINISTRATION HAS A VETO AUTHORITY OVER THE STATES IN THE AREA OF FEDERAL REIMBURSEMENT, THIS AUTHORITY WILL BE EXERCISED IN A REASONABLE WAY. A COMPLETE AND THOROUGH RESOLUTION OF THE STATE CLAIM, WELL DOCUMENTED, FOUNDED IN STATE LAW AND APPLICABLE FEDERAL LAW AND REGULATIONS, HAS ASSURANCE OF ACCEPTANCE BY THE ADMINISTRATION.

Anders, DH *Highway Research Record, Hwy Res Board* 1969

1A 238688

QUALITY CONTROL IN HIGHWAY CONSTRUCTION PROGRAMS

EACH OF THE PARTIES IN HIGHWAY CONSTRUCTION ENGINEERING PROJECTS HAS RESPONSIBILITIES TO THOSE WITH WHOM HE HAS AN IMMEDIATE AND DIRECT CONTRACTUAL RELATIONSHIP. THESE RESPONSIBILITIES ARE DETERMINED PRIMARILY BY THE TERMS OF PARTIES' WRITTEN CONTRACTS. THE MATTER OF ASSURING THAT CONSTRUCTION IS PERFORMED ACCORDING TO ACCEPTABLE STANDARDS OF QUALITY IS CUSTOMARILY COVERED BY CONTRACT AND CERTAIN DOCTRINES OF LAW. THE IMPORTANCE IS DISCUSSED OF SPECIFICATIONS IN HIGHWAY PROJECTS AND IN QUALITY CONTROL. THE CRITERIA OF QUALITY IS DISCUSSED IN RELATION TO: THE CONCEPT OF EQUALITY AND TRADE PRACTICES. QUALITY CONTROL MUST DEPEND UPON CONTRACT PROVISION FOR STORAGE AND HANDLING OF MATERIALS, INSPECTION PROCEDURE, AND ADJUSTMENT PROCEDURES. THE CONTRACT LAW THAT HIGHWAY DE-

PARTMENTS AND CONSTRUCTION CONTRACTORS ARE CONCERNED WITH IS LARGELY ADMINISTRATIVE LAW. CONTRACT ADMINISTRATION IS OFTEN DEFEATED BY THE STATE'S PROCEDURES FOR QUALITY CONTROL WHICH ARE UNREALISTIC, OR THE CONCEPT OF PRIVACY OF CONTRACT. TO IMPROVE CONTRACT ADMINISTRATION, THERE MUST BE SOME NEW AND SEARCHING STUDY OF THE LEGAL FRAMEWORK OF THIS FUNCTION, AND A THOROUGH ANALYSIS OF THE FACTORS THAT AFFECT IT AND THE PUBLIC POLICIES IT SERVES.

Dunbar, DW *Highway Research Record, Hwy Res Board* 1969

1A 243061

FAST-ASSEMBLY BRIDGE OVER THE AEGIDENTORPLATZ IN HANNOVER

A FAST-ASSEMBLY BRIDGE IS A STRUCTURE THAT CAN BE RAPIDLY PROCURED, QUICKLY ASSEMBLED, AND SUBSEQUENTLY DISASSEMBLED. THE SPECIFIC EXAMPLE WAS BUILT TO RELIEVE CONGESTION AT A MAIN INTERSECTION. CONSTRUCTION WAS COMPLETED IN FIVE WEEKS ON A CAREFULLY CONTROLLED SCHEDULE TO MINIMIZE TRAFFIC DISRUPTION. METHODS AND MATERIALS ARE DESCRIBED.

Koger, E *Highway Research Record, Hwy Res Board* 1971

1A 260275

ENERGY RESOURCES-SHORTAGE-HIGHWAYS

The number of construction projects in Colorado has dropped from March of 1972 (147) and March of 1973 (124) to March of 1974 (115). While it is conceded that other factors are at work, energy shortages, real or potential, have definitely limited the number, value and type of projects that Colorado is willing to obligate. Costs have increased due: (1) higher administrative and supervisory expenses; (2) scheduling (when is the best time to award grants?) uncertainties; (3) more travel time; (4) higher equipment rental rates. The quality of the projects may suffer due to: (1) supervising personnel seeking jobs in more stable fields of employment; (2) substitution of materials and designs. To supplement benefits achieved through material substitutions, Colorado is considering various changes in construction requirements. Under advisement are: 1) Designation as mandatory, material pits that will effect fuel saving. 2) Thicker lifts in embankment construction as long as density specifications are met. 3) Most economical balance of surface course and emulsified asphalt treated base thicknesses. 4) Use of dryer-drum mixers; and for standard asphalt plants, temperature-viscosity relationships to establish the lowest permissible mixing temperatures. In the area of transportation planning emphasis is being placed on: preferential treatment for high occupancy vehicles, car pooling, and the National Transportation Energy Conservation Action Plan. The effect of the energy crisis on truck travel, air quality and travel demand are being analyzed. Traffic counting methods are being employed extensively. The reduction in the availability of asphaltic materials has given rise to investigation of the following problems: (1) elimination of the use of rapid curing "cut-back" liquid asphalt; (2) partial elimination of and substitution for medium curing "cut-back" liquid asphalt; (3) improving the penetrating quality of emulsified asphalt for use as a prime coat; (4) substituting other stabilizing agents for emulsified stabilized base. The rapidly improving cost position of rigid vs. flexible pavement is being closely watched. Bridge design personnel are investigating construction methods and design procedures that could reduce fuel consumption and materials usage. Maintenance changes revolve around reduced consumption of energy: 1) More efficient planning in use of equipment and personnel. 2) Mowing is being restricted. 3) Reduction of some interchange lighting has been accomplished. 4) Rejuvenation of old asphalt mats is being actively considered.

This report is from the WASHO Conference held in Portland, Oregon from June 2-6, 1974.

Haase, EN (Colorado Department of Highways)

Western Association of State Highway & Transp Off Proceeding June 1974, 14 pp

1A 260415

VARIATIONS IN PORTLAND CEMENT CONCRETE CONSTRUCTION IN NEBRASKA

This is a report of historical data in a statistical manner which is usable in formulating statistically based specifications for Portland Cement Concrete.

The report covers data from the 1969, 1970, and 1971 construction seasons. Two possible methods of utilizing this data in a statistically based specification are suggested. /FHWA/

Prepared in cooperation with the U.S. Department of Transportation, Federal Highway Administration.

Broughton, J

Nebraska Department of Roads, (R73-9(536)) Final Rpt. Nov. 1973, 36 pp

Contract HPR Study 64-4

ACKNOWLEDGMENT: Federal Highway Administration (P-0047)

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PB-231382

1A 260465

USING SHOTCRETE TO SUPPORT UNDERGROUND STRUCTURES

A conference was conducted to discuss the making, testing, and using of shotcrete for underground support. With regard to the making of shotcrete, quality control was considered essential. It was believed that average 28-day compressive strengths in the range of 3,000-4,000 psi (20.6-27.5 million N/sq m) were more realistic than the presently specified 5,000 psi (34.4 million N/sq m) compressive strength at 28 days. Opinion on the maximum size of coarse aggregate to be used in a shotcrete mix favored at least 1/2-inch (13 mm) maximum size. The importance of compatability tests of the cement and accelerator to be used was emphasized. Though remotely controlled nozzles and wet mix shotcrete equipment has had wider use in Europe, there was considerable interest shown in the use of skilled nozzlemen as employed in the U.S. Cube, core, probe, impact, and pull-out tests were discussed, and it was concluded that such tests need further development. In discussions of where to use shotcrete, it appeared that shotcrete offered economies in nominally unlined water tunnels built by the drill and blast method, where it could serve the dual function of support and final lining. It also appeared to offer economies where a drill and blast tunnel had a persistent need for support and coverage of the rock to prevent deterioration due to moisture change or stress relief. Though it is not believed to be presently compatible with the tunneling machine, an example was presented where a tunneling machine had been designed to accommodate the use of a specific shotcrete system.

Morris, JW (Bureau of Reclamation) *ASCE Civil Engineering* Vol. 43 No. 9, Sept. 1973, p 17

1A 260478

MANAGEMENT OF SOLID WASTES INCIDENT TO HIGHWAY CONSTRUCTION AND MAINTENANCE

The problem with which this report deals involves (1) the disposal of wastes resulting from new highway construction with minimum offense to the environment and (2) the prevention and removal of roadside litter. Current highway waste management practices are reviewed and alternative solutions are proposed for more effective management of these wastes. The results of a survey of the current practices of the fifty states in meeting environmental legislation and litter control are reported. In addition, the report includes data regarding waste management efforts by Federal and State agencies. The report is divided into the following three parts: (1) management of highway construction wastes; (2) management of highway litter; and (3) highway erosion control.

Prepared under a grant from the State of Tennessee, Department of Transportation, Nashville, Tennessee.

Connella, AA Friedman, AA

Tennessee Technological University Final Rpt Feb. 1974, 96 pp, 5 Fig, 8 Tab, Refs, 3 App

1A 260639

PRE-PLANNING YOUR ARBITRATION

Commercial arbitration is a viable and economical alternative to court litigation in the construction industry. The arbitrator has a better understanding of the industry and can act faster than a crowded court's judge. The process of arbitration itself can promote the relationship between contractor, owner, employees, subcontractors etc. This article reviews recent court decisions dealing with arbitration as a means of settlement. Also discussed are contract clauses specifying arbitration of disputes before litigation.

Curtin, WJ *Constructor* Vol. 55 No. 9, Sept. 1973, pp 41-43

1A SYSTEM CONSTRUCTION, MANAGEMENT & QUALITY CONTROL

1A 261493

REINFORCEMENT FOR CONCRETE

This publication which is intended primarily for the use of those working, or acting in a supervisory capacity on construction sites, covers (mainly) the practical operations relating to reinforcement from the stages of ordering, unloading and storing, through those of cutting and bending, to the final stage of fixing preparatory to placing the concrete. In order that the need for the accurate placing of the reinforcement may be understood, the underlying principles of the reinforcing of concrete structural members is briefly described. The book is also intended to be of value to drawing office and design staff. The cross-sectional areas, weights and other data on reinforcing bars and currently available fabrics are tabulated for easy reference. The minimum basic requirements regarding the strength, yield stress and ductility of such bars and wires are specified in the British Standard Specifications, the requirements of current metric editions of which are also presented here. Standard bending dimensions are tabulated and the information together with that in most of the other tables will be of value to the designer and detailer of reinforced concrete structures. The data provided here is entirely in metric SI units.

Disney, LA Reynolds, CE

Cement and Concrete Association No.12.029, 1973, 89 pp, Figs., 10 Tab., 1 App.

1A 261495

A DATA-BASED METHODOLOGY FOR SPECIFYING CONSTRUCTION PROJECT DURATIONS

This report presents a method of determining the construction contract performance times for Military Construction projects. This method is based on information that is regularly reported as feedback during the execution of a construction contract for Military Construction. Army projects. By organizing the data from the manpower- utilization feedback reports, a model is formulated and mathematically derived. An example of data reduction is presented, and the results of applying the methodology to these projects are reported. A proposal of implementation of the methodology in U.S. Army Corps of Engineers' district offices is presented.

Halpin, DW Delong, CE

Army Construction Engineering Research Laboratory CERL-TR-P-14, Aug. 1973, 21 pp, 11 Ref.

1A 261511

AN INTEGRATED APPROACH TO CONSTRUCTION MANAGEMENT

This research developed an integrated approach to construction management that provides an optimal decision-making tool for improving the cost-effectiveness of management organizations. The construction problem is defined in terms of the management processes of planning, scheduling, and controlling construction operations. These processes evaluate the time-cost tradeoffs of alternative courses of action when resources are limited. The integrated approach reflects the true state of the decision-maker in hierarchical management organizations of dynamic construction systems. A new network-based project analysis model was developed that integrates the total costs of construction operations. A rigorous mathematical formulation of the model provides a basis for an optimal solution method utilizing an implicit enumeration, computer routine. The integrated approach was applied to a sample project to yield optimal project and resource schedules.

Richards, JL

Army Construction Engineering Research Laboratory Final Rpt. CERL-TM-P-19, Nov. 1973, 159 pp, 18 Fig., 16 Tab., 139 Ref., 2 App.

1A 263105

QUALITY CONTROL OF COMPACTION IN EARTHWORKS AND PAVEMENTS BY NUCLEAR METHODS

Present density and moisture control methods are fast becoming inadequate, especially with the increased use of high speed, large capacity earth moving and compaction equipment. Speed in the primary advantage of testing by nuclear methods. The result of a test is immediately available to both engineer and contractor. Compaction inadequacies may be corrected immediately before subsequent lifts of material have been laid. Decisions on rejection or acceptance can be made on the spot, and the appropriate action taken before the weather takes a hand in proceedings. In cases of doubt, further tests can quickly be made. If further compactive effort is required, immediate checks can be made to determine whether this has been effective.

An invaluable application of nuclear Hidrodensimeters is determination of the moisture content of borrow areas before the material is placed, thus preventing the use of unsuitable materials, eliminating rule of thumb methods, guess work, "getting away with it", and other hopeful measures which are used in a surprising number of cases. Greater coverage of a job is possible, in the form of many more up to date tests within the same time as those recorded by conventional methods. Thus a truer picture of "as built" conditions is provided. The mobility of the equipment makes it possible for several sites to be checked in one day. The testing organization becomes more flexible, as it is not as dependent on static laboratory based equipment. A qualified soil technician is essential for intelligent operation of the instrument, and for intelligent interpretation of results, but total labor requirements are considerably reduced. Applications of the nuclear method not previously discussed, include determination of the density and asphalt content (while still hot) of thick lift asphalt pavements, in place of expensive conventional coring techniques. Greater coverage and non-destructive properties contribute to its value in this application. Evaluation of compaction equipment and materials in test banks, or in actual site conditions can be readily carried out on the same sites, following subsequent roller passes of smooth wheeled equipment. This non-destructive technique is of great value for investigating the performance of road materials and road rollers. The in situ density of concrete can readily be checked to a high degree of accuracy and rapid moisture determination of timber is possible. In the absence of weight-bridges, the loading of vehicles carrying soils and aggregates can be checked, if the volume of the load is known. In summary, nuclear density and moisture test methods are comparable in accuracy with conventional test methods, and in some applications superior, are more economical on a long term basis, and offer greater coverage, simplicity, and flexibility of operation. Of greatest importance is the ability of these instruments to provide almost instantaneous results of tests.

Proceedings of Roading Symposium, 1971, held at Victoria University of Wellington, 17-19 August, 1971.

Ferguson, DJ (Stevenson (W) and Sons Limited)

National Roads Board, New Zealand Proceeding Vol. 2 1972, pp 452-465, 4 Fig., 7 Tab., Apps.

1A 263764

SAFETY OF MAINTENANCE AND CONSTRUCTION PERSONNEL IN WORK ZONES

Twenty major problem areas were identified as most hazardous to maintenance and construction employees and workers. The more mechanical aspects of safety, such as equipment, signs, weather and design are not the most important factors; the attitude and safety consciousness of the individuals involved is probably the most critical factor affecting the success or failure of any safety program. Another important consideration is the visual impact and uniformity of alerting motorists approaching the work site. There are 101 separate recommendations in this report on safety as it relates to passing traffic. There is a need to develop a Safety Management Information System that will make available information related to maintenance and construction safety to all management levels.

California Division of Highways July 1974, 138 pp

1A 264569

NEW METHODS IN CONSTRUCTION SYSTEMS

Contemporary computer applications make it possible to assemble construction resource planning data and to present this information to a variety of users. Estimating and scheduling are interdependent functions of construction planning. Adequate planning requires detailed construction cost estimates which have been converted to time-dependent models by allocation of resources to activities. Computer printouts, in both tabular and graphic forms, isolate anomalies and provide a basis for redistribution of resources. From the assembled data, histograms representing resource demand modes can be compiled. When two of these resource histograms are compared mathematically, useful effectiveness ratios can be devised, such as man-hours per ton of reinforcing steel. Such planning data can be compared to on-the-job experience in order to evaluate project management.

LeVett, RR (Mathews (AA), Incorporated) *ASCE Journal of the Construction Division* Vol. 100 No. C03, Proc. Paper 10788, Sept. 1974, pp 211-222, 6 Fig.

1A 264579

ENVIRONMENTAL AND CONSTRUCTION MANAGEMENT ENGINEERS

The paper presents the construction management engineer in the first line of defense in preventing environmental pollution and degradation during construction. Damage can be reduced through knowledge about the environment and the project. The major construction activities that cause pollution and its magnitude are examined. The engineer is in a position to influence the outcome if he is aware of the problems associated with construction and their magnitude.

Spivey, DA (Army Corps of Engineers) *ASCE Journal of the Construction Division* Vol. 100 No. C03, Proc. Paper 10804, Sept. 1974, pp 395-401, 1 Fig., 1 Tab., 1 Ref., 1 App.

1A 264587

RATE OF WORK METHOD: SIMPLIFIED PROJECT CONTROL

The preponderance of management consultants that have, to date, successfully offered their services to contractors, assuming the Construction Manager role, have relied on a relatively new form of network planning-precedence planning to illustrate their expertise in the planning and scheduling aspects of project control. Precedence planning has been acclaimed to better meet the scheduling needs of the general contractor in the field; however, it is a major thesis of this article that the use of precedence planning creates a situation in which the contractor is more dependent on the management consultant while the viability of the total project is decreased and, in some cases, the project activities are scheduled on a late start basis. This article will elaborate on the inherent deficiencies of precedence planning as presently employed in the construction industry and, by doing so, will attempt to diminish the mystique of this approach to scheduling.

Cunningham, JA Yarmowich, EP (General Electric Company) *ASCE Civil Engineering* Vol. 43 No. 11, Nov. 1973, pp 62-64, 4 Fig., 1 Phot.

1A 264664

A HEURISTIC MODEL FOR PREDICTING BRIDGE CONSTRUCTION REQUIREMENTS

Research is directed to formulating a bridge and resource requirements simulation model for use by program managers concerned with the ground line-of-communication sector of the construction industry. Bridge alternatives are designed and selected to reduce the obstacle effect of the terrain such that commodities flow (traffic) along the line-of-communication (highway) is improved. The resulting tool provides a heuristic high-resolution model for policy testing and decision making in a highly dynamic system involving non-commensurable objectives such as cost, time and manpower. The problem of predicting bridge and resource requirements is defined through a systematic analysis of the bridge construction system's purpose, components, constraints and required information. Examples of the need for accurate prediction of requirements are discussed for both the civilian and military applications. The bridge construction system is described in terms of four components: (a) an aggregation of terrain obstacles, (b) a set of obstacle reducing alternatives, (c) a pool of construction resources, and (d) a set of bridge construction management policies. Each of the components is discussed in terms of its attributes and then variable and parameter classifications. With the elements of the system description a realistic simulation model is formulated. A controlled enumeration technique is used to generate a small set of feasible alternative bridge designs to be used in the highway construction simulation. Alternatives are designed and selected for construction from a model-user-specified construction criteria or objective function. Bridge and resource requirements are predicted by simulating over the selected terrain, a sufficient number of highway construction replications to satisfy a preset confidence level. The bridge construction simulation model is then applied to the consideration of gap-type obstacles which may be neutralized by bridging. Two specific demonstrations of the flexibility of the model concept are provided: (a) prediction of bridge hardware and construction resource requirements for a hypothesized military operation in West Germany under conditions of uncertainty; and (b) identification of requirements for a flood disaster relief operation in Korea for the deterministic case. Results and consequent model validity are discussed. Recommendations for further study are presented.

Ryan, TC

Army Construction Engineering Research Laboratory Tech Manu
CERL-TM-C-3, July 1974, 117 pp

1A 264754

DENSITY OF BITUMINOUS SURFACE COURSES

Research is reported that was designed to determine the probable causes of low densities obtained during construction of bituminous surface courses designed with slag aggregate, and to determine the effect of low densities on the performance and durability of in-service bituminous surface course throughout Tennessee. The research literature in this field is reviewed and the causes of low density are examined. The probable primary causes of low densities in bituminous surface courses were found to be the lack of rolling in the breakdown and intermediate rolling sequences, the low mat temperatures during rolling operations, and the asphalt contents below the design asphalt content. The effect of density on surface performance is discussed and tables are presented of record densities, core densities and ratings from field inspections. As a result of this project more widespread use is being made of nuclear density surface gauges. A large number of tests may be conducted in a short time after laydown and rolling operations and a closer quality control of paving operations may be maintained.

Proceedings of the 55th Annual Tennessee Highway Conference, 1973.

Marks, BD (Department of the Air Force); Ford, HO
Tennessee University, Knoxville Proceeding Bulletin No. 40, Jan. 1974, 6 Fig., 6 Ref.

1A 264756

TOOLS AND TUNNELS HELP EARN FAT CONSTRUCTION BONUSES

An army of jumbos and intricate temporary tunneling has helped speed work on an underground powerhouse, maximize drill use and increase the contractor's overall job profit. Short stroke Copco drills were used which add 25 to 40 percent to equipment speed and adapts well to the stratified mica schist. The drill steel was changed every 1,500 ft and detachable bits every 750 ft. Three 7-boom tractor-mounted jumbos worked side-by-side in the 82 x 778 x 187-ft-high main powerhouse excavation. Other units included a 4-drill jumbo, two Atlas Copco 3-drill jumbos and 11 Gardner-Denver Model 3200 Air-Trac units plus stoppers and jacklegs. The big 7-boomers and the 3-boomers added flexibility and adapted to the varying heading sizes and shapes. The observation is made that smaller drifts can be mined more efficiently with custom-built jumbos that can handle rockbolting and meshing during the drill cycle. The customized BUT 14ER booms cover twice the area and they position easier than standard units. Details of the timing and tunneling are described as well as the drilling cycle, blasting and rockbolting.

Bloomberg, R (McGraw-Hill World News) *Construction Methods and Equipment* Vol. 56 No. 10, Oct. 1974, pp 46-48, 6 Phot.

1A 265142

PANEL DISCUSSION ON PERFORMANCE OF PAVEMENT WITH GRADED AGGREGATE BASES

In this panel discussion of the performance of pavement with graded aggregate bases, case histories are presented of specific projects. Projects in North Carolina are described in which untreated aggregate bases, treated full-depth bases and concrete bases have been utilized. A representative selection is also presented of several constructed projects in Maryland, where the use of graded aggregate materials will continue to be specified as base courses in flexible pavement construction for the foreseeable future. Experience in Virginia is reviewed where considerable use has been made of the controlled strip method for checking density, particularly in stone bases. In a review of production control systems in aggregate industries, the New York State Department of Transportation requirements are presented, and the point is made that in some states graded aggregate is used only as subbase beneath bases that are stabilized with asphalt or other additives. In such cases gradation control is not required to be as close as where the material is designed to serve as heavy duty base course. Distinction is made between subbase material and quality controlled base materials.

Proceedings from A Conference on Utilization of Graded Aggregate Base Materials in Flexible Pavements, held March 25-26, 1974, Oakbrook, Illinois.

Drake, WB Berrier, LH Greene, WB Fielding, RV
National Crushed Stone Association Conf Paper Mar. 1974

1A 265648

CONSTRUCTION SOLID WASTE

This paper examines the classification and composition of construction solid waste and debris. The components of solid waste management systems are

1A SYSTEM CONSTRUCTION, MANAGEMENT & QUALITY CONTROL

reviewed with emphasis on disposal procedures. Incineration, burial, and recycling options are evaluated for application to construction wastes. A strategy designed for the construction management engineer is presented.

Spivey, DA (Army Corps of Engineers) *ASCE Journal of the Construction Division* Vol. 100 No. C04, ASCE 10993, Dec. 1974, pp 501-506, 1 Tab., 4 Ref.

2A 033160

DISPLACEMENT OF ADJACENT ROADWAY AND GROUND SURFACE DURING CONSTRUCTION PERIOD OF OPEN CAISSON

As the open caisson pier foundation was to be constructed very close to the existing roadway of embankment of weak strata in recent double tracking work on Chuoh line, observation of displacement was carried out to judge the degree of danger for running a train during construction period. According to the results of observation it was confirmed that the protection method by sheet piling was very effective and in this case the displacements or strains were too small to disturb the track or to interrupt the traffic.

Muromachi, T Komine, T Yasuda, Y (Japanese National Railways) *Railway Technical Research Institute Quart Rpt* Vol. 8 No. 3, Sept. 1967, pp157-160

ACKNOWLEDGMENT: Battelle Memorial Institute (BCL-114)

2A 033183

RAILWAY TRACK STRUCTURE FOR HIGH-SPEED TRAIN

Examines the specifications of rail, fastenings, ballast vs. precoated with asphalt ballast, subgrade construction, longitudinal forces present when welded rail used on a bridge, transition curves and PC ties to be used on the New Tokaido Line. Results of tests of the above under high speed conditions are also discussed.

Special Issue

Hoshino, Y (Japanese National Railways) *Railway Technical Research Institute* Nov. 1961, pp4-14

ACKNOWLEDGMENT: Battelle Memorial Institute (BCL-137)

2A 033191

RESEARCH ON REASONABLE EMBANKMENT CONSTRUCTION (FIRST PROGRESS REPORT)

Various problems involved in railway fill construction were attacked in many respects. Several methods of soft subsoil stabilization were compared with each other with particular reference to prevention of base failure, acceleration of settlement, and reduction of excessive vibration. Also, subsidence and slope failure of newly built embankments were investigated.

Uezawa, H Watanabe, S Saito, M Miyako, J Muromachi, T (Japanese National Railways) *Railway Technical Research Institute Quart Rpt* Vol. 9 No. 3, Sept. 1968, pp139-150

ACKNOWLEDGMENT: Battelle Memorial Institute (BCL-147)

2A 037198

CHEMICAL GROUTING FOR PARIS RAPID TRANSIT TUNNELS

Special problems in the construction of subsurface structures for a new rapid transit railroad line in Paris, France. Consolidation of soils was provided by chemical grouting. Grouting technique was also used to consolidate the foundations of a bridge, over the tunnel. Silicate and resin grouting provided the consolidation without recourse to compressed air or dewatering. A classification of modern chemical grouts is given with their limits of injectability. Elaborate grouting procedures prove their efficiency in supplementing or replacing modern tunneling methods.

Janin, JJ LeSciellour, GF *ASCE Journal of the Construction Division* Vol. 96 No. C01, Paper 7382, June 1970, pp 61-74

ACKNOWLEDGMENT: EI (EI 70 38532)

PURCHASE FROM: ESL Repr PC, Microfilm

2A 037447

EXPERIMENTAL CONCRETE TRACK-BED AT RADCLIFFE

Using a slip form continuous road making machine, British Railways has laid a trial length of concrete slab foundation on which six kinds of fastenings are being tested. All systems were laid to give rail alignment level and gauge tolerances considered adequate for 200 km/h conventional trains, although the actual speed of trains through Radcliffe will not exceed 110 km/h. Axleloads are up to 25 tons. Acoustic and vibrational measurements will be made, together with general structural and component performance. Load-detection tests are being made in the laboratory on the different fastening assemblies and site measurements will be made under service conditions.

Lucas, JC Lindsay, D Aitken, WK (British Railways) *Railway Gazette* Vol. 125 July 1969, pp 547-549, 4 Fig, 2 Phot

ACKNOWLEDGMENT: Battelle Memorial Institute (BCL-854)

2A 037642

CHEMICAL CONSOLIDATION OF GROUND IN RAILWAY WORK

Some applications of a successful chemical injection process to tube railway construction work in London are described. The extension of the Central Line tube railway between Bow and Leyton was carried out in water-logged ground by means of compressed air. At Leyton station the lines are carried from the tunnels to the surface in an open cut. On approaching this open cut the two shields of the 12-ft. running tunnels were carried through with a cover of only 4-5 ft. of ballast, with water level almost at the surface. The method of foundation strengthening is discussed and the tunnel network and track foundation is illustrated in drawings and photography.

Railway Gazette Vol. 72 Feb. 1940, pp 147-151, 3 Fig, 6 Phot

ACKNOWLEDGMENT: Battelle Memorial Institute (BCL-545)

2A 037886

FORMATION STRENGTHENING ON THE BOURNEMOUTH LINE, SOUTHERN REGION

Extensive blanketing work was undertaken to stabilize the roadbed. Most of the worst trouble was experienced in the neighborhood of certain of the bridges over cuttings where lifting of the track to provide a greater depth of ballast over the soft formation has been impossible. Rather than raise the bridges, which are mostly brick arches in good condition, it was decided to dig out the weak formation materials. In 1948 and 1949 nearly a mile of double track was treated in this way, and in addition, extensive drainage work was undertaken to collect the water flowing into the cuttings. All of this work was highly mechanized and one of the characteristics was the small amount of labor required. A diagram of a four-mile section between Brockenhurst and New Milton shows the location of blanketing works.

Railway Gazette Vol. 91 Aug. 1949, pp 240-41, 2 Fig, 2 Phot

ACKNOWLEDGMENT: Battelle Memorial Institute (BCL-1077)

2A 037923

BLANKETING OF TRACK, SOUTHERN RAILWAY

Soft formations underlying roadbeds laid on marsh ground fill were treated by excavation and backfilled with quarry waste. Followed consolidation of the material, ballast was spread and tamped, and the track replaced. Another method utilized precast concrete slabs emplaced between a 12 in. blanket of quarry waste and the ballast. Additional details are given on the two methods as employed at specific sites, and include information on the typical "soft formation" conditions encountered and test procedures prior to rebuilding the roadbeds.

Railway Gazette Vol. 87 Dec. 1947, pp 673-675, 5 Phot

ACKNOWLEDGMENT: Battelle Memorial Institute (BCL-1115)

2A 037991

TRACK-SIDE FOUNDATIONS IN SUBSIDENCE AREAS

The main line between Manchester and Crewe, British Railways, passes through a section subject to serious subsidence caused by brine extraction. The average yearly subsidence is 8 in. The design of the overhead line equipment to maintain the contact wire within the maximum and minimum heights above rail level is discussed and is illustrated. The track can be lifted for a period of four to six years before the foundation for the overhead structure will need to be lifted.

Railway Gazette Vol. 110 Apr. 1959, pp 390-391, 2 Fig, 3 Phot

ACKNOWLEDGMENT: Battelle Memorial Institute (BCL-1411)

2A 039221

A COMPUTER PROGRAM FOR ESTIMATING COSTS OF HARD ROCK TUNNELLING (COHART)

A computer performs all logic and computations customarily done by hand in preparation of engineer's estimates or contractor's bids on tunnel-shaft systems. The program described is based on construction methods, work forces and equipment selections corresponding to the current state of the art

of tunneling. The program contains logic to permit the estimate of costs of complicated tunnel-shaft systems. In any estimate, the program will accommodate a large number of values or changes in the values of the factors that affect cost, such as tunnel shape and size, shaft depth, rock characteristics, and construction method. To provide great flexibility, the user of the program is provided with the option of selecting lining type and thickness, profit and overhead margins, and other input data. Suggestions for selecting an appropriate value for these inputs are contained in the report. Complete operating instructions and an illustrative example are presented. (Author)

Wheby, FT Cikanek, EM
Harza Engineering Company Final Rpt May 1970, 242 pp

Contract DOT-FR-9-00003

ACKNOWLEDGMENT: NTIS (PB-193272)

PURCHASE FROM: NTIS Repr PC, Microfiche
PB-193272, DOTL NTIS

2A 039233

STUDIES FOR RAIL VEHICLE TRACK STRUCTURES

Conventional (tie-type) and non-conventional rail vehicle track structures were studied, with the restriction that standard gauge and rail-head contour be used. Computer programs were developed and used to analyze track response to both static and dynamic vehicle loading. The models of conventional track were validated by track, and on the Penn-Central high-speed track near Bowie, Maryland. The DOT research cars were used to obtain a series of controlled-speed passes at speeds up to 125 mph. Track response under Metroliner and regular freight traffic was also recorded, both at a joint and away from a joint. The measurements showed the lack of consistency of track characteristics at different locations and at different times, and indicated the computer results to be as accurate as the degree to which track parameters could be defined. The predicted presence of individual pressure pulses for individual axles on trucks with wheelbases exceeding 6' was verified by measured subgrade pressures 3' beneath the tie base, at speeds up to 125 mph. A major philosophy in the development of improved track structures was to reduce the magnitude and number of pressure cycles transmitted into the roadbed, with the number of cycles reduced by using beam and slab type rail supports having substantial longitudinal bending stiffness. Following the analysis, performance specifications were written for rail fasteners and three types of reinforced concrete structures recommended for further evaluation in field tests: cast-in-place slab, cast-in-place twin beams, and precast twin beams. (Author)

Mcacham, HC Prause, RH Ahlbeck, DR Kasuba, JA
Battelle Memorial Institute Final Rpt Apr. 1970, 208 pp

Contract DOT-FR-9-0021

ACKNOWLEDGMENT: NTIS (PB-194139)

PURCHASE FROM: NTIS Repr PC, Microfiche
PB-194139, DOTL NTIS

2A 039236

ELEVATED STRUCTURES-CONTINUOUS BEAMS

The report addresses the problem of elevated guideway structures employing continuous span beams and spread footing. Various structural materials and components are considered. On the basis of static analysis, practical information about the design requirements was generated. Results are displayed in convenient graphical form for span length up to 160 feet and maximum deflection up to .16 foot. (Author)

Report on High-Speed Ground Transportation Systems Engineering Study.

Wang, CH
TRW Systems Group Final Rpt 06818-W017-RO-00, July 1970, 80 pp

Contract C-353-66

ACKNOWLEDGMENT: NTIS (PB-194371)

PURCHASE FROM: NTIS Repr PC, Microfiche
PB-194371, DOTL NTIS

2A 039240

A SYSTEMS STUDY OF SOFT GROUND TUNNELING

A fundamental investigation of soft-ground tunneling operations was made to identify and assess the potential technical and economic feasibility of new

tunneling system concepts. Quantitative estimates were made of costs and rate of advance of different candidate system concepts relative to an assumed set of tunneling conditions. The magnitude of R and D effort required to achieve cost reductions and performance improvements over the 1970 to 1985 time period was estimated. The study concludes that the major restraints to reducing costs and increasing performance in soft ground tunneling over the 1970 to 1985 time period will result from the lack of any effective method for handling bouldery ground and from the lack of a method for rapid installation of the permanent tunnel liner continuously and concurrently with the advance of the face. With a 15-year R and D effort of \$35 to \$70 million, these problems could be substantially overcome and current tunneling costs could be expected to decrease by 40-65% and advance rates could be expected to increase by a factor of from 4 to 8. Cost differences among the more promising alternative system concepts were found to be small relative to the range of uncertainty associated with the cost forecasts. (Author)

Prepared in cooperation with Little (Arthur D.), Inc., Cambridge, Mass.

Brandt, CT Stone, RB Smith, AR Willis, BH Pastuhof, A
Fenix and Scisson Incorporated Final Rpt DOT-FRA-OHSGT-231, May 1970, 439 pp

Contract DOT-FR-9-0034

ACKNOWLEDGMENT: NTIS (PB-194769)

PURCHASE FROM: NTIS Repr PC, Microfiche
PB-194769, DOTL NTIS

2A 039303

THE KANSAS TEST TRACK

The Federal Railroad Administration and the Atchison, Topeka and Santa Fe Railway Company are jointly sponsoring the construction of a test track as part of the railroad's heavy tonnage main line in Kansas. The objective of the project is a determination of the levels of increased train stability provided by 8 specimens of incrementally improved track support. A further objective is a definition of the cost-benefit relationship associated with each augmentation of stability. The various test segments are defined, associated instrumentation requirements are outlined, and progress to data described. (Author)

Prepared in cooperation with The Atchison, Topeka and Santa Fe Railway Co.

Federal Railroad Administration Prog Rpt FRA-RT-72-08, Oct. 1971, 33 pp

ACKNOWLEDGMENT: NTIS (PB-206622)

PURCHASE FROM: NTIS Repr PC, Microfiche
PB-206622, DOTL NTIS

2A 039603

TRACK STABILITY ON THE NETHERLANDS RAILWAYS

The science of soil mechanics is of greater importance in Holland than in almost any other country because the bearing capacity of the ground is generally low. For the preliminary exploration of the quality of the soil, two standard field tests are made by specially-trained inspectors. The first involves the measurement at intervals of the resistance to pressure when and as a cone of standard diameter and angle is forced down into the ground. The other is the sampling of the soil taken from borings at different depths; the samples are subsequently dried out and examined. Three track construction and stabilization works were in hand in 1950. A new 6-1/2 mile double line had to be constructed between Rotterdam and Nieuwerkerk, mainly over polder land 15 ft. below sea level. The second work was the strengthening of the formation under the double-track main line between Gouda and Oudewater where it is on embankment over peaty subsoil. In the third operation though an electrified and ballasted, traffic was maintained by laying a temporary track at one side complete with overhead conductor.

Railway Gazette Vol. 96 Apr. 1952, p 397, 1 Ref

ACKNOWLEDGMENT: Battelle Memorial Institute (BCL-1255)

2A 039822

QUARTERLY REPORTS: RAILWAY TECHNICAL RESEARCH INSTITUTE, VOLUME 12, NUMBER 3, 1971

Contents: Surface-stratum failure of sandy slope; Horizontal load test of vertical H-type piles; Dynamic response of railway bridge to the passage of

a railway car; Erosion control chemical materials; Eddy current rail brake set; Development of a snow loader; Grouts for prepacked concrete; Air-hole heat transfer in a traction motor; Automatic train positioned stop system; Performance test of type DE 50 diesel-hydraulic locomotive; Cold pressure welding of trolley wire; Evaluation of atmospheric factors.

See also Volume 12, number 2, PB-202 469.

Railway Technical Research Institute Vol. 12 No. 3, Sept. 1971, 62p

ACKNOWLEDGMENT: NTIS (PB-204475)

PURCHASE FROM: NTIS Repr PC, Microfiche

PB-204475, DOTL NTIS

2A 040032

RADIATION PROBES FOR SOIL MECHANICS INVESTIGATIONS IN RAILROAD CONSTRUCTION

The German Federated Railways have been using the Gamma Ray radiation probes for soil mechanics investigation for railway road beds since 1960. This article describes types of probes used, depth, injection and contact and explains the measuring techniques. The apparatus used in these investigations is described and some of the results obtained are given. [German]

Cabos, HP (Bundesbahn-Versuchsanstalt, Minden); Spang, J Werner, K (Bundesbahn-Zentralamt, Munchen) *Eisenbahn-technische Rundschau* Vol. 19 No. 8, Aug. 1970, pp 326-336, 9 Fig, 3 Phot, 7 Ref

ACKNOWLEDGMENT: Battelle Memorial Institute (BCL-1515)

2A 040086

COMPACTED ASPHALTED BALLAST ON THE RHAETIAN RAILWAYS

The preparation of a solid base of rolled and asphalted gravel as a support for block concrete sleepers has been provided in Switzerland on the second track of the metre-gauge Rhaetian Railway line from Chur to Reichenau. Two 4-in. layers of rolled asphalted broken gravel were in turn spread and rolled, and on them were laid R.S.-type block-concrete sleepers carrying continuous-welded rails. Levelling was done by packing with a mixture of fine gravel and asphalt. The first cost of this track is stated to be little greater than that of conventional track.

Railway Gazette Vol. 115 Nov. 1961, p 513, 3 Phot

ACKNOWLEDGMENT: Battelle Memorial Institute (BCL-1582)

2A 040424

PART 2--USE OF SOIL-CEMENT CONSTRUCTION FOR BANK PROTECTION ON LEVEES AND EMBANKMENTS

Once soil-cement was developed for dam facings and bank protection on levees and embankments, the application also appeared suitable for railroads where relocations and bank protection are required. This report is based on an inspection of several dams using soil-cement construction. No specific railroad applications were available for inspection.

AREA Bulletin Vol. 66 Bulletin 591, Feb. 1965, pp 532-535, 4 Fig

ACKNOWLEDGMENT: Battelle Memorial Institute (BCL-1889)

2A 047277

M.I.T. TEST SECTION INSTRUMENTATION, MASSACHUSETTS BAY TRANSPORTATION AUTHORITY, HAYMARKET-NORTH EXTENSION. FINAL PROJECT REPORT

Three objectives of the research were to: (1) develop a method for analyzing braced excavations based on the principles of soil mechanics and the finite element technique, (2) provide insight into the undrained behavior of braced excavations in clay, and (3) predict the performance of two instrumented sections of a braced excavation. The demonstration was undertaken in a section of cut-and-cover subway constructed by the Massachusetts Bay Transportation Authority. The research was intended to illuminate design and engineering considerations with reference to load factors applied to brace sheeting, the transfer of loads to the bracing system, ground movements and changes in water hydrology due to construction, and other questions. The finite element technique was used to develop a unique computer program for predicting movements in the soil mass and the retaining wall, stresses on the wall, and loads in the struts. Appended material includes a user's guide for future applications of the BRACE program.

Paper copy also available from NTIS \$8.00/set of 2 reports as PB-220

876-SET.

Massachusetts Institute of Technology, (UMTA-MA-06-0008) R72-33, Mar. 1972, 359 pp

Contract DOT-H-753

ACKNOWLEDGMENT: NTIS (PB-220877/5)

PURCHASE FROM: NTIS Repr PC, Microfiche

PB-220877/5, DOTL NTIS

2A 047278

M.I.T. TEST SECTION INSTRUMENTATION, MASSACHUSETTS BAY TRANSPORTATION AUTHORITY, HAYMARKET-NORTH EXTENSION. ADDENDUM TO FINAL PROJECT REPORT

The finite element technique was used to develop a unique computer program for analyzing the performance of braced excavations in test sections of a cut-and-cover subway constructed by the Massachusetts Bay Transportation Authority. Finite element programs permit the analysis of previously unsolvable problems; element type, method of load application, element grid size, and input material properties are a few of the variables which determine the accuracy of simulations using this method. The report examines seven limitations and problems of the latest version of the program, called BRACE 2. A complete printout of the braced excavation analysis is provided. This report was generated as an addendum to the final report of MASS-MTD-2 in which development and application of the program is covered in greater detail.

Paper copy also available from NTIS \$8.00/set of 2 reports as PB-220 876-SET.

Massachusetts Institute of Technology, (UMTA-MA-06-0008)

R72-33-Add, Mar. 1972, 60 pp

Contract DOT-H-753

ACKNOWLEDGMENT: NTIS (PB-220878/3)

PURCHASE FROM: NTIS Repr PC, Microfiche

PB-220878/3, DOTL NTIS

2A 047304

MANUAL FOR THE CONSTRUCTION AND MAINTENANCE OF SKID SURFACES CORRESPONDING TO THOSE PREPARED BY TEXAS TRANSPORTATION INSTITUTE UNDER NATIONAL BUREAU OF STANDARDS CONTRACT CST-451

The document is a manual for the construction and maintenance of skid surfaces corresponding to those prepared by Texas Transportation Institute under the National Bureau of Standards Contract CST-451. These surfaces are to be used for standardized tests and correlations relative to tire-traction studies. (Author)

Britton, SC Gallaway, BM

Texas A&M Research Foundation Final Rpt 797-4, Nov. 1972, 113 pp

Contract DOT-FH-11-7718

ACKNOWLEDGMENT: NTIS (PB-220570/6)

PURCHASE FROM: NTIS Repr PC, Microfiche

PB-220570/6

2A 048007

STEEL CASTINGS IN RAILWAY ENGINEERING

Review of developments in the use of steel castings in railway construction in the United States and Great Britain. The way in which casting processes fulfilled a very necessary role during the development of advanced railroad products is explained.

Davies, FH *Railway Engineering Journal* Vol. 1 No. 2, Mar. 1972, pp 7-18

ACKNOWLEDGMENT: EI (EI 72 079915)

PURCHASE FROM: ESL Repr PC, Microfilm

2A 052400

SERVICE TESTS OF SOLID AND MANGANESE STEEL INSERT CROSSINGS SUPPORTED BY STEEL T-BEAMS AND LONGITUDINAL TIMBERS

The purpose of this investigation was to develop an integrally welded steel T-beam type of frog support for crossings to reduce the flexural stresses in the castings and to determine its practicality under actual use in a service

test. Two steel T-beam cross section supports imbedded in asphalt bound crushed rock ballast were compared to two sections having longitudinally framed crossing timbers and crushed rock ballast. One of each of the two crossings in each group was a reversible manganese insert type, and the other a solid manganese type. It is concluded that the T-beam support was strong enough to support the crossing. The steel substructure was moderately beneficial in reducing the extent of flangeway cracks in the manganese-insert type of crossing. The solid manganese crossing with steel support developed more flangeway cracks than the solid manganese supported by crossing timbers. A vertical lip welded along the edges of the T-beam flanges would greatly facilitate the retaining of the ballast under the steel plates. The plan of having the lip on the edges of the T-beams flange with graded 3/4 in. minimum stone ballast and vibratory tamping appears to be the most practical. A greatly improved design of the clamping arrangement must be provided in order to have the steel substructure and the crossing flex function as a unit.

AREA Bulletin Proceeding Vol. 57 1956, pp 689-696, 1 Fig, 2 Phot

ACKNOWLEDGMENT: AAR
PURCHASE FROM: AREA Repr PC

2A 052449 SERVICE TESTS ON CROSSINGS

Service tests of crossings were reported. A shot peened casting installed in a test corner of a crossing showed that the depth hardened running surfaces had not worn down to fit the average wheel tread three months after installation. An inspection of four crossings using manganese insert and solid manganese supported on structural steel substructure and longitudinal timbers showed that all crossings were slightly out of line in the east and west direction, and the movement had been with the traffic on the north and south tracks. The crossings were in good condition except for some batter on the castings. A new installation of a solid manganese crossing on a structural steel T-beam substructure of revised design was described. Continuing tests of crossing frog bolt tension was discussed. The installation of a test crossing on a main line location where high speed operation prevails at Warsaw, Indiana was described.

AREA Bulletin Proceeding Vol. 51 1950, pp 653-660, 1 Fig, 7 Phot

ACKNOWLEDGMENT: AAR
PURCHASE FROM: AREA Repr PC

2A 057873 EXPERIMENTAL TESTS ON VIBRATION-PROOF TRACKS AND THEIR EFFECTS

To minimize vibrations and noise from subway operation under a primarily residential area, a new line incorporated test sections of rubber mats under crushed-stone ballast, neoprene strips in a cast concrete roadbed, and vibration-proof asphalt concrete under crushed stone. The mats proved most effective but would invite greater settling of the track, complicating maintenance. The concrete slab, while more expensive, would minimize maintenance but would be costly to restore once performance had deteriorated. The vibration-proof asphalt concrete was not effective.

Also available through Japan Railway Civil Engineering Association.

Fujiwara, T Nakamura, S (Teito Rapid Transit Authority, Japan)
Permanent Way Vol. 15 No. 3, No. 56, pp 20-28

ACKNOWLEDGMENT: Permanent Way
PURCHASE FROM: ESL Repr. PC, Microfilm

2A 080071 RECENT RESULTS IN FRENCH RESEARCH ON REINFORCED EARTH

The fundamental mechanism of reinforced earth is based on friction between earth and reinforcements. Points of maximum tension in the reinforcements separate two zones: an active zone close to the face of the structure and a resistance zone analogous to the anchoring zone in the case of a tie rod. The influence of the fine fraction of the fill on the friction between earth and reinforcements has been studied in laboratory tests on samples of sand and powdered clay mixtures. Calculation methods of traction forces in the reinforcements are presented. A comparison is made between theoretical and experimental values for reinforced earth walls with and without surcharge (full-scale experiment, two-dimensional or three-dimensional models). A method based on the elastoplasticity theory is formulated for reinforced earth foundation rafts.

Schlosser, F Long, NT (Laboratoire Central des Ponts et Chaussees)
ASCE Journal of the Construction Division Proc Paper Vol. 100 No. CO3, #10800, Sept. 1974, pp 233-237, 12 Fig., 22 Ref., 2 App.

ACKNOWLEDGMENT: ASCE Journal of the Construction Division
PURCHASE FROM: ESL Repr. PC, Microfilm

2A 080378 FIRE-PROOF BUILDING MATERIALS [Materiales de Construccion Centra el Fuego]

This article deals with the problem of the combustibility of the more common building materials: wood, concrete, plastics, textiles, etc., and indicates the treatment these materials must undergo to become effectively non-inflammable. A chapter discusses national and international standards for testing materials which are to be used for delaying combustion or keeping flames down. [Spanish]

Tobio, J *Informes de La Construccion* No. 243, Aug. 1972, pp 49-65, 10 Fig., 4 Tab.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 206572)

2A 080382 ASPHALT IN ROAD CONSTRUCTION AND HYDRAULIC ENGINEERING [Asfalt in Wegen-en Waterbouw]

This book is intended as a manual for polytechnic schools as well as for road-building and asphalt technicians. It includes chapters on road structure, materials, mixtures, asphalt mixing plants, construction of bituminous pavements, testing and control, pavement design, pavement structures, contract prescriptions, and various applications of bituminous materials. A list of references, acknowledgement of illustrations and an index are appended. [Dutch]

Vereniging Voor Bitumineuze Werken Textbook 1973, 219 pp, 81 Fig., 31 Tab., 42 Phot., 17 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 207240)

2A 080562 COMPARISON BETWEEN LIGHTWEIGHT AGGREGATE CONCRETE AND CONVENTIONAL CONCRETE IN CONCRETE BRIDGE CONSTRUCTION- ENGINEERING AND ECONOMIC ASPECTS [Teknisk-Ekonomisk Jaemfoerelse Mellan Betongbroar Utfoerda I Laettballastbetong och Konventionell Betong]

A STUDY IS MADE OF THE ENGINEERING AND ECONOMIC ASPECTS OF SWEDISH BRIDGE PROJECTS IN ORDER TO FORM AN ESTIMATE OF THE COMPETITIVE NATURE OF THE MATERIAL USED: LIGHT-WEIGHT AGGREGATE CONCRETE. FIRST IT IS NECESSARY TO EXAMINE THE RELEVANT REGULATIONS AND STANDARD SPECIFICATIONS. DESIGN RULES, ETC, FOR STRUCTURAL MEMBERS PROVIDED WITH NON-PRESTRESSED REINFORCEMENT HAVE ALREADY BEEN STANDARDIZED IN SWEDEN. IN THE CASE OF THE PRESTRESSED CONCRETE, THE MOST OBVIOUS DRAWBACK IS THE EFFECT OF THE INCREASED CREEP AND SHRINKAGE LOSSES. A STUDY OF THE FORMWORK COSTS FOR TWO SIGNIFICANT BRIDGES INDICATED THAT THE CORRESPONDING SAVINGS RANGE FROM 7.30 TO 26.50 SWEDISH CROWNS PER CUBIC METRE OF CONCRETE. FOR THE LAKE ALBYSJOEN BRIDGE, WHICH IS AN UNDERGROUND RAILWAY BRIDGE SOUTH OF STOCKHOLM, THE TOTAL SAVING VARIES FROM 49 TO 84 CROWNS PER CUBIC METRE OF CONCRETE ACCORDING TO THE ASSUMPTIONS WHICH CONCERN THE FORMWORK EQUIPMENT. FOR THE ROAD BRIDGE AT FRESCATI IN THE NORTH PART OF STOCKHOLM, THE SAVING ESTIMATED IN THE SAME WAY AMOUNTS TO APPROXIMATELY 54 CROWNS PER CUBIC METRE OF CONCRETE. THE GREATEST SAVINGS ARE DUE TO THE FOLLOWING FACTORS: (1) FOUNDATIONS ON PILES OF GREAT OR MEDIUM LENGTH, (2) HEAVY SUPERSTRUCTURE, THAT IS THE DEAD LOAD BEING EQUAL TO AT LEAST 50 PER CENT OF THE DESIGN LOADS, AND (3) FORMWORK BRIDGING OVER RELATIVELY GREAT LENGTHS OF SPAN, E.G. OVER HIGHWAYS OR RAILWAYS. [Swedish]

Alkbrant, F *Nordisk Betong* Vol. 130 No. 11, Nov. 1974, pp 23-26 4, Fig.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 207246)

2A 080574

MATERIAL TESTS FOR ROAD CONSTRUCTION WORK AND THEIR INFLUENCE ON THE QUALITY OF CONSTRUCTION ATTAINED [Materialpruefungen bei Strassenbauarbeiten und ihr Einfluss auf die Erreichte Ausfuhrungsqualitaet]

APART FROM INTENSIVE SUPERVISION BY THE CONTRACTOR AS PART OF QUALITY TESTING, CONTINUOUS CONTROL EXAMINATIONS ARE CONSIDERED NECESSARY SO THAT DIRECT INFLUENCE ON THE QUALITY OF THE CONSTRUCTION CAN BE ATTAINED. THE EXTENSIVE CONTROL TEST RESULTS AVAILABLE AT THE MUNICH MATERIALS TESTING CENTRE WERE EVALUATED STATISTICALLY. TWO IMPORTANT CHARACTERISTIC FEATURES WERE TAKEN FROM THE PRESENT PROGRAMME OF DETERMINING QUALITY CHARACTERISTICS, AND THE CHANGES IN THE FEATURES DURING THE LAST FOUR YEARS ARE ILLUSTRATED GRAPHICALLY. FROM THIS, SOME INTERESTING CONCLUSIONS CAN BE DRAWN: IT WAS FOR EXAMPLE ESTABLISHED THAT THE CHIPPINGS CONTENT OF GUSSASPHALT FOR URBAN ROAD CONSTRUCTION COULD BE REGARDED AS BEING OPTIMUM AT 47 PERCENT OF WEIGHT, BECUASE OF PROCESSING. MOREOVER IT WAS REGULAR CHECKS. SIGNIFICANTLY DURING THE CONSTRUCTION PERIOD AS A RESULT OF [German]

Spaeth, M *Strasse und Autobahn* Vol. 23 No. 8, Aug. 1972, pp 415-417, 2 Fig., 1 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 300691)

2A 080709

RECENT DEVELOPMENTS IN THE CONSTRUCTION OF CONCRETE ROADS [Neure Entwicklungen beim bau von Betonfahrbahnen]

Hitherto Concrete Surfacing have been regarded as having two functions: to act as a carriageway and to transfer the bases was usually not taken into account. Tests carried out in the USA and theoretical investigations show that the stress on the concrete surfacing is more or less dissipated depending on the stiffness and the bonding action between the surfacing and the stabilized layer the inclusion of stabilized layers into the supporting system leads to new methods of constructing concrete roads, enabling better adaptation to bad subsoil conditions to be achieved by means of partial or complete elimination of the frost blanket. particularly high bearing capacity can be brought about by the use of a thin, continuously reinforced concrete surfacing, where the bond between the surfacing and the cement-stabilized layer is even guaranteed after repeated loading and the effects of temperature. [German]

Eisenmann, J (Technical University of Munich, West Germany) *Zement und Beton* pp 17-25, 4 Fig., 3 Tab., 4 Phot., 12 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 301109)

2A 080711

THE CONSTRUCTION OF LIGHTLY TRAFFICKED ROADS IN FRAME

Lightly trafficked roads represent a substantial proportion of the road network in France. Lower standards than those applicable to heavily trafficked roads should be acceptable for these roads. The present design of roads carrying between 200 and 700 vehicles a day in France requires the use of the same high quality materials as for more heavily trafficked roads except that surface dressings are permitted for the wearing course. Those requirements are probably too stringent because the percentage of heavy vehicles in the total volume of traffic is smaller for lightly trafficked roads than that for more heavily trafficked roads. Results from the AASHO Road Test are used to show that a reduced thickness of bitumen-bound bases is adequate for lightly trafficked roads. For these roads, local materials which are unsuitable for heavily trafficked roads are recommended to reduce construction costs. Practical examples of the use of local materials in France

are given; in particular, hot sand mix made with hard bitumen and emulsion stabilized gravel are being increasingly employed for this purpose. Flexible construction is preferred because relatively thin layers are adequate for these roads and semi-rigid construction is therefore uneconomic.

Desvignes, R *Shell Bitumen Review* No. 42, 1973, pp 2-5, 2 Fig., 5 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 207891)

2A 080716

QUALITY REQUIREMENTS FOR AGGREGATES IN SOUTH AFRICA

This paper discusses a draft new specification for aggregates that has been prepared by the South African Bureau of Standards (SABS) to supersede two existing standards (SABS 647 and SABS 718) for single-sized stone for roads and aggregate for concrete, respectively. Entitled "Aggregates from Natural Sources" it covers (A) fine and coarse aggregate for concrete, (B) five aggregate for bituminous mixtures, (C) five aggregate for slurry seals, (D) single-sized coarse aggregate for road construction and (E) aggregate for base-course material. The author gives an outline of the scope and content of the draft specification in which tables have been used as much as possible to show the requirements for different purposes. He considers that the unification of the grading and flakiness requirements of coarse aggregate for concrete and road construction will ease production problems. The main document is to give details of the tests required by the specification itself; other tests are to form appendices. Reference is made by the author to the production of aggregates under the sabs mark scheme which is made possible by the comprehensive testing facilities of the bureau. The mark indicates that the bureau is satisfied that an aggregate complies with the relevant specification and that adequate quality control is exercised in its production.

Bennie, IM *Quarry Managers' Journal* Vol. 27 No. 10, Oct. 1973, pp 341-343, 2 Tab.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 207889)

2A 080830

EVALUATION OF STRESS CELL PERFORMANCE

Described in this paper are the design and construction of a series of low compliance total stress cells and their performance in the laboratory and in the field. Experimental data from laboratory calibration tests are evaluated by means of several different finite element models, and the results indicate that, within the limits investigated, neither the thickness-to-diameter ratio of these cells nor the relative stiffness of the soil and the cell has much influence on the measured response, but regions of loose or dense soil in the immediate vicinity of the cells do affect their output. Limited evidence suggests that these cells can also measure horizontal stresses quite reliably. The qualitative field performance of 35 cells within two soil-pipe installations and the quantitative field performance of three free field cells suggest rather convincingly that these cells are relatively insensitive to temperature variations and are capable of measuring accurately the static stresses acting normal to their faces. /ASCE/

Krizek, RJ (Northwestern University, Evanston); Farzin, MH (Stone and Webster Engineering Corporation); Wissa, AEZ (Geotechniques International, Incorporated); Martin, RT (Massachusetts Institute of Technology) *ASCE Journal of the Geotechnical Engineering Div* Vol. 100 No. GT12, Proc. Paper 11030, Dec. 1974, pp 1275-95, 8 Fig., 1 Tab., 10 Ref.

2A 080850

THE WORK OF THE STANDARDS COMMITTEE ON MASSIVE CONSTRUCTION AND THE EUROPEAN COMMITTEE ON CONCRETE [Die Arbeiten des Fachnormenausschusses Massivbau und des Europaischen Betonausschusses (CEB)]

The author describes the work being carried out by the standards committee on massive construction, and by groups working on highway bridges, prestressed concrete and standards is discussed. Finally a description is given of the work of the European Committee on concrete. /TRRL/ [German]

Soretz, S *Zement und Beton* Dec. 1972, pp 1-8, 3 Fig., 9 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 301119)

2A 080925

HIGHWAY CONSTRUCTION USAGE FACTORS FOR AGGREGATES

In an effort to aid commercial pit and quarry operators as well as highway contractors, engineers and economists in planning highway construction programs, tables are presented of usage factors for aggregates. Aggregates constitute between 20 and 30 percent of the cost of all materials and supplies and between 9 and 13 percent of the total construction cost (excluding the cost of right-of-way and engineering). The data employed in the development of the factors are quantities of the major materials used and the factors are quantities of the major materials used and construction projects on the Federal-aid Primary System. The factors are quotients obtained when total quantities are divided by corresponding totals in millions of dollars of final construction costs. These factors may be applied to any program of highway construction expenditures to obtain estimated requirements. Percentage distribution of cost for aggregate are tabulated, as well as the estimated construction expenditures for all public highways. Estimated national average secondary road factors are also presented.

Federal Highway Administration 1974, 5 pp, Tabs.

2A 080926

HIGHWAY CONSTRUCTION USAGE FACTORS FOR LUMBER TIMBER PILING, PETROLEUM PRODUCTS, AND EXPLOSIVES

The report which provides tabulated data on usage factors, is intended to aid producers, manufacturers and suppliers of lumber, timber piling, petroleum products and explosives. The usage factors, in terms of units of the various materials per million dollars of construction cost, when multiplied by the number of millions of dollars for either Federal-aid highway construction programs, will give reasonably accurate estimates of material requirements. Percentage distributions of cost for lumber, timber piling, petroleum products and explosives are tabulated, as well as estimated construction costs for all public highways. The estimated national average secondary road factors are also presented.

Federal Highway Administration 1974, 5 pp, Tabs.

2A 080927

HIGHWAY CONSTRUCTION USAGE FACTORS FOR STEEL

Tables are presented of usage factors that are intended to aid mills, fabricators, and related industries as well as highway contractors, engineers, and economists in planning to meet the needs of highway construction programs. The usage factors, in terms of units of the various materials per million dollars of construction cost when multiplied by the number of millions of dollars for either a Federal-aid or non-Federal-aid highway construction program, will result in reasonably accurate estimates of material requirements. Steel constitutes between 16 and 29 percent of the cost of all materials and supplies, and between 7 and 13 percent of the total construction cost (excluding the costs of right-of-way and engineering). The percentage distributions of costs for various steel classifications are presented, as well as the estimated construction expenditures for all public highways. The estimated national average secondary road factors are tabulated.

Federal Highway Administration 1974, 5 pp, Tabs.

2A 080931

THE EFFECTS OF VARIATIONS IN HEAT TREATMENT ON THE STRENGTH AND TOUGHNESS OF RAIL STEEL

In an effort to develop stronger and tougher rail material, a research program is outlined which was designed to investigate the fundamental metallurgical parameters involved in rail design and manufacture. The first area of study reported here is concerned with the effects of heat treatment variations on mechanical properties of steel, and was planned to determine the feasibility of developing a rail with improved mechanical properties by making only minor variations in the conventional method of processing. A systematic heat-treating schedule was developed to isolate as well as possible, the effects of the different heat-treating parameters. The two main variables studied were austenitization temperature and isothermal transformation temperature. Experimentally, both tensile and impact tests were performed on each of the 14 different heat treatments. Preliminary results are discussed, and the general effects are defined and evaluated.

Hyzak, JM (Carnegie-Mellon University); Stone, DM (Association of American Railroads); Bernstein, IM (Carnegie-Mellon University) *AREA Bulletin* Vol. 75 No. 468, 75-648-8, June 1974, pp 776-778, 2 Fig.

2A 081016

BIBLIOGRAPHY OF TIMBER BRIDGE DESIGN

Properly designed and constructed timber bridges offer one possible solution to the problem of replacing and upgrading bridge structures on secondary and county highways. For each document on this comprehensive list of design literature on timber highway bridges, a brief abstract is provided to aid the designer in selecting appropriate reference information for a specific design problem. It requires less energy to process timber to a usable construction material than other conventional construction materials.

Williamson, TG *ASCE Journal of the Structural Division Proc Paper* Vol. 101 No. ST1, ASCE #11042, Jan. 1975, pp 1-10

2A 081100

BUILDING TIME HALVED ON KIMBERLEY BY-PASS

THIS ARTICLE DESCRIBES THE COMPLETION OF THE KIMBERLEY- EASTWOOD BYPASS 16 MONTHS AHEAD OF SCHEDULE, DESPITE DIFFICULT SOIL CONDITIONS AND DERELICT MINE WORKINGS. THE 6.4 KM DUAL CARRIAGEWAY RUNS FROM LANGLEY MILL TO THE M1 AT NUTHALL. TWO SOIL SURVEYS INDICATED THAT THE LINE OF THE BYPASS WAS UNDERLAIN BY FAULTED ARGILLACEOUS AND ARENACEOUS STRATA OF LOWER AND MIDDLE COAL MEASURES, MARL, LIMESTONE AND SANDSTONE. COAL SEAMS, WHICH HAD BEEN WORKED, WERE PRESENT. CBR VALUES OF 6% FOR ARGILLACEOUS STRATA AND 30% FOR SANDSTONE WERE RECOMMENDED FOR ROAD DESIGN PURPOSES. SEVEN MINE SHAFTS WERE DRILLED AND GROUTED AND A CONCRETE PLUG PLACED AT ROCK HEAD LEVEL. THE CONTRACT INCLUDED 8 BRIDGES AND 3 SUBWAYS. TWO BRIDGES ARE 3-SPAN REINFORCED CONCRETE ANCHOR/CANTILEVERED WITH PRE-STRESSED CONCRETE 'T' SUSPENDED BEAMS. CIRCULAR COLUMNS FOR 2 BRIDGES WERE CAST ON-SITE FROM ONE REINFORCED GLASS-FIBRE MOULD. OTHER BRIDGES INCLUDE A 2-SPAN BRIDGE WITH A 15 DEGREE SKEW AND A FOOTBRIDGE WITH A 47.0 PARABOLIC ARCH. THE SUBWAYS ARE IN-SITU REINFORCED CONCRETE U-SECTIONS WITH SUSPENDED DECK SLABS.

Contract Journal Vol. 260 No. 4948, July 1974, pp 28-29, 4 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 210191)

2A 081148

THE GLION TUNNELS ON THE LEMAN MOTORWAY [Les tunnels de glion sur l'autoroute du leman]

The project is outlined and details given of the ventilation, lighting, equipment, and entrance works. geological and hydrological conditions are outlined together with construction methods used, work progress, incidents on site during construction, strengthening by means of metal centering and cement injection. [French]

Guisan, F (Bonnard et Gardel) *Travaux* Vol. N No. 39, Oct. 1971, pp 17-27, 8 Fig., Photos.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 100120)

2A 081173

SEISMOGRAPH SPEEDS SUBSURFACE INVESTIGATION

The seismograph technique is described where shock waves bounced off bedrock permit rapid reconnaissance and eliminate need for expensive and time consuming probings. The use is detailed of the seismograph system for the determination of the depth of bedrock, the identification of soil types and the detection of interfaces between different soils, the study of highway materials deposits, and the detection of the water table.

Bigelow, N *Public Works* Vol. 95 No. 9, Sept. 1964, pp 98-99, 2 Tab., 2 Phot.

2A 081265

STABILITY OF RIBBED PLATES IN THE CONSTRUCTION OF RAILWAY VEHICLES [Zur Stabilität gesickter Bleche im Schienenfahrzeugbau]

In the case of plates with tailed-in ends, compressed along the ribbing, coupled elongations are produced as a result of bending deformation. These

additional compression stresses are superposed upon the primary buckling constraints. For this reason, the elastic limit can be exceeded locally in ribbed walls, more especially in the intervention zone of the transversal forces. Other origins of this phenomenon can be: lack of precision in assembling, pre-existent deformations in the ribbed plates, residual welding tensions and the very asymmetrical form of the ribbing. Tests have been carried out in order to determine the bending stress. [German]

Haug, A *Leichtbau der Verkehrsfahrzeuge* Vol. 18 No. 3, May 1974, pp 58-63, 2 Tab., 6 Ref.

ACKNOWLEDGMENT: International Railway Documentation, Selection of (UIC Serial No. 1188)

PURCHASE FROM: International Union of Railways, BD 14 rue Jean Rey, 75015 Paris, France Repr. PC

2A 081346

USE OF LATERITIC SOILS FOR ROAD CONSTRUCTION IN NORTH DAHOMEY

DUE TO THE DETERIORATION OF THE PARAKOU-MALANVILLE HIGHWAY, THE PREPARATION OF A REHABILITATION PROGRAMME WAS NECESSARY. THE RELATED GEOTECHNICAL EXPLORATION PROVIDED AN EXCELLENT OPPORTUNITY TO STUDY THE PROPERTIES OF THE ENCOUNTERED LATERITIC SOILS. THE MINERALOGICAL ANALYSIS PROVED THAT THE LATERITIC OVERBURDEN ORIGINATES FROM THE LOCAL ROCKS. HOWEVER, THE ANALYSES ALSO INDICATED THAT THE SOILS CAN ONLY BE IDENTIFIED AS LATERITIC BY VIRTUE OF THEIR HEMATITE CONTENT. THE SOILS WERE CLASSIFIED ACCORDING TO THE AASHO- SYSTEM AND THEIR GEOTECHNICAL PROPERTIES WERE THOROUGHLY INVESTIGATED. THE RESULTS REVEALED THAT THE OVERWHELMING MAJORITY OF THE AVAILABLE SOILS WAS UNSUITABLE FOR HIGHWAY CONSTRUCTION DUE TO THEIR HIGH PLASTICITY. IN ORDER TO IMPROVE THEM, CEMENT STABILIZATION WAS SUGGESTED. THE LABORATORY TESTS RESULTED IN AN ECONOMICALLY FEASIBLE SOLUTION. /AUTHOR/

Simon, AB Giesecke, J (Institut fuer Erd-und Grundbad, West Germany); Bidlo, G *Engineering Geology* Vol. 7 No. 3, Dec. 1973, pp 197-218, 17 Fig., 3 Tab., 8 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 210194)

2A 081376

THE USE OF FLY ASH, AN INDUSTRIAL BY-PRODUCT, FOR THE CONSTRUCTION OF A HIGHWAY EMBANKMENT

The typical composition range of flyash is given, as well as the standard laboratory density of the flyash used on the embankment construction project. The design criteria and site conditions are outlined and details are given of the construction. Research in this area is briefly reviewed and conclusions based on experience are set forth. The age hardening characteristic of the material is expected to give a strong, lightweight, stable fill. When the moisture content is controlled within a range of 20-25 percent, the material is workable and stable provided appropriate construction methods are utilized. Excellent compaction and penetrometric results were obtained when the flyash was compacted at a moisture content of 2-5 percent below optimum. Flyash may prove useful in the bridging of weak soils.

Bacon, LD (Illinois Department of Transportation) *Highway Focus* Vol. 6 No. 3, July 1974, pp 1-14, 3 Fig., 9 Phot., 6 Ref.

2A 081397

TEXAS HIGHWAY DEPARTMENT PAVEMENT MANAGEMENT SYSTEM

This paper describes a conceptual version of a pavement management system to assist in making pavement decisions that will result in users getting better services for their expenditures. These decisions are made about programming, designing, constructing, and maintaining pavements. A description is given of the conceptual system and the present working system.

Brown, JL (Texas Highway Department) *Transportation Research Record* No. 512, 1974, pp 16-20, 15 Ref.

PURCHASE FROM: TRB Publications Off Orig. PC

2A 081420

INTERNATIONAL RECOMMENDATIONS FOR THE DESIGN AND CONSTRUCTION OF CONCRETE STRUCTURES. PRINCIPLES AND RECOMMENDATIONS

These recommendations cover the whole field of the design and construction of reinforced concrete and prestressed concrete engineering structures. The work is divided into four parts; Principles and Recommendations, which are contained in this volume, and Supplements and Appendices which will be published separately.

Presented at Federation Internationale de la Precontrainte Sixth Congress, Prague, Czechoslovakia.

Cement and Concrete Association 1970, 88 pp, Figs., Tabs.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 58731)

2A 081553

WIRAND FIBRE-REINFORCED CONCRETE--A NEW CONSTRUCTION MATERIAL [Fibremärnad WIRAND-betong--ett nytt konstruktionsmaterial]

The article is based upon the literature describing the experimental work done by J.P. Roumalki and researchers at the Columbus Laboratories of the Battelle Memorial Institute under the guidance of the Battelle Development Corporation, Columbus, Ohio, which led to the international patent for Wirand concrete. This concrete contains up to 3 per cent in volume of 0.025-0.40 mm steel fibre 25 mm long. The size of the largest aggregate is 10 mm. The material is characterized by a high bending tensile strength of 150 kg/sq. cm maximum. This concrete can be used especially for shell structures, thin plates-road and runway surfacings, bridge decks, beams, marine constructions, etc. [Swedish]

Lankard, RR Dickerson, RF *Cement och Betong* Vol. 46 No. 4, Nov. 1971, pp 590-515, 1 Fig., 3 Tab., 6 Phot., 2 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 55811)

2A 081588

CONSTRUCTION AND LANDSCAPE PANEL

The engineering-construction aspects are discussed of the problems and advances encountered in land reclamation. Attention is focussed on the use of one method (vertical sand drains) of foundation treatment to deal with a section of the Washington, D.C. Circumferential Highway (Interstate 495) passing over swampy area. Methods of treatment for soft foundations are reviewed, and the consolidation behavior of soils is discussed. Details are given of the specific treatment in which sand drains consisting of columns of clean sand are installed at specifically designed spacings through the treatment area. The incorporation into the system of stabilizing toe berms, the rate of construction of the overload embankment, and the use of construction control devices are detailed. The basic construction sequence is discussed. Details are given of the placement of a working platform, the use of windrows, the installation of piezometers, and the placement of the overload surcharge beam. The evaluation of the treatment is discussed.

Raysa, EP (Virginia Department of Highways and Transportation); Furgivelle, AW
Virginia Highway Conference Nov. 1963, pp 27-44, 6 Fig.

2A 081655

THE DESIGN OF FLEXIBLE PAVEMENTS 5. A CRITICAL EXAMINATION OF THE USE OF CEMENT BOUND LAYERS IN MOTORWAY PAVEMENTS [Dimensionamento Di Sovrastrutture Flessibili 5. Esame Critico Sull'Impiego Degli Strati Legati A Cemento Per Le Sovrastrutture Autostradali]

This article discusses the use of two types of material, a granular mixture bound with blast furnace slag, and a soil cement mixture, in the strengthening of deteriorated flexible pavements and in the construction of new ones. A description is given of the use of soil cement in the construction of lanes of different bearing capacity (the slow lane for heavy vehicles as opposed to the fast lanes and the shoulders) on the Milano-Bologna section of the Autostrada Del Sole. [Italian]

Camomilla, G Frascchetti, FM *Autostrade* Vol. 15 No. 12, Dec. 1973, pp 14-20, 5 Fig., 1 Tab., 4 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 209532)

2A 081685

VERY HIGH-FREQUENCY HUMIDITY METER FOR CONSTRUCTION MATERIALS [Svch-Vlagomer Stroitel'Nykht Materialov.]

DETAILS ARE GIVEN OF THE DESIGN OF THE HUMIDITY METER AND ITS COMPONENTS, CALIBRATION AND TESTS. THE APPARATUS USES THE PRINCIPLE OF THE REDUCTION IN ENERGY OF A VERY HIGH FREQUENCY CURRENT (10GHZ) GOING THROUGH A SAMPLE. THIS REDUCTION VARIES LINEARLY AS A FUNCTION OF THE WEIGHT OF THE WATER CONTAINED IN THE MATERIAL. [Russian]

Makarov, AN *Stroitel Nye Materialy* No. 5, May 1972, pp 32-4, 4 Fig., 1 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 100497)

2A 081742

CONSTRUCTION OF BITUMINOUS PAVEMENTS WITH A DEGREE OF EVENNESS AND A MINIMUM QUANTITY OF MATERIAL

Owing to the requirement that paved surfaces should be smooth and even, and still have a specified minimum thickness, new plans are constantly being devised to improve the surface quality of newly constructed surfacing. In this paper the problem is discussed with reference to the construction of bituminous overlays on existing airport pavements. It is shown how to deviate from a theoretically perfect plane to a plane deformed within certain tolerances without decreasing the serviceability. Thus the quantity of material required may be considerably reduced with corresponding financial benefits. Particulars of the method with respect to surveying, tolerances, the computer program, plant and construction techniques are given. /TRRL/ Conference held on July 28-Aug. 1, 1969.

Rauth, PL Hugo, F *Conference on Asphalt Pavements for So Africa Proc* Vol. 1 Session X, July 1969, 13 pp, 5 Fig., 8 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 58381)

2A 081743

ASPHALT CONSTRUCTION TECHNIQUES

A detailed description is given of the techniques required for asphalt construction with particular reference to Durban's Southern Freeway. The advantages of this type of construction for South African conditions are also considered and the contractor's problems discussed. /TRRL/ Conference held on July 28-Aug. 1, 1969.

Perry, J *Conference on Asphalt Pavements for So Africa Proc* Vol. 1 Session X, July 1969, 8 pp, 2 Phot., 3 Ref.

ACKNOWLEDGMENT:

2A 081769

MODERN FLEXIBLE ROAD CONSTRUCTION

This book covers the design and construction of flexible pavements under the chapter headings of structural elements of flexible roads, the application of elastic theory to flexible pavements, design of flexible pavements according to Road Note 29 (third edition), materials used in the construction of flexible roads, premixed bituminous materials, dense bituminous road bases, base course materials, wearing course materials, construction of flexible pavements and characteristics of flexible roads. /IRRD/

Asphalt and Coated Macadam Association 1971, 82 pp, 3 Fig., 19 Tab., 11 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 61781)

2A 081770

MOTORWAYS IN NORTHERN IRELAND

There are at the present time 56 miles of motorway completed and opened to traffic in Northern Ireland, a further 7 miles under construction and a

further 47 miles at the project stage. These motorways are similar to those in Great Britain except for the mound barrier on the central reservation, special curbing along each side of the pavement, and a continuous 4.5 ft-wide paved strip next to the fast lane of the pavement in the central reservation. Mention is made of the predominance of boulder clay and peat and construction methods used. Details are given of aggregates and materials utilized, concrete bridge design and construction, motorway lighting systems, and preliminary survey works. Costs are quoted. /IRRD/

This article is based on a paper presented at the Institution of Highway Engineers National Conference- Northern Ireland, July 5-7, 1971.

Allen, GWH *Roads and Road Construction* Vol. 49 No. 584, Aug. 1971, pp 278-281, 1 Fig., 1 Tab., 1 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 61955)

2A 081809

ROAD CONSTRUCTION IN THE CARIBBEAN

Details are given of the 14.1-mile main highway under construction between Chaguanas and San Fernando in Trinidad. It will provide two 24-ft pavements, 15 steel and reinforced concrete bridges and four underpasses, and seven miles of frontage roads. The works include earthworks, drainage, sub-base, bridges and culverts for both pavements, and the gravel base and asphaltic concrete for one pavements only. Mention is made of the soil along the route, earthmoving and compaction equipment. /IRRD/

Bowden, KS *Roads and Road Construction* Vol. 49 No. 585, Sept. 1971, pp 319-320, 3 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 42489)

2A 081820

STRUCTURAL ANALYSIS OF STEAM-HARDENED CONSTRUCTION MATERIALS BY MEANS OF THE SCREEN ELECTRON MICROSCOPE [Getuegeuntersuchungen an dampfgehaerteten Baustoffen mit Hilfe des Raster-Elektronenmikroskops]

The operation of the microscope is described, and examples of application to the structural analysis of steam-hardened construction materials containing calcium silicate are given. /IRRD/ [German]

Schwiete, HE Rehfeld, G *Zement-Kalk-Gips* No. 3, Mar. 1969, pp 109-111, 1 Fig., 6 Phot., 5 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 53372)

2A 081847

MILTON KEYNES NEW CITY--THE ROAD TO SUCCESS

The development of the new town of Milton Keynes provided an opportunity to plan a road network designed to serve the new population and industry in the best possible way. A rectangular grid road system with road spacings at approximately 1 km intervals was adopted. The occurrence of the River Ouzel, the Grand Union Canal (which is elevated above ground level over much of its length), and the main London Midland region railway line formed obstacles for road construction since each required construction of a bridge. This article discusses the soil conditions encountered, cut-and-fill operations, the use of CBR tests for pavement design purposes, and the consideration given to the stability of slopes. The solutions found for runoff problems and problems encountered in obtaining construction materials are also discussed.

James, H Lukey, ME *Ground Engineering* Vol. 7 No. 6, Nov. 1974, pp 39-42, 2 Fig., 5 Phot.

2A 081886

INTERNATIONAL STATE OF THE STATISTICAL SAFETY THEORY AND PLASTIC THEORY [Internationaler Stand der statistischen Sicherheitstheorie und der Plastizitätstheorie]

The author describes the application of mathematical statistics methods to the design of structures. The first part of the article discusses (1) statistics in the manufacture of construction materials, (2) statistics in design, (3) partial coefficient of safety, and (4) damage frequency. The second part entitled "plastic theory" for statistically indeterminate systems, deals with

the redistribution of internal forces, articulated plastic joints, deformations up to rupture point due to compression and folding, and statistically indeterminate deformations up to rupture point. Attention is drawn to the special study of articulated plastic joints for beams and rupture line theory for slabs. /IRRD/ [German]

Soretz, S *Betonwerk und Fertigteile-Technik* No. 10, Oct. 1969, p 625-6331, 5 Fig., 2 Phot., 7 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 53379)

2A 081891

FROST DAMAGE [Frostschaden]

The author differentiates between primary and secondary frost damage and makes a special study of secondary damages, e.g. rupture of the surfacing above points weakened by water penetration under traffic loads. Several preventive and remedial measures are proposed, and mention is made of the "Criterium-Canagrande" which lists natural construction materials resistant to frost and their source. /IRRD/ [German]

Raab, A *Naturstein-Industrie* No. 2, Mar. 1969, pp 57-60

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 53391)

2A 081895

TESTING CONSTRUCTION MATERIALS WITH THE PYCNOMETER [Baustoff-Untersuchungen mit dem Pycnometer]

Details are given on the use of the pycnometer in a number of tests on construction materials. The dimensions of the pycnometer and scale are a function of the characteristics of the materials tested and of the desired accuracy. Fine materials and construction materials such as cement, bitumen, sand and gravel up to a grading of 12 mm, fine asphaltic concrete, and mortar can be studied with a glass pycnometer and a scale having a capacity of 4 kg and accuracy of 0.2 g. For materials of higher grading, a pycnometer preferably made of metal with a capacity of 10 liters and accuracy of 5 g must be utilized. Results can be evaluated by means of simple calculations. The absolute density of the materials and mixed materials tested is used as a basis for the calculations. /IRRD/ [German]

Foth, J *Betonwerk und Fertigteile-Technik* No. 11, Nov. 1969, pp 667-671, 2 Tab., 2 Phot., 1 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 53396)

2A 082731

PRODUCTION EFFICIENCY STUDY ON LARGE-CAPACITY, RUBBER-TIRED FRONT-END LOADERS

In an effort to determine the capabilities of the machine in loading bank material into off-highway hauling units and to locate the delays associated with the operation, 27 large-capacity, rubber-tired, front-end loader operations were studied on both highway and non-highway construction projects. The loaders ranged in size from 5.5 to 15 cubic yards heaped, and the productive work time averaged 59 percent of the Total Available Work Time (TAWT). Minor delays (lasting less than 15 mins.) totalled 27 percent of the TAWT, and 14 percent was attributed to major delays. Weather delays were not included. Productive output was more dependent on an adequate payload per loading cycle than on a quick cycle time. Equipment and maintenance repair delays totalled over 65 percent of the major delay time. Minor delay time was largely due to hauling unit shortages at the load site, and the impact of these delays was dependent on the use of this time by the loader operator. Findings of this investigation are summarized. Based on the study, the conclusion is drawn that a greater in-depth evaluation of the loading operation by the contractor is needed to determine to what extent delay time can be decreased, and further evaluation of loader performance can be accomplished with minimum field data and minimum calculations.

Bernard, Da Ferragut, TR Neumann, DL
Federal Highway Administration Final Rpt. FHWA-RDDP-PC-520,
May 1973, 53 pp, 12 Fig., 8 Tab., 2 App.

2A 082750

REPORT OF AGGREGATES AND WASTE MATERIALS WORKING GROUP

This report is concerned with five items: (A) The derivation of technical coefficients (given as an appendix) for estimating the consumption of aggregates by various construction sectors. A table gives estimates of the annual production of different types of aggregate and the amount used for different purposes; (B) determining the consequences of exploiting alternative aggregates to sand and gravel. It is concluded that crushed rock can be used in concrete, light-weight aggregates may also be used if design criteria are more stringent, lower-grade and waste materials may be used as road fill and in sub-bases, and that an increase in the cost of aggregate has more effect on the overall cost of roads than of buildings; (C) reviewing test criteria in British Standards and other specifications, which in the light of present knowledge, are not considered to be unduly restrictive; (D) surveying waste materials. The current production utilization and amount of stockpiled materials are summarized in a table. The major waste materials are discussed individually and a map shows their distribution. Details are given of an analysis of the social cost of using colliery spoil in road construction; (E) investigation of the part played by the cost of transport on the choice of aggregates. Various forms of transport are discussed including road, rail, water, conveyor belt and pipe-line systems. The report also includes details of a number of recommendations that are made for further research.

Building Research Establishment R&D Rept. No. CP 31/73, 1973, 12 pp, 1 Fig., 5 Tab., 4 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 208026)

2A 082889

GUIDE TO THE SELECTION AND TESTING OF GRAVEL FOR PAVEMENT CONSTRUCTION

This publication which covers the field in general terms, summarizes basic Australian practice in the selection and testing of gravels and soils for pavement construction, and includes references to testing equipment used and details of test procedures. In dealing with specific problems in particular localities, the procedures described may require to be supplemented by investigation and tests of more local application. The factors to be considered in the selection of a gravel are: the type of pavement, position of gravel in pavement, climate, traffic and the use of local materials. The composition of the gravel, grading, the fine aggregate and binder, coarse aggregate and maximum size of aggregate are some of the properties of gravel to be considered. The improvement of sub-standard gravel is also considered. The location and identification of gravel is discussed in detail. Details are given of tests for determining quality and the control of quality during construction. Appendices are included which provide information on sampling equipment, general requirements for gravel for road pavements, grading requirements, and field identification procedures for fine-grained soils or fractures.

National Association of Australian State Road Auth 1974, 25 pp, Figs., Tabs., 6 App.

2A 082901

THE USE OF BY-PRODUCTS IN CONCRETE

This paper evaluates the use of industrial by-products and waste materials for use in construction. The following by-products are included in the evaluation: blast furnace slag, steel slag, colliery spoil, china clay waste, slate waste, waste from coal burning power stations, by-product calcium sulfate, residues from directly incinerated refuse, and several other miscellaneous wastes. The existing knowledge on the present utilizations of these materials as aggregates or cements in concrete is described and future prospects are discussed. For all materials the following stages constitute the technical assessment: (1) determination of physical properties; (2) chemical analysis; (3) mineralogical examination by microscopy and X-ray analysis to identify compounds present; (4) stability tests; (5) use in concrete as aggregate or cement followed by tests of the concrete for strength and durability; (6) assessment of the life of steel reinforcement in the concrete containing the by-product; and (7) determination whether the material can be used directly, or after heat treatment.

Gutt, W
Building Research Establishment CP 53/74, May 1974, 19 pp, 6 Fig., 11 Tab., 35 Ref.

PURCHASE FROM: Building Research Establishment Distribution Unit, Application Services Division, Garston, Watford WD2 7JR, England Repr. PC

2A 082906

STANDARD SPECIFICATIONS FOR CONSTRUCTION OF ROADS AND BRIDGES ON FEDERAL HIGHWAYS PROJECTS

Specifications are presented for those items of work, materials, and construction methods that are generally applicable to direct Federal highway contracts, and which may also be adapted for use by other highway agencies. This publication, which is dualized in order to familiarize the user with the metric system, is patterned to the extent possible after the AASHTO Guide Specifications for Highway Construction in order to establish a nationwide uniformity and consistency of specifications and contractual matters in highway construction. The specifications, which are designed to prevent early obsolescence and controversy in the administration of contracts, and to encourage increased production and decreased costs consistent with high quality work, cover various aspects of general requirements and construction details. Earthwork base courses, bituminous pavements, and rigid pavements are covered in detail, as well as bridge construction, incidental construction and materials.

Federal Highway Administration FP-74, 1974, 461 pp, Figs., Tabs., 1 App.

PURCHASE FROM: Government Printing Office Superintendent of Documents, Washington, D.C., 20402 Repr. PC

5001-00078

2A 082988

STATE OF THE ART: PAVEMENTS

An outline is presented of pavement practice in relation to common pavement design, construction and maintenance. Various aspects of the subject are defined and consideration is given to the pavement system, general evaluation of the pavement, types of pavements and their characteristics, and pavement materials. Quality control and pavement variability are considered as well as pavement design and traffic wear. Pavement construction, material evaluation in the laboratory, and field evaluation are also covered. Earthwork and pavement subgrade, subbases and bases, surfacings, aggregates, drainage and stabilization are other aspects of pavements discussed here. Pavement maintenance and research are also reviewed.

Smith, AD

National Roads Board, New Zealand Bulletin No. 20, 1974, 72 pp

2A 083122

BS 63: PART 2: 1971 SPECIFICATIONS FOR SINGLE-SIZED ROADSTONE AND CHIPPINGS. PART 2. METRIC UNITS

THIS IS A REVISED VERSION OF THE EARLIER IMPERIAL-UNIT STANDARD. IT LAYS DOWN THE GRADING AND PARTICLE SHAPE REQUIREMENTS FOR SINGLE-SIZED ROADSTONE AND CHIPPINGS FOR USE IN THE CONSTRUCTION AND MAINTENANCE OF ROADS. EIGHT SIZES ARE SPECIFIED, NAMELY NOMINAL 50MM, 40MM, 28MM, 20MM, 14MM, 10MM, 6MM AND 3MM MATERIALS. A TABLE GIVES THE TEST SIEVE SIZES THAT DEFINE THE SPECIFIED SIZE, OVERSIZE, UNDERSIZE AND DUST FRACTIONS FOR EACH SIZE OF MATERIAL AND ALSO THE APPROPRIATE MINIMUM AND MAXIMUM PERCENTAGES REQUIRED FOR EACH FRACTION. IT ALSO GIVES THE MAXIMUM PERMITTED FLAKINESS INDEX FOR SIZES BETWEEN 50MM AND 10MM INCLUSIVE. IT DIFFERS FROM THE EARLIER IMPERIAL STANDARD IN THAT A MAXIMUM LIMIT FOR DUST IS SPECIFIED. A SAMPLING PROCEDURE IS LAID DOWN AND A SECOND TABLE GIVES A DETAILED EXAMPLE OF THE WAY IN WHICH THE STANDARD SHOULD BE INTERPRETED. THIS RECORD SUPPLEMENTS IRRD ABSTRACT 203613. /TRRL/

British Standards Institution Standard BS 63: Part 2: 1971, 1971, 8 pp, 2 Tab.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 208280)

2A 083169

ABOUT PENETRATION INDICES OF ARGENTINA ASPHALTIC CEMENTS [Sobre el indice de penetracion de los cementos asfálticos Argentinos]

The object of this paper consists in verifying if asphaltic cements used in Argentina respond to the standards used by Pfeiffer and Van Doormal in their formula for the penetration index, established on the base of the properties of asphalts used in 1936. Evolution in industrial processes and the introduction of crudes of other origins after that date, and the standards IRAM-6694-(1957) fixing-2.0 and 0.5 as pi limiting values for Argentine asphalts for road construction vindicate this effort. The results show the need for a modification of the formula to preserve the meaning of the pi in the asphalts under consideration, i.e., for the index to be a convenient statement of thermal susceptibility to moderate temperature. On the other part the indices for each type and origin of asphalt in the investigation show no relation with the temperature needed to attain the necessary viscosity range for mixing, laying, and densification in conventional hot mixtures. /TRRL/ [Spanish]

Laboratorio de Investigaciones Viales, Argentina Conf Paper 1971, pp 442-453, 3 Fig., 3 Tab., 5 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 207949)

2A 083268

FUEL USAGE IN ROAD CONSTRUCTION

THIS ARTICLE GIVES A GUIDE TO FUEL REQUIREMENTS (DIESEL FUEL AND PETROL) FOR VARIOUS ASPECTS OF ROAD CONSTRUCTION, BASED ON DATA SUBMITTED BY BETWEEN 400 AND 500 HIGHWAY CONTRACTORS TO THE US TRANSPORTATION RESEARCH BOARD. THE INFORMATION IS SET OUT IN A TABLE AND THE GREATER PART OF THE ARTICLE CONSISTS OF EXPLANATORY NOTES. FUEL REQUIREMENTS ARE GIVEN SEPARATELY FOR DIESEL FUEL AND PETROL, AND THREE FIGURES ARE GIVEN TO REPRESENT LOW, AVERAGE AND HIGH CONSUMPTION RESPECTIVELY, THE FIGURE BEING SELECTED ACCORDING TO SITE CONDITIONS. ITEMS OF WORK FOR WHICH FIGURES ARE GIVEN ARE EXCAVATION (EARTH AND ROCK), AGGREGATES (ON SITE PRODUCTION AND IMPORTED), ASPHALT CONCRETE (PRODUCTION AND PLACEMENT), PORTLAND CEMENT CONCRETE (PRODUCTION, HAUL AND PLACEMENT), STRUCTURES, AND MISCELLANEOUS. THE EXPLANATORY NOTES INCLUDE VARIATIONS WHICH APPLY UNDER PARTICULAR CIRCUMSTANCES SUCH AS UNDER LONG HAUL CONDITIONS, NEED FOR QUARRYING OPERATIONS SUCH AS DRILLING AND BLASTING AND THE USE OF NATURAL GAS FOR DRYING. THE FACTORS FOR STRUCTURES AND MISCELLANEOUS ARE BASED ON CONSUMPTION PER UNIT COST.

Highways and Road Construction Vol. 42 No. 1778, Oct. 1974, 31 pp, 1 Tab.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 211526)

2A 083302

CODE OF PRACTICE FOR THE STRUCTURAL USE OF CONCRETE. PART 1. DESIGN, MATERIALS AND WORKMANSHIP. PART 2. DESIGN CHARTS FOR SINGLY REINFORCED BEAMS, DOUBLY REINFORCED BEAMS AND RECTANGULAR COLUMNS. PART 3. DESIGN CHARTS FOR CIRCULAR COLUMNS AND PRESTRESSED BEAMS.

Part 1 of this code of practice is presented under the following headings:-1. General. 2. Design: objectives and general recommendations. 3. Design and detailing: reinforced concrete. 4. Design and detailing: prestressed concrete. 5. Design and detailing: precast and plain concrete construction. 6. Specification and workmanship: concrete. 7. Specification and workmanship: reinforcement. 8. Specification and workmanship: prestressing tendons. 9. Inspection and testing of structures and components. 10. Fire resistance. 11. Autoclaved aerated concrete. 12. High alumina cement concrete. The design charts contained in Parts 2 and 3 of the code are intended to be used as an aid when analysing the cross-section of a member at the ultimate limit state. The charts are based on the assumptions laid down in Part 1, use being made of the parabolic-rectangular stress block

throughout. Full details of the derivation of the charts are appended. (See also IRRD Abstract No 205515)

British Standards Institution Standard No. CP 1, Nov. 1972, 418 pp, Figs., Tabs.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 205514)

2A 083306

THE CONSTRUCTION OF RURAL ROADS BY THE USE OF AGRICULTURAL EQUIPMENT [Costruzione di Strade Rurali Con L'Impiego di Mezzi Meccanici di Tipo Agricolo]

This article describes methods by which farming undertakings can improve and build their own service roads by the use of agricultural machinery. The process basically is the cement stabilization of earth roads, and details of mix design and pavement thickness are given. Some recommendations are included, useful to farmers in the application of their own machinery to this purpose. The article is based on the construction of a rural road of soil-cement in Toledo, Spain, where apart from existing farm machinery available on the spot, only a vibrating roller (towed by a farm tractor) was used. [Italian, French/Italian]

Zanotti, GT *Strade* Jan. 1972, pp 36-44, 3 Tab., 11 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 205626)

2A 083431

IMPROVEMENTS RELATING TO APPARATUS FOR TRANSPORTING LOADS

Details are given of an invention to transport loads on difficult terrain by means of inflatable elements arranged laterally. The elements are tubes of flexible material arranged to collapse when deflated so that their lower walls are raised clear of the ground when not in use. The apparatus creates a series of waves, caused by successive inflation and deflation of the tubes, and these waves progress across the whole undersurface of the device and result in a progressive movement relative to the ground of an attached sheet or board composed of a light alloy or reinforced plastic material. /TRRL/

Lewis, OT Lewis, JG
Patent Office Patent No. 1302535, 1973, 10 pp, 13 Fig.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 206960)

2A 083432

'FEATURELESS' M62 SECTION PUTS MCALPINE-FAIRCLOUGH CONSORTIUM

Brief details are given of the construction of the M62 between Manchester and Liverpool and the problems associated with the geology of the area, particularly construction over deep saturated peat in an area which suffers from mining subsidence. The bridge construction (48 bridges on this stretch of the motorway) has been designed to allow for up to 0.45m of horizontal movement at the abutments, and because subsidence from mining advances in a wave, each bridge span is flexibly joined to the next with dowel bars. A major problem in the area of peat was the stabilization of the sides of the motorway which was accomplished by placing slag bunds. A portion of the motorway has been built over a disused runway, which was first covered with a 1.5m thick blanket of coal tip waste to cushion the effect of subsidence in the large runway slabs. The slabs were broken up by trenches at 15m intervals to further reduce the risk of the slabs punching through the motorway surface as a result of subsidence, and also to drain the runway surface. /TRRL/

New Civil Engineer No. 42, 1973, pp 26-28, 1 Fig., 4 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 206892)

2A 083579

COMPACTION OF ASPHALT CONCRETE PAVEMENTS

This research project was initiated in order to study the compaction of asphalt-concrete pavements. It was determined that adequate densities were not being obtained with the California Standard Specifications and new Standard Special Provisions were written. A rolling procedure was devel-

oped for both thick-lift and thin-lift construction. Measurements were made of recently constructed pavements to determine the riding qualities associated with the various construction methods using different lift thicknesses. Standard Special Provisions were written to improve the final surface roughness by limiting the lift thicknesses. Research was also conducted on the use of nuclear gages to determine asphalt concrete densities and a method was written for the use of nuclear gages in conjunction with the qualification of rollers. /FHWA/

Study sponsored by California DOT, Division of Highways in cooperation with FHWA.

Cechetini, JA Sherman, GB
California Division of Highways, (19 301-762503-633294) Final Rpt.
CA-DOT-TL3294-4-7409, Feb. 1974, 35 pp

Contract D-05-26

ACKNOWLEDGMENT: Federal Highway Administration (P-0066)

PURCHASE FROM: NTIS Repr. PC, Microfiche

PB-239051/AS

2A 083685

AMERICAN RAILWAY ENGINEERING ASSOCIATION-BULLETIN

Specifications are presented for the preparation of stone, slag and gravel ballast, which cover aspects of percentages of wear, and the resistance to abrasion. Terminology used in vegetation control is defined. Various aspects of locomotive standing facilities are considered. These include capacity, storage and service tanks, unloading, dryers air pressure, sand cocks, gravity loading lines, nozzles, platform, etc. Specifications are presented for design of plain and reinforced concrete members. Specifications for design of spread footing foundations are also considered. Specifications are presented for highway grade crossings over railroad tracks, the construction of bituminous crossings, the construction of wood plank crossings, the construction of prefabricated sectional treated timber crossings and for the construction of tracks in a paved area.

AREA Bulletin Vol. 76 Bulletin 650, Nov. 1974, 277 pp, Figs., Tabs.

2A 083693

COMMENTS ON CHEMICAL INJECTIONS [Comentario sobre las Inyecciones Quimicas]

DURING UNDERGROUND CONSTRUCTION WORK IN URBAN AREAS, IT IS NECESSARY TO TAKE SAFETY MEASURES NOT ONLY TO ENSURE THE SAFETY OF THE WORKERS BUT ALSO TO PREVENT ANY EFFECTS ON BUILDINGS, STRUCTURES AND SERVICES LOCATED IN THE AREA SURROUNDING THE WORK SITE. ONE PROPOSED PROCEDURE IS THE USE OF INJECTION TO FORM SILICA GELS; DETAILS OF THIS TECHNIQUE ARE GIVEN IN THIS PAPER. IT CANNOT BE USED WHEN THE PERMEABILITY COEFFICIENT OF THE SOIL IS LOWER THAN 10-4CU/ SEC; IN THAT CASE, LOW VISCOSITY PRODUCTS SHOULD BE INJECTED (E.G. ORGANIC RESINS). IF THE PERMEABILITY IS VERY HIGH, CEMENT INJECTION WITH OR WITHOUT BENTONITE, SHOULD BE USED. AN ADEQUATE REACTIVE PRODUCT SHOULD BE USED. THE DRILL HOLES MUST BE SUFFICIENTLY CLOSE FOR THE GROUT TO BE SATISFACTORILY INJECTED. THE RADIUS OF ACTION OF EACH DRILL HOLE MAY NOT BE CONSIDERED LARGER THAN 1 METER. OTHER KIND OF PRACTICAL RECOMMENDATION ARE INCLUDED REGARDING THE USE OF PIPES, SLEEVES, INJECTION PUMPS WITH LOST TIPS, ETC. [Spanish]

Lopez, M *Materiales Maquinariay Metodos Para la Constr* No. 112, May 1974, pp 407-408

ACKNOWLEDGMENT: Transportation & Soil Mechanics Laboratory, Spain (IRRD 211431), Transport and Road Research Laboratory

2A 083715

INCREASING ENERGY COSTS WILL BOOST CONCRETE CONSTRUCTION

Two reasons are given for the use of concrete in construction in the current energy situation: concrete requires less energy to produce than any other major construction material; and concrete lends itself well to the design and construction of buildings that have excellent thermal characteristics.

Although portland cement itself requires much energy to produce, the other materials of cement-mineral aggregates and water-require very little energy. It is expected that the growth in concrete consumption will increase faster than the growth in gross national product and in total construction volume—a pattern similar to that observed in Europe and Japan.

Alaska Department of Highways Vol. 20 No. 3, Mar. 1975, p 113

2A 083729

REPROCESSED ASPHALT GETS FIRST HIGHWAY TEST

A major test of a new asphalt recycling system is described, in which a highway pavement was repaved using the old pavement as raw material. The old 4-inch pavement was ripped with a Cat D8H dozer with twin rippers and the 3500 tons of rubble was stockpiled. The roadable processing system was brought to the site and erected. The prototype system (with its limited capacity of 70 tph) was used to process and lay down the pavement. An additional 2000 tons of new asphalt was required to complete the work since the new pavement was specified at 5.5 inch. The 23 ft. wide subgrade was contoured with a Cat 12E grader, roller with a 84 in. wide vibrostatic roller and sprayed with an MC-70 asphalt prime load. Paving was done with a 11-ft wide paver using the passing lane surface for reference. A 18,000-lb pneumatic tired roller was used to complete the job. The lower course was put down in two widths, 11 ft. and 12 ft., each 4-inch rolled thickness. Finish course of 1.5 inch was of plant mix asphalt and was put down in 11 ft. widths. While the old pavement was being renewed and stockpiled, the crushers, screens, heating drum and conveyors making up the processing system were being erected. The basic crushing system is described, as well as the portable screening plant, the proportioning system, and the continuous mix pugmill.

Roads and Streets Vol. 117 No. 2, Dec. 1974, pp 28-30, 1 Fig., 3 Phot.

2A 083746

APPLICATION OF SCANNING ELECTRON MICROSCOPY OF BUILDING MATERIALS

Scanning electron microscopy has been applied to the study of several building materials at the Building Research Station. This paper reviews the application of this method and also describes the sample preparation techniques. Materials examined include metals, cement hydration products, glass ceramics, structural ceramics, glass fiber reinforced plaster and cement and weathered paint surfaces. Conclusions are drawn as to the applicability of informative value of this method of studying the surface structure of materials. /TRRL/

Majumdar, AJ Speakman, K Treadway, KWJ deVekey, RC
Building Research Station No. 48/69, Dec. 1969, 21 pp, 33 Phot., 28 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 60607)

2A 083757

LINKING UP THE LIVERPOOL LOOP

THE CONSTRUCTION OF AN UNDERGROUND RAIL NETWORK LINKING FOUR STATIONS IN LIVERPOOL IS DESCRIBED. THE EXTENSION OF EXISTING RAIL SERVICES IS AIMED AT REDUCING THE CONGESTION IN LIVERPOOL'S CENTER CITY. LARGE CAR PARKS ARE TO BE PROVIDED AT STATIONS TO ENCOURAGE PEOPLE TO TRAVEL INTO THE CITY BY TRAIN. THE LOOP AND LINK TUNNELS WERE DRIVEN THROUGH SANDSTONE, WHICH VARIES IN COMPRESSIVE STRENGTH FROM 5-28 MN/M². MODIFICATIONS TO THE DOSCO TUNNELER USED ARE DESCRIBED. COLLIERY ARCH GIRDERS SUPPORT THE WEAKER SANDSTONE AND IN-SITU CONCRETE LINING WAS USED. SPRAYED CONCRETE LINING WAS SUITABLE FOR THE STRONGER SANDSTONE. IN THE STATIONS THE 7.5M TUNNEL HAS EXTENSIVE RIB SUPPORT. CONSTRUCTION DETAILS OF THE 5.1M EXTERNAL DIAMETER TUNNELS FOR THE 1.8 KM LINK ARE GIVEN. THE DOWNLINE TUNNEL PASSES THROUGH A DISUSED TUNNEL, WHICH WAS FILLED WITH CONCRETE AFTER THE SHAPE OF THE NEW UPLINE TUNNEL HAD BEEN FORMED IN POLYSTYRENE. THE CONTRACT IS SCHEDULED FOR COMPLETION IN DECEMBER 1976.

Gosney, J *Contract Journal* Vol. 261 No. 4959, Sept. 1974, pp 38-40, 1 Fig., 5 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 211489)

2A 083780

BIG PROGRESS MADE IN EARTH WORKS FOR ROAD CONSTRUCTION

The topographical and climatic conditions and the problematic characteristics of road construction in Japan are reviewed, and features of road earth works are discussed. Soil investigation and quality control are described. A soil profile is usually prepared by means of simple soundings, and detailed investigations are conducted by mechanical boring and sampling. Some typical field measurement methods have been developed to determine the bearing capacity of the subgrade and subbases. Problems of earth works with cohesive soil of high water content (especially volcanic ash) are discussed. Effort has been made to reduce the contact pressure of machines by increasing the width of caterpillars etc., or decreasing the air pressure of tires. It has been observed that the sticky soil which was remolded during operation of works may have a considerable thixotropic regain and restoration of bearing capacity is considerable. It is accompanied by the effect of drying with the lapse of time. Counter measures for soft ground are considered. Several ways have been tried for the prevention of embankment settlement displacement of press-in compacted sand column for the soft soil after placing compacted sand pile on the foundation of embankment; forced consolidation; and concentration of the loads of embankment on the sand column. This compacted sand pile also serves for preventing slips of foundations of the embankment and other structures on the soft ground.

Construction Technique Vol. 4 No. 3, Feb. 1966, pp 70-73

2A 083792

USE OF HYDRATED LIME IN HIGHWAY CONSTRUCTION

The chemical nature of lime is explained, the chemical reactions it produces with natural highway construction materials are described, and its used are examined. The lime stabilization of soils, the formation of subbase material from clayey soils, and use of hydrated lime in subbase, base course aggregates and asphalt and asphalt paving mixtures are reviewed. The need for an additive to asphalt may be determined by the Immersion-Compression test results. Various means are listed whereby the water resistance of compacted asphalt mixtures may be improved when tests show that the Wet/Dry Stability Ratio criteria has not been met. Laboratory test data are presented from actual construction projects. In the first project, the desired improvement in stripping resistance was obtained by adding hydrated lime to the aggregate and heating it immediately to mixing temperature. No curing period was required. Test results showed a marked increase in Wet/Dry Stability Ratio with the addition of 1 percent hydrated lime and the increase of 0.5 percent in asphalt content. Similar results were obtained in further projects. The addition of 1 percent hydrated lime adds about 30 cents to the cost of a ton of asphalt mix, and is equivalent to the cost of hauling a ton of aggregate 4 miles.

Lowrie, CR

Colorado Division of Highways Feb. 1964, pp 1-13

2A 083864

LAND SLIDES ON THE TIJUANA-ENSENADA MOTORWAY [Deslizamientos en la Autopista Tijuana-Ensenada Autopista Tijuana-Ensenada]

THIS REPORT PRESENTS RESULTS AND CONCLUSIONS OF OBSERVATIONS ON THE BEHAVIOUR OF SEVEN LANDSLIDES BETWEEN KILOMETRE 12 AND KILOMETRE 21 ON THE TIJUANA-ENSENADA MOTORWAY. THE OBSERVATIONS WERE CARRIED OUT OVER A PERIOD OF 22 MONTHS (AUGUST 1967 TO JUNE 1969). THE UNSTABLE REGION RUNS ACROSS A ZONE OF SLOPES WHICH REST ON SHALE, SANDSTONE AND CONGLOMERATE, IN WHICH LANDSLIDES OCCURRED PREVIOUSLY. IT IS PARALLEL TO THE SEA SHORE WHERE EROSION TAKES PLACE. THE SEVEN LANDSLIDES WHICH OCCURRED ARE GRAPHICALLY SHOWN; THREE OTHER FAILURES WERE OBSERVED DURING CONSTRUCTION. STUDY FINDINGS SHOWED THAT THESE SLIDES MUST HAVE BEEN MAINLY CAUSED BY THE REACTIVATION OF OLD LANDSLIDES DUE TO THE WEIGHT OF THE EMBANKMENTS BUILT ON THE SLOPE AND TO THE SEEPAGE OF RAIN WATER IN THE UNSTABLE MASS. DETAILS ARE GIVEN OF THE BEHAVIOUR OF THE ROAD

PRIOR TO THE SLIDES, GEOLOGICAL CONDITIONS, OBSERVATIONS AND MEASUREMENTS TAKEN, AND GENERAL CONCLUSIONS. [Spanish]

Ministry of Public Works Mexico Conf Paper 1969, 213 pp, Figs., Tabs., Phots., 8 Ref.

ACKNOWLEDGMENT: Laboratoire Central des Ponts et Chaussées (IRRD 100615), Transport and Road Research Laboratory

2A 083955

ENGINEERING ECONOMY AND ENERGY CONSIDERATIONS. COST SAVING SUGGESTIONS

A list of cost saving suggestions, which could be implemented with little or no additional effort, were developed and evaluated by a task force of District Engineers and Division Heads of the Texas Highway Department. The suggestions which have provided a basis for determining the future course of action in the project on "Engineering, Economy and Energy Considerations in Design, Construction and Materials", are presented under the following categories: suggestions for administrative considerations (contracting, time, payment, mobilization, detours, procurement and other); suggestions that have been already implemented; suggestions which may be implemented subject to comments shown; those that reflect good engineering; those relating to maintenance management; miscellaneous suggestions; and suggestions requiring development effort prior to implementation.

Texas State Department of Highways & Public Transp, Texas Transportation Institute Res. Proj. 2-9-74-214, Dec. 1974, 20 pp

2A 083983

BRIDGE CONSTRUCTION PRACTICE

In an effort to provide information for the guidance of field engineers appointed to supervise the construction of highway bridges by direct labor, recommended practices are presented for construction of bridges in the more usual materials: timber, steel, reinforced and prestressed concrete. Most phases of bridge construction are covered and include the following: equipment of a bridge construction gang; camp and depot establishment; engagement and payment of labor-costing; job planning and control; job reports and measurements; supply, delivery to site and storage of materials, plant and equipment; provision for traffic; setting out of work; materials for permanent work; foundation work; substructure works; superstructure; handrailing; protective treatment; immediate approaches; stream treatment; demolition and removal of old structure; maintenance of works; and cleaning up of site.

National Association of Australian State Road Auth 1974, 100 pp, 24 Fig., 6 App.

2A 084068

MATERIALS EXPLORATION AND FIELD TESTING AT OROVILLE DAM

Design studies for Oroville Dam, a 735-ft high embankment dam now under construction, called for extensive material exploration because of the large quantities of materials required. The dam, which will contain 77 million cu yd of material, is located on the Feather River, 5 miles northeast of Oroville, Butte County, Calif. Original concrete-aggregate exploration and subsequent impervious and pervious materials exploration required procedures and techniques that would provide representative samples of material for testing and a reliable analysis of the in situ characteristics of the areas. A 7000-acre tailings deposit, which was the result of gold dredging along the Feather River downstream from Oroville, was investigated as a source for concrete aggregate and later for transition and pervious embankment material. A unique hole excavator and several types of casing were used in the very loose tailing deposit during the concrete aggregate investigation, and an elaborate field grading procedure was followed. Later exploration was accomplished by dragline, bulldozer, and backhoe. Impervious core material explorations were confined to clayey gravels adjacent to the tailing deposit. Bucket augers were used to drill 30-in. diameter uncased holes for most of the impervious borrow exploration. Field grading equipment was improved and mechanized and over 100 holes were drilled; excavated materials were logged, field graded, and sampled. Through careful analysis and control of the exploration procedures and techniques, it was concluded that samples used for laboratory testing and from which design values were obtained are adequately representative of the requiring field grading, mechanization of equipment is recommended.

O'Neil, AL (California Department of Water Resources); Nutting, RG *ASTM Special Technical Publications* No. 351, 1963, pp 96-107, 3 Fig., 7 Phot.

2A 084097

FIELD TESTING OF SOIL STABILIZING MACHINES

The use of mixed-place soil stabilisation for road construction has increased considerably during the last few years, and a number of mixing machines designed specifically for this type of work are now available. The relative merits of these machines have been the subject of much discussion and controversy, and this report describes a series of tests carried out by the Main Roads Department, Queensland, in an attempt to provide some data on which the relative capabilities of some of these machines might be assessed. In order to give even a moderate coverage of the various combinations of the three main variables, viz. materials to be mixed, speed of travel of mixing machine and number of mixing passes, an extensive and expensive testing programme would have been necessary. It must therefore be emphasized that the results and conclusions to be drawn from this rather limited experiment apply only to the particular conditions of the test.

Wilson, PG (Queensland Department of Main Roads, Australia); Gray, PJ (Queensland University, Australia) *Australian Road Research* Vol. 1 No. 6, June 1963, pp 38-43, 6 Fig., 5 Phot.

2A 084689

LONG LINE PRODUCTION OF BUILDING ELEMENTS IN UNITED STATES

The trend in the production of prestressed building elements in the United States is toward wider, deeper, and longer members. The pursuit of this concept requires larger plants, heavier equipment, and greater investment. The objective is to reduce labor and material costs. Longer spans and wider members have been introduced, without increasing the material quantities required per square foot, by improving and updating all design. Even where material quantities are increased slightly by the use of longer wider members the reduction in labor costs for production and erection results in overall economy. The present trend toward larger units probably will continue until a method is developed for the mass production and assembly of small elements into compact building units.

Bryan, RH *ASCE Journal of the Construction Division* Proc Paper Vol. 101 No. C01, ASCE 11188, Mar. 1975, pp 143-153, 16 Fig., 16 Phot.

2A 090105

STRENGTH COEFFICIENT OF MATERIALS

The study investigates the relationship of strength to thickness and type of material for six different construction materials; two bituminous paving materials, the same two aggregates without asphalt and two gravels typical of those normally used for base or subbase materials. Testing was conducted at a test site where each material was placed in thicknesses of 3 to 24 inches in three inch increments. In addition to normal laboratory and construction test procedures, plate bearing, Benkelman beam and Dynaflect tests were performed. Coefficients of strength were determined for the test materials and examples of design based upon these coefficients are shown.

Crawford, RA Anderson, DW South Dakota Department of Transportation, Federal Highway Administration Final Rpt. SD-613(70), Dec. 1973, 49 pp

ACKNOWLEDGMENT: NTIS PURCHASE FROM: NTIS Repr. PC, Microfiche

PB-238164/8ST

2A 090192

DESIGN AND ECONOMICS OF BITUMINOUS TREATED BASES IN TEXAS

Types of tests, test criteria and types of materials suitable for bituminous stabilization have been defined. A review of layer equivalency is included as well as current cost data for both stabilized and unstabilized base courses.

Prepared in cooperation with Texas A and M Univ., College Station., and Texas Highway Dept., Austin.

Epps, JA Galloway, BM Texas Transportation Institute, Federal Highway Administration, Texas A&M University, Texas Highway Department Intrm Rpt. TTI-2-8-73-14-1F, July 1974, 96 pp

ACKNOWLEDGMENT: NTIS
PURCHASE FROM: NTIS Repr. PC, Microfiche

PB-239046/6ST

2A 090197

LINEAR ELASTIC LAYER THEORY AS A MODEL OF DISPLACEMENTS MEASURED WITHIN AND BENEATH FLEXIBLE PAVEMENT STRUCTURES LOADED BY THE DYNAFLECT

Presented in the report are the results of an investigation of the capability of linear elastic theory to predict measured displacements on the surface, within, and beneath flexible pavement structures. In measuring predictive capability, the yard stick used was replication error. Sources of data were an NCHRP project, the AASHO Road Test, and the Texas Transportation Institute's Flexible Pavement Test Facility. Only the Texas source, which employed a vibrating surface load (the Dynaflect) and specially designed transducers lowered into small-diameter measurement holes, furnished both horizontal and vertical displacements. These were measured at various depths ranging from zero to 65 inches beneath the pavement surface, and at horizontal distances ranging from 10 to 216 inches.

Prepared in cooperation with Texas Highway Dept., Austin, and Texas Transportation Inst., College Station. Report on 'A System Analysis of Pavement Design and Research Implementation.'

Scrivner, FH Michalak, CH
Louisiana Department of Highways, Texas Highway Department, Texas Transportation Institute, (CFHR-1-8-69-123) Res. Rpt. TTI-1-8-69-123-25, Aug. 1974, 142 pp

ACKNOWLEDGMENT: NTIS
PURCHASE FROM: NTIS Repr. PC, Microfiche

PB-239244/7ST

2A 090304

COMPARATIVE PERFORMANCE OF STRUCTURAL LAYERS IN PAVEMENT SYSTEMS. VOLUME III. DESIGN AND CONSTRUCTION OF MESL

This report describes design and construction procedures for membrane-encapsulated soil layers in airport pavement systems based on analyses of results of recent tests of full-scale accelerated traffic test sections. Included are descriptions of material and equipment requirements and recommended test methods. The procedures are applicable of both rigid and flexible airport pavement systems. Recent material developments and subsequent testing have demonstrated the structural integrity of MESL-type construction. It is believed that substantial savings can be realized using MESL's in airport pavements because of less strict material quality requirements and lower maintenance requirements due to the waterproofing protection provided by the MESL.

See also Volume 1 dated Jun 74, AD-785 024.

Mammitt, GM, II
Waterways Experiment Station, Federal Aviation Administration Final Rpt. AEWES-TR-S-74-8, Dec. 1974, 43 pp

Contract DOT-FA71WAI-218

ACKNOWLEDGMENT: NTIS
PURCHASE FROM: NTIS Repr. PC, Microfiche

AD/A-005893/3ST

2A 090562

USERS' MANUAL FOR MEMBRANE ENCAPSULATED PAVEMENT SECTIONS (MEPS)

This User's Manual describes the design and construction techniques for installing Membrane Encapsulated Pavement Sections (MEPS). This concept has been developed and implemented by the Corps of Engineers in response to a need by the Army for a rapid and stable road building method in areas where conventional materials are not readily available. Suitable in-place or borrowed soil can be effectively used in the MEPS System in place of conventional aggregate bases or stabilized sub-bases. Construction costs can often be competitive with standard designs and no special equipment or training is required.

Webster, SL
Waterways Experiment Station, Federal Highway Administration Final Rpt. June 1974, 34 pp

ACKNOWLEDGMENT: NTIS
PURCHASE FROM: NTIS Repr. PC, Microfiche

PB-240690/8ST

2A 090610

POROUS FRICTION SURFACE COURSE

A study was conducted on the use of porous friction courses for airport pavements as a means of alleviating aircraft hydroplaning. The study consisted of a laboratory investigation of material requirements and mix design development and of a field study of construction control, construction processes, and long-term performance. The laboratory results were correlated where possible with the field observations. Satisfactory performance was obtained with a recommended aggregate gradation. A procedure for obtaining a design asphalt content and field mixing temperature, minimum field permeability values, and laboratory procedures for conducting permeability tests are described. A standard recommended guide specification is also included as an appendix.

White, TD
Waterways Experiment Station, Federal Aviation Administration Intrm Rpt. Feb. 1975, 119 pp

Contract FA-71-WAI-218

ACKNOWLEDGMENT: NTIS
PURCHASE FROM: NTIS Repr PC, Microfiche

AD-A009012/6ST

2A 090679

THE USE OF WASTE AND LOW-GRADE MATERIALS IN ROAD CONSTRUCTION: 1. GUIDE TO MATERIALS AVAILABLE

A considerable amount of work has been done on the utilization of waste materials in road construction but the information so obtained is scattered among a large number of publications. The main purpose of this Report is to bring this information together so that an assessment can readily be made of the suitability of any particular waste material for roadmaking. The Report therefore considers the extent to which the road construction industry can use low-grade and waste material. It discusses the types and quantities of each material that are available, the purpose to which each material can be put in the various stages of road construction and the tests needed to ensure that the materials meet the required specifications. Materials discussed include: colliery shale, spent oil shale, wastes from coal-fired power stations, quarry wastes, chalk, incinerator waste, and blastfurnace and steel slags.

Sherwood, PT
Transport and Road Research Lab., Crowthorne, (England). TRRL-LR-647, 1919, 16p

ACKNOWLEDGMENT: NTIS
PURCHASE FROM: NTIS NTIS Price, /MF\$2.25

PB-240355/8ST

2A 090681

ARCHITECTURAL CONSTRUCTION MATERIALS. PART 2. CONCRETE AND CEMENTS (A BIBLIOGRAPHY WITH ABSTRACTS) [Rept. for 1964-May 75]

Concrete/cement construction materials for architectural applications are investigated in this bibliography of Government-sponsored research reports. Structural design and performance are reviewed. (Contains 127 abstracts). See also Part 1, NTIS/PS-75/389.

Habercom, GEJ
National Technical Information Service., Springfield, Va. May 75, 132p

ACKNOWLEDGMENT: NTIS
PURCHASE FROM: NTIS NTIS Price, 0/MF\$25.00

NTIS/PS-75/390/5ST

2A 090682

ARCHITECTURAL CONSTRUCTION MATERIALS PART 1. NON-CONCRETE (A BIBLIOGRAPHY WITH ABSTRACTS) [Rept. for 1964-May 75]

Non-concrete construction materials for architectural applications are investigated in this bibliography of Government-sponsored research reports. Structural design and performance are reviewed. (Contains 189 abstracts). See also Part 2, NTIS/PS-75/390.

Habercom, GEJ
National Technical Information Service., Springfield, Va. May 75, 194p

ACKNOWLEDGMENT: NTIS
PURCHASE FROM: NTIS NTIS Price, 0/MF\$25.00
NTIS/PS-75/389/7ST

2A 090683
CONSTRUCTION MANAGEMENT (A BIBLIOGRAPHY WITH ABSTRACTS)

The report includes management studies on the physical, social, and environmental factors of the construction industry. Cost and design studies are also included for military and civilian construction of buildings, houses, mobile homes, tunnel excavation, and roads. To aid the manager in planning and control, construction codes, data management, and contract administration research are also cited. (Contains 103 abstracts).
Supersedes COM-73-11798.

Grooms, DW
National Technical Information Service Bibliog Apr. 1975, 108 pp

ACKNOWLEDGMENT: NTIS
PURCHASE FROM: NTIS Repr. PC, Microfiche
NTIS/PS-75/253/5ST, DOTL/NTIS

2A 090732
ON THE THEORY OF GROUND ANCHORS [Technical rept]

The findings of a literature review of anchor design are presented to give a synopsis of the numerous theoretical and empirical techniques available for predicting anchor capacity. The review revealed that anchor capacity is related to anchor configuration, soil characteristics and depth of anchor embedment and that the mode of soil failure as a result of anchor loading is dependent upon soil type and state as well as on the ratio of the depth of anchor embedment to anchor diameter. As a result it was found that no single equation can be used to predict anchor capacity under all soil conditions or anchor embedment depths.

Kovacs, A Blouin, S McKelvy, B Colligan, H
Cold Regions Research and Engineering Lab Hanover, N H,
(DA-1-T-062112-A-130) CRREL-TR-258, Jan 75, 80p

ACKNOWLEDGMENT: NTIS
PURCHASE FROM: NTIS NTIS Price, /MF\$2.25
AD/A-006582/1ST

2A 090752
INVESTIGATION OF THE DESIGN AND CONTROL OF ASPHALT PAVING MIXTURES. VOLUME III. APPENDIX D: TRAFFIC TESTS. APPENDIX E: FINAL LABORATORY CORRELATION TESTS

The appendix presents a description of the loading equipment, the tracking procedure, and the results of tests and observations made during and after the traffic tests on the asphalt stability test section. Analyses of the test results are also included.

Previously announced as PB-093 232.

Waterways Experiment Station Tech Memo AEWS-TM-3-254-VOL-3,
May 1948, 507 pp

ACKNOWLEDGMENT: NTIS
PURCHASE FROM: NTIS Repr. PC, Microfiche
AD/A-006523/5ST

2A 090758
LOAD-DEFLECTION BEHAVIOR OF LIME-STABILIZED LAYERS

The static and dynamic load-deflection response of soil-lime pavement layers was investigated. Soil-lime mixture layers 6, 9, and 12 in. thick were compacted over a stiff subgrade ($k=450$ psi/in.) and a soft subgrade ($k=50$ psi/in.). The soil-lime layers were statically and dynamically loaded after curing periods of 2, 14, 28, and 56 days. Supplemental subgrade soil and soil-lime mixture property data were also developed. The load-deflection data are summarized and analyzed. Various pavement behavior theories are evaluated to determine their capability to predict the load-deflection behavior of soil-lime pavement layers.

Suddath, LP Thompson, MR
Army Construction Engineering Research Laboratory, (DA-4-A-664717-D-895) Final Rpt. CERL-TR-M-118, Jan. 1975, 59 pp

ACKNOWLEDGMENT: NTIS
PURCHASE FROM: NTIS Repr. PC, Microfiche
AD/A-006015/2ST

2A 090759
THE D-645-2 COMPLEX OF EQUIPMENT FOR PREPARING ASPHALT CONCRETE MIXES

The D-645-2 complex is intended for preparing asphalt concrete and bitumen-mineral mixes which are used in road building and for other types of construction. It is designed so that when necessary the formula for the mix can be changed easily. The article gives the order of preparation of the mixes and describes the various units of the complex. The equipment was tested under unfavorable weather conditions and proved to be entirely satisfactory. Its adoption in industry will effect large economic savings.

Trans. of Stroitelnye i Dorozhnye Mashiny (USSR) n7 p8-11 1972.

Bardaev, SV Zabolotnyi, VM Mendeleev, AI Gurbanov, IM
Army Foreign Science and Technology Center FSTC-HT-23-11092-73,
Apr. 1973, 9 pp

ACKNOWLEDGMENT: NTIS
PURCHASE FROM: NTIS Repr. PC, Microfiche
AD/A-005952/7ST

2A 090789
DS-70 AGGREGATE FOR CRUSHING SOIL

The DS-70 aggregate is additional equipment for the D-709 soil-mixing installation and is intended for crushing weak (kaolinite) clays with moisture of up to 12%. The aggregate contains a bar screen, a mill, and a conveyor. When changing to different soils, the aggregate need not be removed from the D-709 installation.

Trans. of Stroitelnye i Dorozhnye Mashiny (USSR) n8 p2-3 1972.

Kaganovskii, Y
Army Foreign Science and Technology Center FSTC-HT-23-1394-73,
July 1974, 7p

ACKNOWLEDGMENT: NTIS
PURCHASE FROM: NTIS Repr. PC, Microfiche
AD/A-005477/5ST

2A 090801
REVIEW OF CONSTRUCTION EQUIPMENT AND METHODS FOR PAVEMENTS

The investigation reported herein was conducted to review methods and equipment being used by industry in the construction of pavements and to recommend changes to Corps of Engineers guide specifications to incorporate new methods and equipment. Literature reviews were conducted, and visits were made to construction sites and equipment manufacturers. Observations and measurements were taken on pavements constructed with slip-form pavers, and a separate report was written on the results. As a result of the overall investigation, the pertinent guide specifications will be revised to allow the use of slip-form pavers for portland cement concrete pavements in airfield construction and to add methods of testing for quality of mixture and for determining mixing times.

Rone, CL
Assistant Secretary of the Navy, (DA-4-A-162121-A-891) Final Rpt.
AEWS-Misc-Paper-S751, Jan. 1975, 15p

ACKNOWLEDGMENT: NTIS
PURCHASE FROM: NTIS Repr. PC, Microfiche
AD/A-005007/0ST

2A 090845
CONCRETE-POLYMER MATERIALS FOR HIGHWAY APPLICATIONS. PROGRESS REPORT NO. 3
For abstract, see NSA 31 03, number 08069.

Kuckack, LE Fontana, J Romano, AJ Steinberg, M Pike, RG
Brookhaven National Laboratory, (BML 50417) Prog. Rpt.
FHWA-RD-74-17, May 1974, 132 pp
RESPONSIBLE INDIVIDUAL: Pike, RG (HRS-22)

Contract P.O.2-1-0926
 ACKNOWLEDGMENT: NTIS
 PURCHASE FROM: NTIS Repr. PC, Microfiche

BNL-50417

2A 091372**CONSTRUCTION MONITORING OF SOFT GROUND RAPID TRANSIT TUNNELS. VOLUME I: A DEFINITION OF NEEDS AND POTENTIAL DEVELOPMENTS**

The Urban Mass Transportation Administration (UMTA) Tunneling Program Concentrates its efforts on reducing tunneling costs, minimizing environmental impact and enhancing safety as it applies to the planning, organization, design, construction and maintenance cycles of rapid transit tunnels in the urban environment. This study investigates the area of construction monitoring of rapid transit tunnels in soft ground. Soft ground tunnel construction monitoring has the potential to reduce construction costs, safety hazards and environmental impacts. Monitoring can diagnose face stability and ground movement problems, and allow appropriate preventive or remedial action. Monitoring provides data for prediction of ground movements and allows the compilation of useful legal documentation. Such data are also required for improving design and prediction methods.

Prepared in cooperation with Soil and Rock Instrumentation, Inc., Newton Upper Falls, Mass. Paper copy also available in set of 2 reports as PB-241 535-SET, PC\$11.00.

Schmidt, B Dunicliff, CJ
 Parsons, Brinckerhoff, Quade and Douglas, Inc, Transportation Systems Center, Soil and Rock Instrumentation, Incorporated Final Rpt., 3-V1 DOT-TSC-UMTA-75-9-V1, UMTA-MA-06-0025-74-1, Nov. 1974, 189p

Contract DOT/TSC-661

ACKNOWLEDGMENT: NTIS
 PURCHASE FROM: NTIS Repr. PC, Microfiche
 PB-241536/2ST, DOTL NTIS

2A 091373**CONSTRUCTION MONITORING OF SOFT GROUND RAPID TRANSIT TUNNELS. VOLUME II: APPENDIXES**

The Urban Mass Transportation Administration (UMTA) Tunneling Program Concentrates its efforts on reducing tunneling costs, minimizing environmental impact and enhancing safety as it applies to the planning, organization, design, construction and maintenance cycles of rapid transit tunnels in the urban environment. This study investigates the area of construction monitoring of rapid transit tunnels in soft ground. Monitoring practices now in use do not usually allow full utilization of the data for the project from which they were gathered. Deficiencies in present practices are pointed out, and a systematic approach to monitoring is presented. Information presented will aid owners, designers, specification writers and instrumentation engineers. A computer program for data storage, interpretation and retrieval is proposed. An interim quality control specification for instrumentation procurement is presented, and instrumentation hardware improvements are suggested.

Prepared in cooperation with Soil and Rock Instrumentation, Inc., Newton Upper Falls, Mass. Paper copy also available in set of 2 reports as PB-241 535-SET, PC\$11.00.

Schmidt, B Dunicliff, CJ
 Parsons, Brinckerhoff, Quade and Douglas, Inc, Transportation Systems Center, Soil and Rock Instrumentation, Incorporated Final Rpt., 3-V2 DOT-TSC-UMTA-75-9-V2, UMTA-MA-06-0025-74-1, Nov. 1974, 104p

Contract DOT/TSC-661

ACKNOWLEDGMENT: NTIS
 PURCHASE FROM: NTIS Repr. PC, Microfiche
 PB-241537/0ST, DOTL NTIS

2A 091493**FEDERALLY COORDINATED PROGRAM OF RESEARCH AND DEVELOPMENT IN HIGHWAY TRANSPORTATION. VOLUME 4, IMPROVED MATERIALS UTILIZATION AND DURABILITY**

The program of materials research is primarily designed to concentrate on a limited number of problems in order to bring about significant pay-offs within a short period of time. Another criterion is the need to be responsive

to the public's growing concern with environmental pollution. The highway industry can make a significant positive contribution toward alleviating this problem, particularly in our major cities, by devising procedures for converting industrial and household wastes into useful highway products. The FCP projects provide a coordinated effort in bringing about short range gains in materials research as well as continued development of new basic knowledge needed for long range improvements.

Paper copy also available in set of 7 reports as PB-242 057-SET, PC\$42.00.

Federal Highway Administration FHWA/RD-FCP-005, Jan. 1975, 202 PP

ACKNOWLEDGMENT: NTIS, Federal Highway Administration (R0005)
 PURCHASE FROM: NTIS Repr. PC, Microfiche

PB-242062/8ST

2A 091494**FEDERALLY COORDINATED PROGRAM OF RESEARCH AND DEVELOPMENT IN HIGHWAY TRANSPORTATION. VOLUME 5, IMPROVED DESIGN TO REDUCE COSTS, EXTEND LIFE EXPECTANCY AND INSURE STRUCTURAL SAFETY**

Under this program category, coordinated research is undertaken to provide for (a) improved protection against the natural hazards of earthquake, wind, and flooding; (b) improvements in highway tunneling technology for future highways to increase construction rate and safety; (c) technical information to develop methods of flaw detection in structural members and bridge failure criteria for use in the national bridge safety inspection program; (d) new methodology for the design of flexible pavements to deal with measuring and relating materials properties to the performance of pavements under load-associated and environmental stresses; (e) exploitation of new materials and improved methods in structural rehabilitation and serviceability enhancement of damaged pavement systems by innovative patching of layered systems and new overlay design techniques; and (f) the examination of investment strategy for pavements expected to carry high traffic volumes to determine whether higher initial costs are justifiable as a trade-off for minimizing maintenance.

Paper copy also available in set of 7 reports as PB-242 057-SET, PC\$42.00.

Federal Highway Administration FHWA/RD-FCP-006, Jan. 1975, 278 PP

ACKNOWLEDGMENT: NTIS, Federal Highway Administration
 PURCHASE FROM: NTIS Repr. PC, Microfiche

PB-242063/6ST

2A 091495**FEDERALLY COORDINATED PROGRAM OF RESEARCH AND DEVELOPMENT IN HIGHWAY TRANSPORTATION. VOLUME 6, CONSTRUCTION, MAINTENANCE, IMPLEMENTATION, AND MANAGEMENT**

The Federally Coordinated Program emphasizes the development and transfer of research results into practice; e.g., bridging the gap between research and operations. The objective of this category is to stimulate and expand the application and practical use of the products of highway research and development. To achieve this objective, the program will emphasize the development of an environment that is conducive to nationally coordinated and cooperative implementation efforts by the Federal Highway Administration, State highway agencies and other highway organizations. It will also emphasize systematic management and the assessment of the success of implementation including the benefits realized.

Paper copy also available in set of 7 reports as PB-242 057-SET, PC\$42.00.

Federal Highway Administration FHWA/RD-FCP-007, July 1973, 58 PP

ACKNOWLEDGMENT: NTIS
 PURCHASE FROM: NTIS Repr. PC, Microfiche

PB-242064/4ST

2A 091506**EVALUATION OF FULL-SCALE EXPERIMENTAL CONCRETE HIGHWAY FINISHES**

Results on an evaluation of two sets of full-scale experimental concrete test sections are summarized. Eighteen experimental concrete finishes were

evaluated in terms of skid resistance under standard trailer water conditions and under simulated rainfall conditions. In addition the change in texture depths and skid values with time were measured. Results indicate that (1) texture depths of 0.060 in. or greater can easily and economically be constructed with 1/8 in. metal tines spaced closer than 1/2 in. apart, (2) under normal traffic conditions all concrete textures can be expected to wear-down approximately 25 to 35 percent during the first 1/2 year and then remain relatively unchanged for a prolonged period, (3) skid measurements made under standard trailer water conditions may not be indicative of real life conditions in wet weather, (4) low skid values could be obtained in almost any rainfall in which the pavement is completely wetted, and (5) under simulated rain conditions deep transverse texturing will result in the greatest improvement in skid values.

Ledbetter, WB Meyer, AH Ballard, DE
Texas Transportation Institute Final Rpt. TTI-2-6-70-141-4F, Sept. 1974,
81 pp

ACKNOWLEDGMENT: NTIS
PURCHASE FROM: NTIS Repr. PC, Microfiche

PB-242288/9ST

2A 092025
FEASIBILITY OF USING SEWAGE SLUDGE IN HIGHWAY
EMBANKMENT CONSTRUCTION

A laboratory evaluation of the feasibility of using sewage sludge in construction of a highway embankment was conducted. Mixtures composed of lime, fly ash, waste calcium sulfate and up to 17% sewage sludge were evaluated. The effect of lime type, fly ash source and the relative proportions of lime, fly ash and waste calcium sulfate on compressive strength of compacted specimens was measured. Two soils, one sandy and the other clayey, were used to replace 30, 50 and 70% of the fly ash in selected formulations. All samples with the soil replacement exceeded the minimum strength gain criterion. Selected formulations were further evaluated for volume change, durability, permeability and leachability. Analysis of the leachate from the permeability tests indicated that the heavy metals present in the sewage sludge--cadmium, chromium, mercury and zinc--were retained in the mixture. However, lime and gypsum did increase the pH and calcium and sulfate ion concentrations in the leachate.

Kawam, A Smith, LM Ross, J Larew, HG Rude, L
Gillette Research Institute, Incorporated, Federal Highway Administra-
tion Intrm Rpt. FHWA-RD-75-38, Feb. 1975, 51 pp
RESPONSIBLE INDIVIDUAL: Ormsby, WC (HRS-23)

Contract FH-11-8122

ACKNOWLEDGMENT: NTIS, Federal Highway Administration
PURCHASE FROM: NTIS Repr. PC, Microfiche

PB-242260/8ST

2A 092427
STRUCTURAL OVERLAYS FOR PAVEMENT REHABILITATION
California's research on the use of deflection measurements for asphalt concrete overlay design has resulted in a revision to the California overlay design method. Deflection reduction characteristics and tolerable deflection levels of asphalt concrete were revised based on the performance of highway projects under study since 1960. An evaluation of the design method compares predicted versus measured deflections on 69 reconstructed highways. Pavement deflections were measured using a traveling deflectometer which provides a dynamic-type measurement while traveling along the roadway at one-half mile per hour. The results are discussed.

Prepared in cooperation with Federal Highway Administration, Wash-
ington, D.C.

Bushey, RW Baumeister, KL Matthews, JA Sherman, GB
California Department of Transportation, Federal Highway
Administration, (HPR) Intrm Rpt. CA-DOTTL-3128-3-7412, July 1974,
24 pp

ACKNOWLEDGMENT: NTIS
PURCHASE FROM: NTIS Repr. PC, Microfiche

PB-244579/9ST

2A 092498
SUGGESTIONS FOR TEMPORARY EROSION AND SILTATION
CONTROL MEASURES

The manual was prepared as an aid to field personnel engaged in the construction of highways in Latin America. It provides suggestions on the most efficient ways of providing emergency care against erosion and sedimentation by prompt treatment of the slopes. The booklet contains 24 pages of diagrams of various types of problems and methods of controlling them. The report was designed for distribution to the governments of Latin American countries through the cooperation of the Agency for International Development.

Text in Spanish.

Office of Policy, Plans and International Affairs 1975, 24 pp

ACKNOWLEDGMENT: NTIS
PURCHASE FROM: NTIS Repr. PC, Microfiche

PB-245004/7ST

2A 092529
THE USE OF WASTE AND LOW-GRADE MATERIALS IN ROAD
CONSTRUCTION: 2. COLLIERY SHALE

The use of lower-grade and waste materials as alternatives to naturally occurring aggregates in the construction of roads helps to conserve the supplies of good quality aggregates and assists in problems arising from the disposal of unwanted materials. This Report is one of a series that is aimed at bringing together the information that is available on each of the major waste products that have roadmaking potential. It deals with colliery shale and it considers the extent to which shale can be used in road construction. The Report discusses the types and quantity of shale that are available, the purposes to which it can be put in the various stages of road construction and the tests needed to ensure that shales meet the required specifications.

Sherwood, PT
Transport and Road Research Lab., Crowthorne, (England).
TRRL-LR-649, 18, 1975, 25p

ACKNOWLEDGMENT: NTIS
PURCHASE FROM: NTIS NTIS Price, /MF\$2.25

PB-243740/8ST

2A 092531
CONCRETE (RIGID) HIGHWAY PAVEMENTS. VOL. 3.
1974-JULY 1975 (A BIBLIOGRAPHY WITH ABSTRACTS)
Concrete (rigid) pavement construction, construction materials, and mechanical properties of concrete pavements are evaluated in reports generated under Government sponsored research in highway engineering. (Contains 61 abstracts) See also NTIS/PS-75/075, Bridges: Construction and Construction Materials; NTIS/PS-75/518, 519, and 520, Airfield Pavements; and NTIS/PS-75/672, 673, and 674, Flexible Highway Pavements.
See also NTIS/PS-75/678.

Habercom, GEJ
National Technical Information Service Bibliog. Aug. 1975, 66 pp

ACKNOWLEDGMENT: NTIS
PURCHASE FROM: NTIS Repr. PC, Microfiche

NTIS/PS-75/679/1ST

2A 092532
CONCRETE (RIGID) HIGHWAY PAVEMENTS. VOL. 2. 1971-1973
(A BIBLIOGRAPHY WITH ABSTRACTS)
Concrete (rigid) pavement construction, construction materials, and mechanical properties of concrete pavements are evaluated in reports generated under Government sponsored research in highway engineering. (Contains 131 abstracts) See also NTIS/PS-75/076, Bridges: Construction and Construction Materials; NTIS/PS-75/518, 519, and 520, Airfield Pavements; and NTIS/PS-75/672, 673, and 674, Flexible Highway Pavements.
See also NTIS/PS-75/679.

Habercom, GEJ
National Technical Information Service Bibliog. Aug. 1975, 136 pp

ACKNOWLEDGMENT: NTIS
PURCHASE FROM: NTIS Repr. PC, Microfiche

NTIS/PS-75/678/3ST

2A 092533

CONCRETE (RIGID) HIGHWAY PAVEMENTS. VOL. 1. 1964-1970 (A BIBLIOGRAPHY WITH ABSTRACTS)

Concrete (rigid) pavement construction, construction materials, and mechanical properties of concrete pavements are evaluated in reports generated under Government sponsored research in highway engineering. (Contains 204 abstracts) See also NTIS/PS-75/076, Bridges: Construction and Construction Materials; NTIS/PS-75/518, 519, and 520, Airfield Pavements; and NTIS/PS-75/672, 673, and 674, Flexible Highway Pavements.

See also NTIS/PS-75/678.

Habercom, GEJ

National Technical Information Service Bibliog. Aug. 1975, 209 pp

ACKNOWLEDGMENT: NTIS

PURCHASE FROM: NTIS Repr. PC, Microfiche

NTIS/PS-75/677/5ST

2A 092534

FLEXIBLE HIGHWAY PAVEMENTS. VOL. 3. 1975 (A BIBLIOGRAPHY WITH ABSTRACTS)

Flexible pavement construction, construction materials, and mechanical properties of flexible pavements are evaluated in reports generated under Government-sponsored research in highway engineering. (Contains 41 abstracts) See also NTIS/PS-75/076, Bridges: Construction and Construction Materials; NTIS/PS-75/518, 519, and 520, Airfield Pavements; and NTIS/PS-75/677, 678, and 679, Concrete Pavements.

See also NTIS/PS-75/673.

Habercom, GEJ

National Technical Information Service Bibliog. Aug. 1975, 46 pp

ACKNOWLEDGMENT: NTIS

PURCHASE FROM: NTIS Repr. PC, Microfiche

NTIS/PS-75/674/2ST

2A 092535

FLEXIBLE HIGHWAY PAVEMENTS. VOL. 2. 1970-1974 (A BIBLIOGRAPHY WITH ABSTRACTS)

Flexible pavement construction, construction materials, and mechanical properties of flexible pavements are evaluated in reports generated under Government-sponsored research reports in highway engineering. (Contains 299 abstracts) See also NTIS/PS-75/076, Bridges: Construction and Construction Materials; NTIS/PS-75/518, 519, and 520, Airfield Pavements; and NTIS/PS-75/677, 678, and 679, Concrete Pavements.

See also NTIS/PS-75/674.

Habercom, GEJ

National Technical Information Service Bibliog. Aug. 1975, 304 pp

ACKNOWLEDGMENT: NTIS

PURCHASE FROM: NTIS Repr. PC, Microfiche

NTIS/PS-75/673/4ST

2A 092536

FLEXIBLE HIGHWAY PAVEMENTS. VOL. 1. 1964-1969 (A BIBLIOGRAPHY WITH ABSTRACTS)

Flexible pavement construction, construction materials, and mechanical properties of flexible pavements are evaluated in reports generated under Government-sponsored research in highway engineering. (Contains 245 abstracts) See also NTIS/PS-75/076, Bridges: Construction and Construction Materials; NTIS/PS-75/518, 519, and 520, Airfield pavements, and NTIS/PS-75/677, 678, and 679, Concrete Pavements.

See also NTIS/PS-75/673.

Habercom, GEJ

National Technical Information Service Bibliog. Aug. 1975, 250 pp

ACKNOWLEDGMENT: NTIS

PURCHASE FROM: NTIS Repr. PC, Microfiche

NTIS/PS-75/672/6ST

2A 092577

TECHNICAL AND ECONOMIC EVALUATION OF RECYCLED INDUSTRIAL SECONDARY PRODUCTS FOR THE PREPARATION OF SYNTHETIC HIGHWAY BUILDING AGGREGATES

This study investigated and tabulated data relating to the supply and proposed use of lime fly ash sulfate sludge compositions as a substitute for conventional road building materials. It was found that this would be economically feasible and environmentally beneficial. This would solve pollution problems and at the same time provide highway construction material within the state of West Virginia.

IU Conversion Systems, Incorporated, Appalachian Regional Commission
ARC-73-40/RPC-772, July 1974, 73 pp

ACKNOWLEDGMENT: NTIS

PURCHASE FROM: NTIS Repr. PC, Microfiche

PB-242576/7ST

2A 092584

A MODEL STUDY OF SPILING REINFORCEMENT IN UNDERGROUND OPENINGS

The objective of this research was to contribute to the development of rational design approach in the use of spiling reinforcement in underground construction. By investigating the mechanisms of spiling reinforcement, through physical and numerical models, its contribution as an immediate stabilization as well as its contribution to the permanent stabilization of a circular tunnel were ascertained. From case histories and other investigations, where spiling had found application, the rock mass characteristics were assessed. On the basis of physical model laws, and the rock mass characteristics a suitable modeling material was developed. A model test chamber for three dimensional studies, and an instrumentation system were designed. Physical model tests with and without spiling reinforcement were performed. A numerical model was developed to aid in the interpretation of the physical model test results.

Report on project 'Rational Design of Tunnel Supports'.

Corbin, GE Brekke, TL

California University, Berkeley, Army Corps of Engineers Intrm Rpt.
MRD-TR-2-75, Feb. 1975, 278 pp

Contract DACW-45-74-C-0026

ACKNOWLEDGMENT: NTIS

PURCHASE FROM: NTIS Repr. PC, Microfiche

AD-A012816/5ST

2A 092588

AIRFIELD PAVEMENT CONSTRUCTION: SLIPFORM PAVING METHOD [Final rept. Jul 71-Jun 73]

This report presents the results of a study conducted to evaluate the use of slipform paving equipment for the construction of airfield pavements. Nine construction projects were observed and smoothness measurements made on eight of these projects. Currently used equipment and construction practices are presented and analyzed; problem areas and corrective measures are discussed. Results from the smoothness measurements are presented and considered in terms of current construction requirements and the effect of the surface smoothness on the functional performance of the pavement. Although the elimination of fixed side forms is the most appealing feature of the slipform method, it also causes the most complications.

Parker, FJ

Army Engineer Waterways Experiment Station, Vicksburg Miss 5-18
AEWES-Misc-Paper-S-7, 18, June 1975, 76p

ACKNOWLEDGMENT: NTIS

PURCHASE FROM: NTIS NTIS Price, /MF\$2.25

AD-A012769/6ST

2A 092616

REPORT OF INTERAGENCY CONFERENCE OF COORDINATION OF RESEARCH ACTIVITIES (8TH) HELD AT ARMY ENGINEER WATERWAYS EXPERIMENT STATION, VICKSBURG, MISS. ON 13-15 NOVEMBER, 1973

This publication summarizes the proceedings of the Eighth Interagency Research Coordination Conference held at the U. S. Army Engineer

Waterways Experiment Station (WES), 13-15 November 1973. Conference agenda and session reports include the following: General agenda and schedule of technical sessions; Report of executive session; Agenda and report of hydraulics session; Agenda and report of soil mechanics session; Agenda and report of rock mechanics session; Agenda and report of earthquake engineering session; Agenda and report of concrete and structural technology session; Agenda and report of power session; Agenda and report of finite element analyses session; Agenda and report of shotcreting session; Special reports--Coordination of water quality research; Recreational waste management.

Waterways Experiment Station Nov. 1973, 103 pp

ACKNOWLEDGMENT: NTIS
PURCHASE FROM: NTIS Repr. PC, Microfiche

AD-A011991/7ST

2A 092644

LOGGING ROADS AND PROTECTION OF WATER QUALITY

This report is a state-of-the-art reference of methods, procedures and practices for including water quality consideration in the planning, design, construction, reconstruction, use and maintenance of logging roads. Most of the methodology also is applicable to other forest management roads. The report is divided into two parts. The first part provides general perspective on physical features and conditions in EPA region X which are relevant to water quality protection and logging roads. The second part outlines specific methods, procedures, criteria and alternatives for reducing the degradation of water quality. Topic coverage in this part includes road planning, design, construction and maintenance including the use of chemicals on roads. Silvicultural activities are one category of water pollution from nonpoint sources described in Public Law 92-500. Of all silvicultural activities, logging roads have been identified as the principal source of man-caused sediment.

Prepared in cooperation with Arnold, Arnold and Associates, Seattle, Wash., and Dames and Moore, Seattle, Wash.

Environmental Protection Agency, Arnold, Arnold and Associates, Dames and Moore Final Rpt. EPA/910/9-75/007, Mar. 1975, 306 pp

ACKNOWLEDGMENT: NTIS
PURCHASE FROM: NTIS Repr. PC, Microfiche

PB-243703/6ST

2A 092998

LONG TERM SETTLEMENT STUDY AT BRIDGE APPROACHES, (NORTH MAXWELL)

This report evaluates the use of lime treatment as a means to reduce differential settlement which frequently occurs between bridges and their approach embankments. Experimental and control sections consisted of a twin bridge site on Interstate 5, north of Maxwell, California. The entire 35 feet of the experimental section was treated with 2% lime, by dry weight of the soil. Due to the minor embankment compression actually measured, there is no evidence of potential benefit from embankment stabilization with lime.

Yee, WS
California Department of Transportation, Federal Highway Administration, (HPR) Final Rpt. CA-DTTTL-2400-1-7428, Dec. 1974, 26 pp

ACKNOWLEDGMENT: NTIS
PURCHASE FROM: NTIS Repr. PC, Microfiche

PB-244663/1ST

2A 093188

GERMAN STANDARD DIN 1045-CONCRETE AND REINFORCED CONCRETE STRUCTURES: DESIGN AND CONSTRUCTION

This Standard applies to loadbearing and stiffening components made of plain or reinforced ordinary or heavyweight concrete with closed texture. It also applies to components with flexurally rigid reinforcement, see clause 2.1.3.7, to hollow-tile floors and to reinforced concrete structures with glass filler elements. The use of materials for plain and reinforced concrete and of components and construction methods which depart from this Standard will, under the building regulations, require permission from the appropriate highest-building inspection authority or from the authority designated by the latter, unless a general certificate of approval or a test mark has been issued. Steel girders in concrete which have a web depth constituting a substantial

proportion of the thickness of the structural component should be designed in accordance with DIN 1050 or DIN 1073 so that they can resist the loads alone. If steel girders and concrete are joined together by a shear-transmitting connection so as to co-operate structurally, the component should be designed in accordance with DIN 1078 or DIN 4239.

Trans. of Deutscher Normenausschuss (DNA). German Committee for Reinforced Concrete, Berlin, 1972 81p. Price to members \$74.88.

British Standards Institution, Hemel Hempstead, (England). Technical Help to Exporters. 18, 1973, 78p

ACKNOWLEDGMENT: NTIS
PURCHASE FROM: NTIS NTIS Price

THE/TRANS-120

2A 093189

FRENCH CODE FOR REINFORCED CONCRETE-CC BA 68

The technical rules for design and calculations relating to reinforced concrete structures and buildings are applicable to all structures and buildings of reinforced concrete. They do not apply however to structures and buildings of reinforced lightweight concrete or reinforced hollow block concrete, nor do they apply to combined steel/concrete structures.

Trans. of Societe de Diffusion des Techniques du Batiment et des Travaux Publics. Technical Rules for Design and Calculations relating to Reinforced Concrete Structures and Buildings, Paris, Jun 70 145p. Price to members \$86.40.

British Standards Institution, Hemel Hempstead, (England). Technical Help to Exporters. 18, June 1970, 163p

ACKNOWLEDGMENT: NTIS
PURCHASE FROM: NTIS NTIS Price

THE/TRANS-110

2A 093224

RESIN BOUND AGGREGATE MATERIAL SYSTEMS

Data are presented on composition, strength, modulus of elasticity and thermal expansion for polymer concrete material systems. Resin systems included polyesters, epoxies, and vinyl esters. Fine and coarse aggregate fillers in volume fractions up to 0.85 were incorporated into the resin binders. Fiber reinforcement of various types, lengths, and contents was incorporated into several mixes. By a judicious selection of resin modifiers and filler materials a wide range of densities and strengths may be obtained. Material property data on coefficients of thermal expansion, bond strength, water absorption, and effect of elevated temperatures have been obtained.

Naus, DJ
Army Construction Engineering Research Laboratory Final Rpt. CERL-TM-M-145, July 1975, 22 pp

ACKNOWLEDGMENT: NTIS
PURCHASE FROM: NTIS Repr. PC, Microfiche

AD-A014141/6ST

2A 093434

SPLICING OF PRECAST-PRESTRESSED CONCRETE PILES

A broad range of splices for precast-prestressed concrete piles were evaluated, based largely upon information furnished by fabricators, designers, and proponents of the various splices. Basic considerations included size range, field time for splicing, approximate cost, availability, and construction usage. Data on the strength of the splices was obtained from tests during the study, from experience and tests conducted by others, and from theoretical and analytical studies. The cement-dowel splice was tested under hard and soft driving conditions. Study results indicate that the Herkules splice, the Anderson sleeve splice, and the cement-dowel splice would be most effective in fulfilling the needs of practical applications for highway and bridge construction in Louisiana.

Prepared in cooperation with Louisiana Dept. of Highways, Baton Rouge. Research and Development Section, Rept. no. 71-5C.

Tulane University, Federal Highway Administration, Louisiana Department of Highways, (LA-736-01-66) Final Rpt. TR-106, July 1974, 123 pp

ACKNOWLEDGMENT: NTIS
PURCHASE FROM: NTIS Repr. PC, Microfiche
PB-245605/1ST, DOTL NTIS

2A 093621

EFFECTS OF THE CLARY SCREED AND TUBE FLOAT ON RIGID PAVEMENT CONSTRUCTION

Effects of the Clary screed and the tube float, used as finishing devices on portland cement concrete pavement placed with a slipform paver, were examined on six construction projects. Alternate sections were finished with and without the Clary screed on three projects, and on three others with either none, two, four, or six tube float passes. Pavement roughness was measured with a California profilograph and surface mortar samples were tested for compressive strength. The screed, used without additional water, resulted in reduction of roughness and was not considered detrimental to the surface mortar. The tube float, normally used with a fog-spray of water, had little effect on roughness, and resulted in a substantial reduction in quality (compressive strength) of the surface mortar. Both devices helped close the pavement surface.

Amsler, DE Bryden, JE

New York State Department of Transportation, Federal Highway Administration Final Rpt. NYSDOT-ERD-75-RR-32, Aug. 1975, 24 pp

HP&R 25-5

ACKNOWLEDGMENT: NTIS

PURCHASE FROM: NTIS Repr. PC, Microfiche

PB-247695/0ST

2A 093722

PROBLEMS OF THE NORTH. NUMBER 16, 1972

A partial listing of topic areas includes: Basic aspects of increasing efficiency of resource allocation in the North of the U.S.S.R.; Building in the North; Cost structure and evaluation of engineering solutions in the North; Some ways of reducing the cost of developing new machinery for the North; Ways of developing local food production and exploitation of biological resources in the North; Increasing the efficiency of production in the European North of the U.S.S.R.; The economic efficiency of the oil and gas industry of the Komi A.S.S.R.; Integrated development of building materials production and the construction industry in the European North; Comparative efficiency of thermal and atomic power generation in the Northeast; Role of ferrous metallurgy in the development of the resources of the far-eastern North; Methods of economic development and construction in the Canadian North; Problems and new concepts of mid-Canada development; The oil industry of Alaska; Improving the cross-country performance of vehicles under Arctic conditions.

Trans. of Problemy Severa (USSR) n16 p3-254 1972. See also AD-784 569.

National Research Council of Canada L Vol. 2 Z Z, Z, 422 pp

ACKNOWLEDGMENT: NTIS

PURCHASE FROM: NTIS Repr. PC, Microfiche

AD-A017017/5ST

2A 093757

EXPANSION JOINTS (A BIBLIOGRAPHY WITH ABSTRACTS)

[Rept. for 1964-Sep 75]

Expansion joints relative to such widely separated applications as highways and spacecraft are reviewed in these Government-sponsored research reports. Highway and bridge applications are examined in Part 1. Miscellaneous applications such as railroads, underwater equipment, space vehicles, and artificial limbs, are investigated in Part 2.

Habercom, GEJ

National Technical Information Service., Springfield, Va. 18, Oct. 1975, 70p

ACKNOWLEDGMENT: NTIS

PURCHASE FROM: NTIS NTIS Price, 0/MF\$25.00

NTIS/PS-75/795/5ST

2A 094326

TECHNIQUE FOR LINING SHAFT [Patent Application]

The patent application relates to a method and apparatus for lining large diameter, deep, boreholes in the earth, which provides a relatively thick lining of cement. The boreholes are drilled with mud and the process of lining is carried out with the mud in place. A slip form is provided having a cylindrical outer wall of the diameter corresponding to the desired inner

diameter of the liner. This is supported on a long central pipe through which cement can be pumped through side pipes and through openings in the wall of the slip form. A base unit is provided with an internal diameter substantially equal to that of the slip form. A petal basket of flexible material is provided to seal against the wall of the borehole.

Government-owned invention available for licensing. Copy of application available NTIS.

Cobbs, JH

Department of the Interior, Washington, D.C. PAT-APPL-580 111, 18, Filed 22 M, 20p

ACKNOWLEDGMENT: NTIS

PURCHASE FROM: NTIS NTIS Price, /MF\$2.25

PB-245393/4ST

2A 094330

BRIDGES: CONSTRUCTION AND CONSTRUCTION MATERIALS (A BIBLIOGRAPHY WITH ABSTRACTS) [Rept. for 1970-Oct 75]

Bridge design, construction, construction materials, and the structural/mechanical properties are investigated in these Government-sponsored research reports. (This updated bibliography contains 223 abstracts, 119 of which are new entries to the previous edition).

Supersedes NTIS/PS-75/076.

Habercom, GEJ

National Technical Information Service., Springfield, Va. 18, Dec. 1975, 228p

ACKNOWLEDGMENT: NTIS

PURCHASE FROM: NTIS NTIS Price, 0/MF\$25.00

NTIS/PS-75/888/8ST

2A 095267

RAPID EXCAVATION AND TUNNELING CONFERENCE, PROCEEDINGS, 1974

Proceedings (in 2 volumes) of the 1974 Rapid Excavation and Tunneling Conference (R.E.T.C.), held at San Francisco, California on June 24-27, 1974, that was sponsored by the Am Soc of Civ Eng and the Am Inst of Min, Metall and Pet Eng. contains 115 papers (some as abstracts only). Main topics covered by the papers were: civil applications and planning; site investigation; planning construction; small-size tunnels; soil and rock mechanics; safety; environmental aspects; tunnel supports; materials handling; mining applications; shafts; legal aspects; engineering geology; tunneling machinery; as well as special techniques. Individual papers are provided with bibliographic references. Selected papers are indexed separately.

This is a 2 volume report.

Pattison, HC D'Appolonia, E *Rapid Excavation and Tunneling Conf, 2nd Proc* June 1974, 1843 pp

ACKNOWLEDGMENT: EI

PURCHASE FROM: American Inst of Mining, Metallurg & Petrol Engrs 345 East 47th Street, New York, New York, 10017 Repr. PC

2A 095273

PREDICTION OF SETTLEMENTS DUE TO TUNNELING IN SOIL: THREE CASE HISTORIES

Decisions regarding underpinning, real estate acquisitions and tunneling methods have in the past usually been made on the basis of conservative judgment. It now appears possible to inject a measure of rationality into this judgment, and as more case histories are recorded and digested, our confidence in the use of rational semi-empirical methods of prediction will improve. Monitoring of construction performance is required for construction control, reduction of costs, and increase of safety.

Schmidt, B (Parsons, Brinckerhoff, Quade and Douglas, Inc) *Rapid Excavation and Tunneling Conf, 2nd Proc* Vol. 2 June 1974, pp 1179-99, 9 Ref.

ACKNOWLEDGMENT: EI

PURCHASE FROM: American Inst of Mining, Metallurg & Petrol Engrs 345 East 47th Street, New York, New York, 10017 Repr. PC

2A 095274

SUBSIDENCE OVER SOFT GROUND TUNNEL

Knowing the potential causes of and being capable of reducing subsidence during a tunneling operation is important, as well as means of forecasting the magnitude and distribution of settlements prior to tunneling. This paper describes the existing soil and ground water conditions encountered, as well as the construction procedures used in advancing a machine-mined tunnel in soft ground. Settlement data obtained from a comprehensive instrumentation program performed during tunnel construction are presented. A favorable comparison is made between the data obtained for the tunnel in question and that published for other soft ground tunnels. This comparison makes it possible to apply a mathematical expression (the error function) to approximate the subsidence profile. An overall look at soil responses to construction practices and shield dimensions further substantiates findings that the magnitude of subsidence obtained in soft ground tunneling is directly related to the soil encountered and techniques used to reduce the magnitude of source disturbance in the area of tunneling.

Butler, RA (Mathews (AA), Incorporated); Hampton, D *ASCE Journal of the Geotechnical Engineering Div* Vol. 101 No. 1, Jan. 1975, pp 35-49

ACKNOWLEDGMENT: EI

PURCHASE FROM: ESL Repr. PC, Microfilm

2A 095278

PRE-FORMED LININGS IN TUNNELLING PRACTICE

Based on a detailed description of the applications for preformed metallic and concrete segmental lining in Europe and North America paper concludes that the use of pre-formed segmental linings instead of in situ placed linings in tunnels will predominate where the physical characteristics of the ground require the placing of a support system quickly after excavation and where economic considerations show that a permanent lining can be achieved in a single process. These linings are more usefully employed in soft ground, possibly water bearing, varying from sands and gravel through cohesive clays, mudstones and chalks rather than hard rock conditions although even in regard to the latter the choice must depend on the degree of competence of the rock. A reduction in lining thickness in some grounds may be achieved by allowing the newly excavated cavity at a tunnel face to redistribute ground stresses before placing the permanent lining. Because of the time element, and the need to protect the tunnel, either a temporary flexible support is required or pre-formed linings must be devised which will partially collapse through frangible packings to take up the initial deformations of the ground. In the former case a permanent lining would eventually be formed to encompass the temporary work, while the latter in a single construction perhaps provides the more economic solution.

Tough, SC (Transit and Tunnel Consultant, Incorporated);

Noskiewicz, TM *Rapid Excavation and Tunneling Conf, 2nd Proc* Vol. 1 June 1974, pp 643-668, 16 Ref.

ACKNOWLEDGMENT: EI

PURCHASE FROM: American Inst of Mining, Metallurg & Petrol Engrs 345 East 47th Street, New York, New York, 10017 Repr. PC

2A 095557

RESOURCES AND ECONOMICS

"Asphaltic Bitumen in Australia,"-which is the first paper in this session, discusses the history of bitumen supply, examines the interaction between bitumen specifications, availability, cost and price, and shows that small changes in specifications can cause large changes in availability and cost. This necessitates a continuing review of specifications to ensure the maximum economy of resources. Bitumen examination must give consideration to the whole road structure. A plea is made for the adoption of specifications based on fundamental engineering units. This will enable the designing of road structures on rational engineering principles. The availability of local materials is discussed as well as the possibility of upgrading desired characteristics of bitumen binders with materials such as sulphur, rubber and plastics. The second paper "Strategies and Economics in Using Bituminous Materials"-starts from the purpose of road pavements and service to the user, and identifies the kinds of pavement management strategies most appropriate in a condition of rapid change, and what the consequences are if efficient use is to be made of bituminous materials. It is deduced that most efficient construction and maintenance choices will be made if pavements are continually monitored and the final selection of pavement treatment is made as late as possible. This implies that initial

pavement design and construction must be consciously chosen to allow maximum freedom of choice when such maintenance or rehabilitation become necessary. By corollary, changes in design approach and in selection of bituminous and associated non-bituminous materials follow. In the field of economic choice for particular works, complementary changes in the balance between materials choice, design input and quality control result.

Conference on the Efficient Use of Bitumens, Asphalts and Tars as Paving and Construction Materials, Sydney, Australia, 2-3 December 1974, Session 1.

Kerr, D (Department of Minerals and Energy, Australia); Major, NG (Ministry of Works and Development, New Zealand)
New South Wales University, Australia Dec. 1974, 21 pp, 1 Fig., 7 Ref.

2A 095558

BITUMINOUS MATERIALS

Specifications for paving bitumens, in addition to tests to indicate contamination, should control deformation response over the whole temperature and rate of loading ranges encountered by the material in use, and also indicate its tendency to harden or otherwise deteriorate during handling and service. Deformation response from the highest handling temperature to the maximum pavement temperature is predominantly viscous and specification of viscosity limits at 70 and 130 deg C gives control of response in this temperature range. The simple assessment and specification of deformation response in the lower part of the service temperature range remains a problem but the effect of temperature can be assessed by a 'consistency' measurement in the lower part of this range. This could either be an 'apparent' viscosity measured on the sliding plate viscometer at 25 deg C, a penetration test at 15 deg C or the Frass brittle test. The California Rolling Film Oven test is preferred as a means of assessing hardening and deterioration in handling. Increase in viscosity at 60 or 70 deg C gives a measure of hardening and a low ductility after treatment gives an indication of either breakdown in the structure of the bitumen or of one with an unacceptably high temperature susceptibility in the service temperature range.

Conference on the Efficient Use of Bitumens, Asphalts and Tars as Paving and Construction Materials, Sydney, Australia, 2-3 December 1974; Session 2.

Dickinson, EJ (Australian Road Research Board)

New South Wales University, Australia Dec. 1974, 17 pp, 7 Fig., 11 Ref., 1 App.

2A 095559

BITUMINOUS SEALS

The design procedure based on estimated void content and average least dimension of an aggregate layer is presented in this paper on sprayed bituminous seals. Factors considered in this process (which is extensively used for single application and surface treatments which serve as seal coats), include nominal aggregate size, shape, crushed or screened products, spreading rate, aggregate texture and surface condition, binder, cutting and fluxing, effects of underlying pavement surface, pavement temperature and traffic compactive effects. Emphasis is placed on hot cut bitumen binders, and some reference is made to emulsified binders, slurry seals and seal coat combinations. The paper sets forth the fundamental propositions and discusses in detail the selection of aggregates. Basic assumptions, design procedures, adjustment of residual cold spray rate and recent design references are detailed. Discussions are presented on theoretical voids assumption and field control of binder viscosity. The functions, and selection of primers are discussed, and the control of processes (management training, plant, materials, records, safety, traffic control, and the neatness of the job) is described.

Conference on the Efficient Use of Bitumens, Asphalts and Tars as Paving and Construction Materials, Sydney, Australia, 2-3 December 1974; Session 3.

Andrews, JH (Queensland Main Roads Department, Australia)

New South Wales University, Australia Dec. 1974, 35 pp, 10 Fig., 4 Tab., 5 Ref., 6 App.

2A 095560

ASPHALT PAVING

The various aspects are reviewed which influence the selection of the type and properties of the surfacings and materials, as well as their design, construction and rehabilitation. These are discussed within the framework

of the structural requirements which include factors such as load dependent characteristics permeability and wear resistance. The operational requirements covered here include resistance to skidding and aquaplaning, spray reduction, improved riding quality, and reduction of tire-road noise. Characteristics of the most commonly used asphaltic surfacings namely, the dense-graded (continuous and gap-graded mixes) and open-graded types are examined. The design methods used are briefly reviewed and examples are given of criteria applicable in South Africa. The discussion of the materials used for asphalt surfacings, directs attention on aggregates, binders, bitumens and tars. Reference is made to the modification of the latter two materials to improve their performance. Important construction aspects are reviewed, the requirements of quality assurance are discussed, and comments are made on the performance of the types of surfacing described. Factors that need to be considered when surfacings are maintained are noted. Aspects such as process control, and statistical methods of quality assurance are covered, as well as the critical states with regard to maintenance.

Conference on the Efficient Use of Bitumens, Asphalts and Tars as Paving and Construction Materials, Sydney, Australia, 2-3 December 1974; Session 4.

Kuehn, SH (National Institute for Road Research, South Africa)
New South Wales University, Australia Dec. 1974, 26 pp, 4 Fig., 7 Tab., 18 Ref.

2A 095561

TARS AND THEIR APPLICATION

The nature of coal tars and their variation in composition arises from differences in the rank and type of coal carbonised, and the pyrolysis conditions used. Conventional tars from gas work and coke oven, sources are contrasted with low-temperature tars produced by static, fluidised, or entrained-bed techniques. Characterization of road tars and pitches is discussed with reference to viscosity of road tar and the softening point of pitch. The use of these materials in road construction is summarized. The main advantages of tar over bitumen are better adhesion to stone, greater skid resistance, and better resistance to fuels and mineral oils. Tar, however, has the disadvantage of higher temperature susceptibility. Tar-bitumen mixtures are useful in improving adhesion, anti-stripping properties and skid resistance of bitumen, and in lowering the temperature susceptibility of road tar. Pitch-bitumen mixtures could improve the skid-resistance of hot-rolled asphalt. Tar-polymer mixtures exhibit properties superior to those of tar. Natural and synthetic rubbers have been blended into road tars. Addition of polyvinyl chloride has proved useful for special purposes. Good performance has been noted in low-volatile tars which are manufactured by raising the ratio of anthracene oil II to anthracene oil I from 0.7 to between 1.3 and 3.0. The use of tar for paving is foreseen to increase as the supply of petroleum dwindles. Conventional coke oven tar will be a major source, and tars from various low-temperature carbonization processes and "formed-coke" manufacture will be important alternative sources.

Conference on the Efficient Use of Bitumens, Asphalts and Tars as Paving and Construction Materials, Sydney, Australia, 2-3 December 1974; Session 5.

Maher, TP

New South Wales University, Australia Dec. 1974, 13 pp, 22 Ref.

2A 095562

BITUMINOUS STABILIZATION AND SPECIAL CONSTRUCTION USES

This session's first paper-"Bituminous Stabilization and Special Construction Uses" discusses the various uses of bituminous materials for soil stabilization, with the object of improving construction detailing, and heightening awareness of the properties of bitumen. Road and water storage applications are discussed and reference is made to other uses such as slope protection. The review of pavement practice covers such aspects as emulsion stabilization, cutback stabilization, penetration stabilization, mixed stabilization with secondary additives, soils suitable for bituminous stabilization, design and performance, equivalency and new materials and methods. The use of bitumen for sealing of water storages includes dams, reservoirs, tanks, or catchment areas. The second paper-"Foamed Bitumen Stabilization, Building Construction, and Other Special Uses"-describes the kinds of special situations and the types of bitumen needed in such situations. The specific uses covered are: foamed bitumen mixtures for pavements; mastic asphalt for roofs and tanking; building insulation and damp proof courses;

concrete construction slabs; grouting and undersealing concrete pavement slabs; tough flexible bridge deck surfacings; metal corrosion protection; and hot sprayed buried membrane canal linings.

Conference on the Efficient Use of Bitumens, Asphalts and Tars as Paving and Construction Materials, Sydney, Australia, 2-3 December 1974; Session 6.

Ingles, OG Bowering, RH (Mobil Oil Australia, Limited)

New South Wales University, Australia Dec. 1974, 66 pp, 13 Fig., 16 Tab., Refs., 1 App.

2A 095563

ALTERNATIVE MATERIALS AND METHODS

Choice of materials and construction are reviewed with reference to aggregates, binders and alternatives to bitumen in flexible pavements. Although aggregates do not seriously affect the choice of construction method, pertinent questions are raised regarding the use of local aggregates, the use of reactive aggregates, the utilization of waste materials, and economy in the use of binders. Magnesium oxychloride may be considered as a possible lower course binder. The use of Pozzolanic materials such as furnace slag (chemical reactivity may be increased by ultrafine grinding) needs to be researched. A natural polymer which may be considered as an alternative in flexible pavements is clay binder used in soil-gravel combinations. Lignin and natural rubber, however, could be costly. Rubber from reprocessed tires may be used as an improver of other binders. Polyvinyl-chloride, the cheapest of synthetics, costs about \$200 per ton and does not have the desired properties. Synthetic petroleum processes are briefly reviewed. Chemical products made directly from brown coal are theoretically possible. Such products may be used (possibly) to form three dimensional chemical links in the road itself (analogous to concrete setting). Product costs for various synthetic liquid hydrocarbon products are discussed.

Conference on the Efficient Use of Bitumens, Asphalts and Tars as Paving and Construction Materials, Sydney, Australia, 2-3 December 1974; Session 7.

Simon, SR (Melbourne University, Australia)

New South Wales University, Australia Dec. 1974, 4 pp

2A 095574

HIGHWAY MATERIALS AS AGGREGATE-BINDER COMPOSITES

For many years engineers and scientists in geology, soil mechanics, and paving technology have contributed their efforts to improve the quality and economy of materials used in highway construction. Yet there has been a tendency to neglect the fact that the materials these specialists study possess a common denominator: All are aggregate-matrix composites. This paper provides a tentative classification of the materials involved in these 3 fields to support the claim that they can be organized by the systems approach. Unfilled binders, such as clay and asphalt cement, occur at one extreme of the composite spectrum; unbound fillers, such as clean sand and rock base, occur at the other. Examples are cited from particulate, viscoelastic, and graphic models that have interdisciplinary acceptance in displaying the rheological behavior of highway materials. In education, it is not enough that the student be taught how much different one conventional paving material is from another. More use should be made of those phenomenological tools and physical testing procedures that will enable the student to use the diverse combinations of fillers and binders being created to meet pressing economic and ecological needs.

Alexander, RL (California State University, Long Beach) *Transportation Research Record* No. 155, 1974, pp 124-131, 3 Fig., 1 Tab., 29 Ref.

PURCHASE FROM: TRB Publications Off Orig. PC

2A 096024

CHEMICAL AND PHYSICAL PROPERTIES OF SABKHA-TYPE MATERIALS

Saline-marsh materials, known in the Arabian peninsula as sabkhas, are used locally for road construction because of the lack of conventional road-building materials in the area. The identification and selection of sabkhas that are suitable for road construction present many problems because the moisture environment to which they are subjected greatly affects their field performance. This report describes an investigation into the chemical and physical properties of these materials and suggests tentative criteria for the selection

of sabkha for road construction on the basis of its chemical composition and particle size distribution. However, more experience of the performance of the material in controlled road trials is required before firm criteria can be established. A method for the quantitative chemical analysis of sabkha is also given. /Author/TRRL/

Russell, RBC
Transport and Road Research Laboratory TRRL SR 79 UC, 1974, 24 pp,
8 Fig., 2 Tab., 3 Phot., 13 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 211756)

PURCHASE FROM: Transport and Road Research Laboratory Crowthorne, Berkshire RG11 6AU, England Orig. PC

2A 096026
MEASUREMENT OF GROUND MOVEMENTS DURING A BENTONITE TUNNELLING EXPERIMENT

The report describes the ground movement and pore-pressure measurements carried out during the construction of an experimental tunnel at new cross, London using the bentonite tunnelling process. The measurements confirmed the ability of this process to limit ground settlements in reasonably dense cohesionless soils to values similar to those produced by conventional tunnelling methods in London clay. /Author/TRRL/

Boden, JB McCaul, C
Transport and Road Research Laboratory TRRL LR 653, 1974, 20 pp,
9 Fig., 2 Phot., 4 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 211784)

PURCHASE FROM: Transport and Road Research Laboratory Crowthorne, Berkshire RG11 6AU, England Orig. PC

2A 096037
USE OF SOLID BY-PRODUCTS FOR IMPROVING CONSTRUCTION

Possible solutions for the use of solid waste products in construction are examined together with their quantities and costs. Details are given of previous research results. Techniques utilized in outer space studies were applied to evaluate new types of construction materials such as beer bottles, tyres, plastic containers, and animal matter for road construction use. /TRRL/

Bynum, D (Texas Engineering Experiment Station); Everton, JF Fleisher, HO Ray, DR (Texas A&M University) *Materiaux et Constructions, Essais et Recherches* Vol. 5 No. 28, 1972, pp 221-229, 63 Ref.

ACKNOWLEDGMENT: Laboratoire Central des Ponts et Chaussees, Transport and Road Research Laboratory (IRRD 100917)

2A 096078
MOVEMENT OF MATERIALS [El Movimiento de los Materiales]
Machines for handling materials on site can be divided into two groups. The first group, dealing with the short-distance continuous transport, comprises fixed conveyors, articulated bucket line chains, screw feeders, pneumatic conveyors and vibratory equipment. The second group comprises earthmoving equipment and vehicles such as trailer-type lorries and dumpers. If the movement is vertical or nearly vertical, lifting machines are used; for example; lifts, hoists, cranes, etc. The operation of the various types of equipment listed is described. /TRRL/ [Spanish]

Garcia, HE *ATEMCOP* No. 28, May 1972, pp 11-21, 8 Fig., 7 Phot.

ACKNOWLEDGMENT: Transportation & Soil Mechanics Laboratory, Spain, Laboratoire Central des Ponts et Chaussees, Transport and Road Research Laboratory (IRRD 100899)

2A 096249
CONSTRUCTION OF THE I-40 REINFORCED EARTH EMBANKMENT

The materials construction procedures and techniques used in building reinforced earth structures are described, and the site conditions on the 4-mile section of Interstate 40 are briefly reviewed. Three basic reasons for failure are given which relate to the permeable colluvial veneer, the impermeable, underlying clay shale, the differences in permeability, and the

perched water. The successful functioning of the Reinforced Earth depends on sufficient friction between the soil and the reinforcing strips to prevent slippage, and sufficient density of reinforcing strips in the soil mass to prevent failure. Galvanized steel or aluminum strips are used as the reinforcement in the soil mass. The essential elements of the construction consisted of facing elements, granular backfill, reinforcing strips, and cork or polyfoam filler.

This article was taken from the Proceedings of the 56th Annual Tennessee Highway Conference, Knoxville, April 25-26, 1974.

Trolinger, WD (Tennessee Department of Transportation)
Tennessee University, Knoxville Bulletin No. 40, Jan. 1975, pp 24-32, 4 Fig.

2A 096289
NATIONAL COAL BOARD COLLIERY SHALES-SOME TECHNICAL AND ENVIRONMENTAL CONSIDERATIONS IN THEIR DEVELOPMENT AND USE

"Colliery shale" which is a general term describing minerals associated with coal consists of clay minerals (50-80 percent), pyrite (0-10 percent) and a residue of quartz. The desirability is indicated for describing the material as minestone and the material from older tips where combustion has occurred as "burnt shale". Characteristics of these two classes are identified. Current use of colliery shales are many and range from screened burnt shale on running tracks and tennis courts through the range of road uses from fill to land reclamation and sea/river defences. The results of research indicate that stabilized minestone provides a material suitable either as CBGM or as sub-base. Other uses include various hard standing areas such as pathways, car parks, etc., as well as low and medium strength masonry blocks. Work is in progress on the use of heat-treated minestone as an aggregate.

Presented at Seminar X (Road Design 1: General Topics) of the PTRC Summer Annual Meeting, Warwick University, England, 8-12 July 1974.

Behrman, S (National Coal Board Minestone Executive, England)
Planning and Transport Res and Computation Co Ltd PTRC/P/108,
July 1974, pp 229-236, 4 Tab., 7 Ref.

PURCHASE FROM: Planning and Transport Res and Computation Co Ltd 167 Oxford Street, London W1, England Orig. PC

2A 096290
NEW DEVELOPMENTS IN GROUND CONSOLIDATION TECHNIQUE

The vibroflotation methods are described (which consist essentially of surface vibration or rolling) in which a metal tube is inserted into the ground which has within its lower end an electric motor driving an eccentric weight, by this means imparting vibrations into the ground as the tube was inserted to a required depth. Limitations encountered when dealing with sands of high silt or clay content are discussed. Treatment of the ground by the "stone column" process is described, as well as treatment by the Dynamic Consolidation process. The latter process (which is suitable for large areas where the ground is of non-cohesive granular materials, partially, saturated clay fills & older deposits of refuse and other debris) consists of tamping the area to be treated on a predetermined pattern with a weight of between 8-20 tonnes dropping in free fall from 8 to 20 meters. Ground conditions suitable for treatment are reviewed with particular reference to cohesionless soils. In cohesive soils, granular backfill is introduced around the vibroflot to form stone columns which are located directly beneath the foundations and generally extend down to firmer ground. Alternatively, in ground where the strength increases with depth, a depth of treatment based on conventional elastic theory is used. Comments are made on the way in which fill materials and older refuse tips respond to ground treatment. After treatment the ground is considered, for the purposes of foundation design, to act as a semi-elastic medium of relatively uniform properties. Observations are made regarding new roads and motorways which are required to cross areas of soft organic clays and peat deposits.

Presented at Seminar X (Road Design 1: General Topics) of the PTRC Summer Annual Meeting, Warwick University, England, 8-12 July 1974.

Thomson, GH (Cementation Ground Engineering, Limited)
Planning and Transport Res and Computation Co Ltd PTRC/P/108,
July 1974, pp 237-245, 6 Fig., 13 Ref.

PURCHASE FROM: Planning and Transport Res and Computation Co Ltd 167 Oxford Street, London W1, England Orig. PC

2A 096291

REINFORCED EARTH ON M62 MOTORWAY

A new technique is outlined for reinforced earth structures (made up of soil, reinforcement and facing unit) in which the vertical reinforcing member is incorporated with the horizontal reinforcement and the facing is a non-structural unit. On the basis of economy, galvanized mild steel traps were chosen for the horizontal reinforcement. A block of 100 straps supporting a section near the middle of the wall was made of glass fiber roving impregnated with polyester resin-as an additional experiment. The facing unit was a hexagon based pyramid, 125 mm deep and measuring 600 mm across the flats. A glass reinforcement cement was used for the facing unit. Bunter sandstone from a borrow pit on site was used as the fill material. A discrete gap was formed between each facing unit. Details of construction are briefly described. Construction was in layers with the facing keeping pace with the fill. The maximum area of wall completed including backfilling by 2 men in one day is 60 sq. m. Three general categories of problems have risen with the use of new construction techniques and materials. These problems are related to: the internal stability of the wall and the adequacy and relevance of the present design methods and assumptions, the problem of corrosion or damage of the materials forming the structure, and the general behaviour of the wall and its capacity to accommodate differential settlements and externally imposed stresses, and the internal strain movements of the wall. Comparisons are made of reinforced earth construction costs using the new method and the costs using the French method.

Presented at Seminar X (Road Design 1: General Topics) of the PTRC Summer Annual Meeting, Warwick University, England, 8-12 July 1974.

Jones, CJF (West Yorkshire Metropolitan County Council, Eng)
Planning and Transport Res and Computation Co Ltd PTRC/P/108,
July 1974, pp 246-255, 3 Fig., 8 Ref.

PURCHASE FROM: Planning and Transport Res and Computation Co Ltd
167 Oxford Street, London W1, England Orig. PC

2A 096371

SOIL STABILIZATION TEST AT THE SWEDEN BRIDGE IN VIENNA-A NEW APPLICATION OF RADIO NUCLIDES IN BUILDING [Badenverfestigungsversuch Bei Der Schwedenbuecke In Wien Eine Neue Anwendung Von Radionukiden In Der Bauwirtschaft]

As part of the preliminary work for the construction of the underground railway tunnel tubes under the Danube canal, experimental injections were made to stabilize the soil, but these were not successful. Following this an attempt was made to develop a control procedure for routine injections using radioactive marking substances. Based on measurements made of filter rate and direction of flow, an assessment was able to be made of the condition of the soil and thus of the effectiveness of soil stabilizing injections. The testing methodology (central boreholes in which to introduce the water and the inspection equipment) are described in detail. The results of the four tests showed that the method used appears to effect a workable control of injections for stabilization and possible also for support. /TRRL/ [German]

Rank, D Nussbaumer, W *Oesterreichische Ingenieur Zeitschrift* Vol. 16
No. 10, Oct. 1973, pp 331-38, 8 Fig.

ACKNOWLEDGMENT: Road Safety Board, Austria, Federal Institute of Road Research, Inzel, W Ger, Transport and Road Research Laboratory (IRRD 301715)

PURCHASE FROM: ESL Repr. PC, Microfilm

2A 096407

ASPHALT PAVING IN 1974

This discussion of the prudent use of asphalt, reviews engineering design considerations, engineering construction methods, techniques and specifications, as well as the engineering of maintenance. Full depth asphalt pavements, planned stage construction, and soil-asphalt mixes are economical design factors. The placement of asphalt mixes in thick lifts will achieve both greater density and fewer lifts. Lower mix temperatures coupled with greater density, can produce high performance pavements. The review of specifications (to pug out mix at 250 deg F and haul it in insulated trucks) and the substitution of other asphalt products for cutback asphalts also require attention. The utilization of the correct maintenance techniques are advocated, and the areas of surface preparation treatment, surface preparation, rejuvenation and heater planning are also considered.

This paper was presented at the Twenty-Third Annual Arizona Conference on Roads and Streets.

Boring, JE (The Asphalt Institute, Phoenix)
Arizona University Proceeding Apr. 1974, pp 102-106

PURCHASE FROM: Arizona University Transportation and Traffic Institute,
Tucson, Arizona, 740418 Repr. PC

2A 096435

CONVENTIONAL CHIP SEALS AS CORRECTIVE MEASURES FOR IMPROVED SKID RESISTANCE

Chips seals are used to improve the surface friction or skid resistance of streets and highways. Their desirability is discussed. Properties including aggregate gradation, type, size, and mineralogy and surface texture are reviewed; bituminous binder type, viscosity, and amount are discussed and related to field experience. Relations of factors associated with the binder and the aggregate are evaluated. Also evaluated are design, construction, and performance to improve skid resistance of the finished surface.

Gallaway, BM Epps, JA (Texas Transportation Institute) *Transportation Research Record* No. 523, 1974, pp 97-109, 10 Fig., 2 Tab., 64 Ref.

PURCHASE FROM: TRB Publications Off Orig. PC

2A 096663

TUNNEL CONSTRUCTION IN ARTIFICIALLY FROZEN SOIL [TUNNELBYGGNAD I FRYST JORD]

This is a description of a tunnel construction project in Gothenberg, Sweden, especially two parts of the tunnel, driven through soil. The freezing of the soil, a sandy silt and a till were performed by means of evaporation of freon gas in steel pipes surrounding the tunnel tube. The pipes had the same strength as the respective part of the tunnel and were installed parallel to the tunnel tube in a circle, 700 mm outside the tube. Thus a layer of frozen soil about 1 m. thick, surrounded the tunnel tube. /TRRL/ [Swedish]

Groenblad, G Karlsson, L *Boggnadsindustrin* Vol. 44 No. 20, 1974, pp 22023, 1 Fig., 2 Phot.

ACKNOWLEDGMENT: National Swedish Road & Traffic Research Institute, Transport and Road Research Laboratory (IRRD 210534S)

PURCHASE FROM: National Swedish Road & Traffic Research Institute
Fack, S-581 01 Linköping 1, Sweden Repr. PC

2A 096693

STATISTICAL STUDY OF DISORDERS IN DEEP EXCAVATIONS [Etude statistique des desordres dans les fouilles a grande profondeur]

The decomposition of soil is classified into two types: powdery soil of low cohesion, and slightly powdery cohesive soil. Six statistical curves are proposed which express the percentage between the number of disorders and the number of excavations studied. Some observations of an experimental nature are presented to facilitate the discussion on the shape of the different curves. See IRRD abstract no. 100334. /TRRL/ [French]

Presented at the 5th European Conference on Soil.

Collin, B Dufour, C
Sociedad Espanola de Mecanica del Suelo y Cemento Conf Paper 1972,
pp 445-459, 7 Fig.

ACKNOWLEDGMENT: Transportation & Soil Mechanics Laboratory, Spain, Laboratoire Central des Ponts et Chaussées, Transport and Road Research Laboratory (IRRD 100346)

PURCHASE FROM: Sociedad Espanola de Mecanica del Suelo y Cemento
Laboratorio del Transporte y Mecanica del Suelo, Alfonso XII, Madrid,
Spain Repr. PC

2A 096715

PAVEMENT STRESSES AND MECHANICAL TRIAXIAL TESTING OF PAVEMENT MATERIALS

The potential of the simple triaxial test for investigating the non-linear mechanical behaviour of bitumen-bound and unbound granular pavement materials and soils is discussed in relation to the stress regimes encountered in practice. The discussion is based on the use of the stress invariants as measures of the magnitude and nature of the stress system. The triaxial test imposes severe limitations on the possible values of the invariants, which make it impossible to use the test to simulate many of the stress regimes encountered in pavements. In general, the limitations imply a unique relation between the invariants, independent choice of which is generally impossible. Within a limited region, however, the relation is not unique, and some scope

exists for their independent variation. A test programme taking advantage of these opportunities is proposed, which should assist in identifying the separate effects of the three invariants on the mechanical behaviour. Because of the severe limitations on the nature of the possible stress regimes inherent in the simple triaxial test, the potential of other systems, in particular a torsion triaxial system, is considered along the same lines. It is shown to be much more flexible, and the invariants can be chosen independently over a wide region. /Author/TRRL/

Thrower, EN
Transport and Road Research Laboratory TRRL SR 100 UC, 1974, 22 pp, 11 Fig., 4 Tab., 4 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 211775)

PURCHASE FROM: Transport and Road Research Laboratory Crowthorne, Berkshire RG11 6AU, England Orig. PC

2A 096786

THE PROBLEMS OF CHOOSING MACHINERY FOR CONSTRUCTION OF ALL-BITUMEN (HB) PAVEMENTS
[Maskinvalet Problem vid Bygge av HB-Vaeg]

The National Road Administration constructed a test road in order to study the problems in using all-bitumen (HB) pavements, such as strengthening of the subgrade, choice of plant for spreading the pavement, and suitable course thickness. The test road is approx. 1 km long, the subgrade being clay mixed with sand. It was divided into 10 sections, each of which had a different subgrade preparation, pavement thickness and construction method. It has been found that lime stabilisation of the subgrade is suitable if this is reasonably uniform and well compacted clay. If composition is variable, then bituminous gravel (BG) must be spread in such a way that the formation is not broken up. If the clay is very wet, the surface must be lime stabilised. It is best to lay BG by a spreader if the subgrade is strong enough, otherwise a grader must be used. The first course must then be at least 15 cm. The pavement is more even when laid by spreader; 20 cm can however be spread by grader and remainder by spreader. If the subgrade is strong enough then it is best to lay 25 cm course with a spreader, while on weak subgrades 2-3 courses are more suitable. /TRRL/ [Swedish]

Lindahl, T *Byggnadsindustrin* No. 34, 1974, p 4, 1 Fig., 2 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 212472)

PURCHASE FROM: National Swedish Road & Traffic Research Institute S-11428 Stockholm, Sweden Repr. PC

2A 096890

USE OF PLANT MIX SEALS IN LOUISIANA

A policy has been adopted which stipulates that all new asphaltic concrete construction projects on highways serving average daily traffic volumes of 1000 vehicles per lane and greater shall be provided with a plant mix seal (PMS) surface. The PMS performance is determined by choice and quality of aggregates. Porous, polish-resistant aggregates possess the most desirable skid resistance characteristics. The skid characteristics of native Louisiana aggregates are compared with that obtained from a typical dense graded hot mix. Study data have prompted regulations which require that a slag, expanded clay or gravel PMS be placed on all new asphaltic concrete surfaces serving between 1000 and 2000 vehicles per lane per day. On roadways where the ADT per lane exceeds 2000 vehicles, only slag and expanded clay plant mix seals are permitted. The policy is applicable only to roadways with posted speed limits of 40 mph or higher. However, when the speed limit is less than 40 mph, a number of pre-established guidelines determine the need for a PMS riding surface. Inspection of several installations with PMS surfaces reveal the importance of the source of aggregate, and the fact that PMS surfaces that contain excessive fines seemed to yield lower skid numbers.

Adam, V Glascock, PE (Louisiana Department of Highways) *Paving Forum* Mar. 1975, pp 4-6, 3 Fig.

2A 096900

WAYS AND MEANS OF ASPHALT PAVING

The screed which is identified as the heart of the paving operation, smooths out irregularities in the mix with a floating action, while its weight provides the first stage of compaction of the pavement. The screed's sensitivity and

its finishing role requires that it receive the mix in an even flow. Factors which affect steady pull are identified, and the lift and approach angle of the screed which set the mat thickness are discussed. The material directly in front of the screed must be distributed by the augers along the full width of the unit. The automatic controls which help establish profile grade, transverse slope, and screed approach angle are outlined, and the factors important for good operation are noted. Improvements are noted which contribute toward easier operation of the paving machine (sophisticated controls), delivering a continuously consistent asphalt mix (by a hydrostatic and interlocked feeding system), achieving more tightly controlling grade and transverse levels (through inboard and outboard guides and crown-making screen adjustments), and attaining smoother roadability (through tire and track selection). Trends toward more economic use of asphalt (chip sealing, towed pavers, heater-scarifying treatment) are examined. Ripped out, crushed, treated and recycled material is described which appears to cut the cost of conventional hot mix by 25 percent, reduces bitumen consumption, and sharply curbs gas and fines emission.

Construction Methods and Equipment Vol. 57 No. 5, May 1974, pp 72-80, 1 Tab., 1 Photo.

2A 096950

CONSTRUCTION MATERIALS AND TESTING TECHNIQUES FOR SOIL STABILISATION WITH CEMENT
[Baustoffkundliche und Prueftechnische Fragen bei der Planung und Ausfuehrung von Bodenverfestigungen mit Zement]

Roadbase improvement by cement stabilisation of cohesive and noncohesive soils was practised 40 years ago, but has become very popular again. There is therefore a great need for revising the guidelines for cement stabilisation published in 1956. The paper reports on compressive strength limits, the method of testing, the effect of soil moisture, and quality control. Finally, experiences with special types of cement are described and examples of the exact specifications for stabilisation work are given. /TRRL/ [German]

Henk, B *Strassenbau-Technik* Vol. 25 No. 18, Sept. 1972, pp 38-42, 1 Tab., 15 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 300930)

PURCHASE FROM: Verlagsgesellschaft Rudolf Mueller Stolberger Strasse 84, D-5000 Koeln-41, West Germany Orig. PC

2A 096952

SOIL STABILIZATION FOR THE CONSTRUCTION OF THE HAMBURG-FLENSBURG-KIEL MOTORWAY
[Bodenverfestigung Bein der Bab Hamburg-Flensburg/Kiel]

Most of the motorway subgrade consists of uniform, frostproof fine sand. By means of cement stabilization it provides a good support for the bituminous roadbase. Since coarser road materials are not available in Schleswig-Holstein, the method was also very economical. The contract specifications for the 15 cm thick stabilized layer are described, including compressive strength after 28 days (50-125 kg/sq.cm); compaction (103% Proctor density); difference in level (between 1 and 4 cm). In addition, the mixing and compaction equipment is described and illustrated. /TRRL/ [German]

Engelmann, KH *Strassenbau-Technik* Vol. 25 No. 18, Sept. 1972, pp 53-56, 9 Fig.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 200932)

2A 096986

CONSTRUCTION GUIDE FOR SOILS AND FOUNDATIONS

This book is intended to provide contractors and subcontractors with the practical aspects of foundation construction. It discusses soils, soil behaviour and the construction of foundations, emphasizing that the soil is as much a part of the overall structure as are the components of the superstructure. Potential problems in specifications, contracts, soils data, etc., are pointed out and some solutions offered. Special emphasis is given to: the importance of obtaining all available information on subsurface, rock, and groundwater conditions; the difficulties in the installation of specialized foundation elements such as piles, caissons and underpinning; and the necessity for the proper engineering of all temporary construction, excavation slopes, sheeting and bracing, and other measures to prevent property damage. /TRRL/

Fletcher, GA Smoots, VA
Wiley (John) and Sons, Limited Textbook 1974, 60 pp, Figs., Tabs.,
Photos., 60 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD
212258)

PURCHASE FROM: Wiley (John) and Sons, Incorporated 605 Third Avenue,
New York, New York, 10016 Repr.PC

2A 097042

USE OF MINING AND METALLURGICAL WASTES IN CONSTRUCTION

With the depletion of natural industrial mineral resources, such as construction aggregates, and the increasing emphasis on the protection of the environment from expanding waste generation, it is critical that the utilization of various secondary products and wastes as construction materials be examined. The increased use of mining and metallurgical wastes in construction will decrease the demand on the available natural resources and help to solve many perplexing disposal problems in mining and industrial areas. Trends in the utilization of mining and metallurgical waste in construction have been determined from general waste recycling surveys of North American and British construction agencies, supplemented by literature surveys. This information is being incorporated into a data bank on waste utilization that is continually updated. In some cases laboratory studies on particularly promising secondary products and wastes, such as taconite tailings, slags, spent pickle liquors, fly ashes, waste limes, etc., have been conducted. Some of these studies, and other examples of potential waste recycling in construction, are presented to indicate the trends in utilization, some of the techniques developed for particular applications, the general economics involved and requirements for future research.

Emery, JJ
McMaster University, Canada Paper 18, June 1974, 12 pp, 6 Tab., 35 Ref.

2A 097155

APPLICATIONS OF THE FINITE ELEMENT METHOD TO GEOTECHNICS AND TRANSPORTATION ENGINEERING

The potential uses of the finite element method are described with particular reference to problems in geotechnics and transportation engineering, and several research projects are outlined. The details are given of the numerical technique in which, instead of considering the structure or continuum as a whole, the behavior of each constituent part is studied and then combined to predict the behavior of the whole. The technique can be extended to two-(basic element is a triangle) or three (basic element is a tetrahedron) dimensional analyses. Problems in both structural and nonstructural types can be solved with a minimum of over-simplifying identifications. The major advantages of the method stem from its simplicity in handling nonhomogeneous, discontinuous, and nonlinear media with irregular shape and cross section, which are typical of natural geologic and soil formations. Care must be exercised in selecting input data for finite element analyses. The finite element method can be used in geotechnics and transportation engineering as a tool for design and analysis, monitoring and control of construction, location of instrumentation analysis, analysis of laboratory specimens, and field evaluation of material parameters. The need is indicated for the development of constitutive laws for describing material properties.

Proceedings of the Ohio River Valley Soils seminar held October 5, 1973. This conference was sponsored by the Kentucky Soil Mechanics and Foundations Group of the American Society of Civil Engineers.

Huang, YH (Kentucky University)
American Society of Civil Engineers 14 pp, 14 Fig., 18 Ref.

2A 097162

TRENDS IN THE UTILIZATION OF WASTES FOR HIGHWAY CONSTRUCTION

A study involving the characterization and potential utilization of (municipal, mining and metallurgical) wastes and secondary products is reported which placed emphasis on information retrieval (to determine previous and current effort in this area), obtaining information on particular wastes that show promise, laboratory characterization and usage studies, and design implementation and field studies. Emphasis is placed on metallurgical wastes and examples are given of application of this approach to secondary products and wastes such as slags and taconite tailings. A computerized waste utilization data bank was developed which has been made (to increase its efficiency) a subset of a general Civil Engineering Reference Program

(CERPU). Trends in blast furnace and steel slag usage are tabulated. Steel slag has a high unit weight (120 lb/cu ft average) and a potential expansive behavior. Quick test procedures to measure the expansion potential have been developed and are being used in the investigation of the effects of steel slag types, age, acid treatment, gradation changes etc. on expansion. Nickel slag has been successfully used as subbase and base course material in highway construction and has established itself as the best ballast used on the CN system. An extensive study was made of steel slag bituminous mixes and some of the more important characteristics are tabulated. Comments are made on their skid resistance, dynamic moduli, and high compacted weight. Steel slag precoated chippings and slurry seals are also considered. Current research is reported on fine-grained self-cementing pelletized blast furnace slag for use in stabilized base construction. The applications in highway construction of spent pickle liquors and sulphite liquors are discussed. The utilization of tailings in construction is discussed, and research on the use of taconite tailings in bituminous concrete is outlined.

Emery, JJ Kim, CS
McMaster University, Canada No Date, 19 pp, 7 Tab., 56 Ref.

2A 097333

CRITERIA FOR AND NEW TENDENCIES IN STANDARDS FOR ROAD CONSTRUCTION BITUMINOUS MATERIALS [Nuevos criterios y tendencias sobre especificaciones de asfaltos para uso vial]

The basic principles behind the requirements for road construction materials are outlined in relation to the present criteria resulting from the development in scientific techniques. Recommendations are put forward for the establishment of standards and specifications for surfacing bitumen. Attention is drawn to the desirability of conducting additional tests such as the determination of ashes, the olienses test, and the determination of the specific weight and flash point. /TRRL/ [Spanish]

Pinilla, A *Vialidad* No. 54, Jan. 1971, pp 22-31, 5 Tab.

ACKNOWLEDGMENT: Transportation & Soil Mechanics Laboratory, Spain,
Laboratoire Central des Ponts et Chaussées, Transport and Road Research
Laboratory (IRRD 100759)

2A 097335

CORROSION OF REINFORCEMENT IN REINFORCED CONCRETE AND REINFORCED BRICK CONSTRUCTIONS

The paper presents the results of an investigation into the causes of corrosion of reinforcement in reinforced concrete and reinforced brick constructions. It suggests permissible limits for the salt contents of the different constituents of concrete, and discusses briefly some of the methods of prevention of corrosion. /Author/TRRL/

Rajagopalan, KS Rengaswamy, NS Balasubramanicam,
TM Chandrasekaran, S (Central Electrochemical Research Institute,
India) *Indian Concrete Journal* Vol. 48 No. 5, May 1974, pp 163-170, 8
Fig., 10 Tab., 17 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD
212068)

2A 097336

UNDERPASS THRUST AT BRENT CROSS FLYOVER

The thrusting of precast concrete tunnel boxes beneath the three-level flyover approaches at Brent cross is reported and claimed to be the largest thrust in the UK to date. The need for thrust boring was found to be essential, in order to meet the condition that access to the shopping centre should not interfere with the heavy traffic flow at the existing interchange. Details of the excavations required, materials used and methods employed in construction are given, together with diagrams and photographs, and the overcoming of the problem of pockets of soft material located in the line of thrust is described. The work was coordinated by Cementation Projects Ltd., and the other companies that were involved are listed. /TRRL/

Highways and Road Construction Vol. 43 No. 1781, Jan. 1975, pp 10-12,
2 Fig., 3 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD
212067)

2A 097343

MOTORWAY PLANS AND DESIGN IN HUNGARY

This article gives a brief account of Hungary's programme for motorway construction, which is planned to total over 500km by 1985. The M7 motorway from Budapest to the Yugoslav frontier is first discussed, which forms part of the European road E96. The design initially gives 2 x 2 traffic lanes, but will eventually provide 2 x 3 lanes with provision for further widening. Brief details are given of the pavement design (concrete overlying a bituminous gravel and stabilized soil), of bridge design and of surface water drainage. The first phase of construction has required the haulage of 4 million cu. M of earth and 200000 cu. M of replaced material. Similar information is then given for the M1 motorway which has a common origin with the M7 and runs to meet the Austrian section of the European road E5 at Hegylshalom. The pavement structure is planned to include a roughened asphaltic concrete wearing course, a rolled asphalt base course, a bituminous gravel base and a cement stabilized sub base. The article includes a map showing the long-term plan for a high-speed highway network in Hungary. /TRRL/

Highways and Road Construction Vol. 42 No. 1780, Dec. 1974, pp 13-14, 1 Fig., 5 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 212064)

2A 097346

AGGREGATES. ASPHALT PENETRATION MACADAM

[Agregados. Macadame betumlnoso por penetracao]

This specification covers the quality and grading of crushed stone, and gravel suitable for use in the construction of asphalt penetration macadam pavements, with asphalt bitumen, liquid asphalt or asphalt emulsion as binder. /TRRL/ [Portuguese, French]

National Civil Engineering Laboratory, Portugal Standard E295, Mar. 1974, 3 pp, 4 Tab.

ACKNOWLEDGMENT: National Civil Engineering Laboratory, Portugal, Transport and Road Research Laboratory (IRRD 211887)

PURCHASE FROM: National Civil Engineering Laboratory, Portugal Avenida do Brazil, Lisbon 5, Portugal Orig. PC

2A 097352

GUIDELINES FOR SAMPLING IN PHYSICAL SOIL TESTS ASSOCIATED WITH ROAD CONSTRUCTION [Merkblatt ueber die Probenahme fuer Bodenphysikalische Versuche im Strassenbau]

The guidelines have been drawn up by the Subcommittee on "Sampling", of the Working Committee on "Testing Technology" of the Working Group "Subsoil-Subgrade". They deal with principles to be observed during the sampling of granular and cohesive soils, and with the further processing of the soil samples and the cohesiveness of the sample. The various methods and the technical data related to them are summarized in a table. /TRRL/ [German]

Research Association for Road Communications, W Gr Standard 1972, 27 pp, 5 Tab., 17 Phot.

ACKNOWLEDGMENT: Research Association for Road Communications, W Gr, Transport and Road Research Laboratory (IRRD 300962)

2A 097356

SIGNIFICANCE OF THE PHYSICAL AND CHEMICAL PROPERTIES OF SM SLAGS FOR THEIR USE IN ROAD CONSTRUCTION [Bedeutung der Physikalischen und Chemischen Eigenschaften von SM-Schlacke fuer eine Verwendung im Strassenbau]

The study carried out enables defective Siemens-Martin slags to be eliminated, contributes to a useful evaluation of the slags and indicates a new source of raw material for road construction. After an analysis of chemical and mineralogical composition, the slag is tested for the occurrence and influence of lime and iron decomposition, blistering and insufficient crystal structure. Treatment with soft burnt lime means that these defects do not affect the slag as a construction material, and they are suitable for use in roads. /TRRL/ [German]

Schwiete, M-E Kroenert, W Deckert, K Westdeutscher Verlag No. 2218, 1972, 104 pp, Tabs., Photos., 120 Ref.

ACKNOWLEDGMENT: Research Association for Road Communications, W Gr, Transport and Road Research Laboratory (IRRD 300976)

2A 097364

THE TRANSPORT OF FRESH CONCRETE THROUGH PIPES- PREREQUISITES FOR THE PERFECT PUMPING OF CONCRETE THROUGH PIPES HAVING SMALL DIAMETERS [Die Foerderung des Frischbetons Durch Rohre-Voraussetzungen fuer das Stoerungsfreie Pumpen von Beton Durch Rohre mit Kleinen Durchmessern]

This book presents the results of numerous individual studies carried out at the institute for construction operations and construction machinery, Technical University of Berlin, and on a series of construction sites in Berlin and in the Federal Republic of Germany. An evaluation of the tests shows that the pumping of concrete in the rheological sense is a "plug flow" process. A disturbance-free operation can only be expected if the concrete is saturated with cement paste. The work examines all the factors which influence the pumping of concrete, explains the theoretical relations and illustrates the results in tables. The book is intended as an aid to the engineer to enable him to judge whether a concrete having a certain granular structure and a defined binder and consistency can be transported through small-diameter pipes. /TRRL/ [German]

Bauer, H *Forschungsreihe der Bauindustrie* No. 10, 1972, 152 pp, Tabs., Photos., Refs.

ACKNOWLEDGMENT: Research Association for Road Communications, W Gr, Transport and Road Research Laboratory (IRRD 300990)

2A 097365

TECHNICAL SPECIFICATIONS AND RECOMMENDATIONS FOR THE CONSTRUCTION OF BITUMINOUS ROAD SURFACINGS. PART 3: ASPHALTIC CONCRETE AND SAND ASPHALT (HOT-LAID)-TV BIT 3/73 [Technische Vorschriften und Richtlinien fuer den Bau Bituminoeser Fahrbahndecken. Teil 3. Asphaltbeton und Sandasphalt (Heisseinbau) TvBit 3/73]

The 1972 edition replaces the 1964 edition. It has been adapted to changes in particle sizes and limit values. For practical application time limits are set for the changes in the rules. After definition of concepts the specifications and recommendations deal with subsoil principles, surfacing thickness, materials and mixture, construction of the surfacing, requirements of the surfacing and tests. A final table summarizes the new requirements and correct values in accordance with TV/Bit 3/72. /TRRL/ [German]

Research Association for Road Communications, W Gr Standard 1972, 34 pp, 28 Tab.

ACKNOWLEDGMENT: Research Association for Road Communications, W Gr, Transport and Road Research Laboratory (IRRD 300978)

2A 097389

SLURRY SEAL

The results are reported of two inspections of slurry seal projects in Ohio. The first was conducted to observe the condition and evaluate the performance of Slurry Seal on highway shoulders. Both inside and outside sealed shoulders were inspected after 4 winter seasons. The overall condition of the seal was considered at least as good as the results obtained with chip and seal and is expected to continue functioning without major maintenance. The method does not result in waste of aggregate, and surface drainage characteristics were good. The second inspection reports on the relatively new use of slurry seal on Ohio highways. Comments are made on the equipment and materials used, the work itself, field observations, and method of performance. The maintenance of quality control is covered, and the maintenance of traffic thought the project is described.

Material has been compiled from special reports as requested in Federal-Aid Highway Program Manual, Volume 6, August 23, 1974. Taken from "Special Reports on Use of Equipment and Methods of Maintenance".

Motl, LC Schimelfenyg, RC Federal Highway Administration Mar. 1975, pp 8-19, 13 Phot.

PURCHASE FROM: Federal Highway Administration Construction & Maintenance Div, Office of Hwy Constr, r 3135, Washington, D.C., 20590 Repr. PC

2A 097417

PCC PAVEMENTS FOR LOW-VOLUME ROADS AND CITY STREETS

In an effort to provide information that may be utilized in decision-making by interested individuals (highway officials, design and construction engineers and others), detailed information is offered on planning, designing and constructing portland cement concrete pavements for light traffic conditions. The accumulated experience of 20 years of highway agencies in several states and cities was utilized in developing this report. The data indicate that PCC pavement has a good probability of maintaining extremely low maintenance costs and a satisfactory level of service over a long period. The planning of the paving project is detailed and the importance is emphasized of a reliable forecast of traffic that will use the road over its projected service life. Subgrade conditions, exposure elements affecting performance, materials availability, and utilities in the pavement area are considered as well as equipment and construction expertise, pavement design life, costs, serviceability, performance, project size and funding. The physical characteristics required for acceptable performance of any pavement are listed, and aspects such as data development for design, geometric design and control of other design features are considered. Mixture proportions and thickness design are also discussed. Plans to handle local traffic during construction are important. Observations are made regarding subgrade preparation, materials handling, placing, vibrating and finishing. Various aspects of surface maintenance are discussed, as well as deicing chemicals, drainage and enforcement of load limits. A check list is provided as an aid to determine if the use of concrete pavement can offer the best long-range solution. Suggestions are made for reducing costs and upgrading quality. Research needs are identified.

Report on National Cooperative Highway Research Program, Synthesis of Highway Practice. (Library of Congress Catalog Card No. 75-13909)

Transportation Research Board NCHRP Reports Final Rpt. NCHRP Synthesis 27, 1975, 31 pp, 19 Fig., 22 Ref., 2 App.

Contract HR 20-5

ACKNOWLEDGMENT: NTIS

PURCHASE FROM: TRB Publications Off Repr. PC, Microfiche, NTIS

2A 097487

BENEFICIAL USES OF SULPHUR IN SULPHUR-ASPHALT PAVEMENTS. VOLUME 2: TASK 2: LITERATURE SEARCH AND PATENT REVIEW

In an effort to exploit the available technology and evaluate the technical and economic potential of aggregate-asphalt-sulphur composites for use as highway pavement materials, the literature and patents were reviewed and a comprehensive bibliography and data bank was established. The work presented here is the result of the second phase of a study which attempts to provide a preliminary comparison of the engineering characteristics of sand-asphalt-sulphur with conventional asphaltic concrete pavements. Each article and patent was abstracted to provide a quick reference summary capability. The annotated bibliography on sulphur-asphalts is presented. This literature review will continue to be updated.

Sponsored by Bureau of Mines and the Sulphur Institute.

Galloway, BM Saylak, D

Texas Transportation Institute Final Rpt. Aug. 1974, 36 pp, Refs.

2A 097488

BENEFICIAL USES OF SULPHUR IN SULPHUR-ASPHALT PAVEMENTS. VOLUME 3: TASK 3: PRELIMINARY DESIGN, CONSTRUCTION AND QUALITY CONTROL PROCEDURES

This effort which represents the third phase of a study to provide a preliminary comparison of the engineering characteristics of sand-asphalt sulphur (S-A-S) with conventional asphaltic concrete pavements, presents a users manual and sets forth some preliminary specifications and recommended procedures for selecting an optimum mix design and constructing highway pavements with S-A-S composites. The manual on "Recommended Practices" explains the engineering, economic and ecological basis of the specifications and offers recommendations for the accomplishment of these requirements. Considerable information on sulphur is included, and details are presented on the preparation of paving mixtures, especially emphasizing tolerances and the effect of variations on the properties of the finished pavement. Paving equipment is reviewed. The manual on "Construction Specification" provides the basis for a contractual agreement between the

constructor of the highway demonstration facility and the sponsor of the project. The "Quality Control" manual relates largely to the paving materials and to the sampling and testing of these materials and compositions therefrom. Raw materials, pavement mix design, and field sampling and testing are covered.

Sponsored by Bureau of Mines and the Sulphur Institute.

Galloway, BM Saylak, D

Texas Transportation Institute Final Rpt. Aug. 1974, 101 pp, 9 Fig., 8 Ref.

2A 097678

RESEARCH INTO THE COMPACTION OF BITUMINOUS MATERIALS

After pointing out that good compaction increases durability, reduces deformation and increases stiffness and strength, the authors discuss present specifications and the methods used to measure the state of compaction. Studies of a number of factors that affect the state of compaction are reviewed: these include aggregate type, stiffness of working platform, binder content, compaction effort (including correlation between roller passes and level of compaction and their distribution across the laid width), traffic, roller speed, temperature, thick lift construction. Methods of increasing compaction on the nearside are laying the hard shoulder and nearside lane together and modifying the pattern of rolling operations. The relation between compaction and pavement performance is studied and a detailed investigation made of the deflection of the macadam base and its foundation, the dynamic modulus of the macadam and the tracking of cores at elevated temperatures. It is concluded that improving compaction improves pavement performance, and that it is possible to construct more economic macadam bases by reducing binder content and improving compaction. For the covering abstract of the seminar see IRRD abstract no 212145. /TRRL/

Lister, NW Powell, WD (Transport and Road Research Laboratory)

Asphalt and Coated Macadam Association Conf Paper 1974, 54 pp, 23 Fig., 2 Tab., 14 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 212146)

2A 098112

AGGREGATES, WATERBOUND MACADAM [Agregados, Macadame Hidraulico]

This specification covers the quality and grading of crushed stone and crushed gravel suitable for use in the construction of waterbound macadam pavements. /TRRL/ [Portuguese]

National Civil Engineering Laboratory, Portugal Standard E 294, Mar. 1974, 2 pp, 2 Tab.

ACKNOWLEDGMENT: National Civil Engineering Laboratory, Portugal, Transport and Road Research Laboratory (IRRD 211886)

PURCHASE FROM: National Civil Engineering Laboratory, Avenida do Brasil, Lisbon 5, Portugal Orig. PC

2A 098473

HIGHWAY CONSTRUCTION USAGE FACTORS FOR CEMENT, BITUMENS, CONCRETE PIPE AND CLAY PIPE

In an attempt to aid producers, manufactureres and suppliers of cement, bitumens, concrete pipe and clay pipe, usage factors are presented here in terms of units of the various materials per million dollars of construction cost. These factors, when multiplied by the number of millions of dollars for either a federal-aid or non-Federal-aid highway construction program, will result in reasonably accurate estimates of material requirements. The data employed in the development of usage factors are quantities of the major materials used and reported by contractors upon completion of highway construction projects on the Federal-aid Primary System. Investigations indicate that for comparable standards of design, material usage factors on non-Federal-aid work do not differ appreciably from those developed for Federal-aid construction. Estimated construction expenditures for all public highways are tabulated. A table is also presented of estimated national average secondary road factors.

Federal Highway Administration 1975, 5 pp, 5 Tab.

2A 098477

SOLID WASTE IN HIGHWAY CONSTRUCTION

The use has been demonstrated of mixtures of three power plant wastes (flyash, bottom ash and calcium sulphate) in paving parking areas. The parking area of Dulles International Airport, Washington, D.C. was paved with 5 inches of a compacted mixture of sulfate, lime, fly ash and aggregate on a compacted subgrade. About 75,000 tons of this mixture was placed at the rate of 1,000 tons per acre. The areas to be used for passenger car parking were given a bituminous seal primarily to retain poisture for curing, but which also served as the final surface. Two inches of conventional bituminous concrete was used to surface traffic lanes and bus parking areas. Details are given of the materials used as well as the construction procedures. The processing is also discussed of incinerator residue through grinding, further ignition and fusion to form a slag-type aggregate. A research and development process is described which involves a stepwise approach to effecting the fusion of incinerator residue and together with the minimal use of supplemental thermal energy. The 4 sequential steps are: reduce the residue particle size to minus 1/4 inch by hammer milling; burn out remaining combustibles in a rotary kiln while simultaneously permitting all noncombustible particles to heat up to 1600 deg F; fuse the noncombustible particles by permitting them to fall from the kiln into a pile that is heated to a relatively mild temperature of 2000 deg F where low melting gasses and oxides envelop unmelted high melting metals and oxides; cool the fused matrix at a controlled rate as it flows from the fusion furnace and is picked up on a moving grate conveyor leading to a crusher. Another approach to using incinerator residue is also outlined. Laboratory work indicates that satisfactory bituminous mixtures can be made with residue as the major portion of the aggregate, and field application of such mixtures used in black base construction has been made. Economic considerations however, pose a serious deterrent to the use of waste products in highway construction.

Halstead, WJ (Federal Highway Administration) *APWA Reporter* Vol. 42 No. 6, June 1975, pp 12-14

2A 098641

LARGE-SCALE MODEL TEST OF DRILLED PIER IN SAND

A technique is presented for assessing the magnitude of skin friction for pier foundations in sand. The technique employs the results of interface direct shear tests between sand and the construction material; the results are presented in hyperbolic equation form. The test pier was 16 in. (407 mm) in diameter and 15 ft (4.6 m) long. The test pier was heavily instrumented with Carlson stress meters, electrical resistance strain gages, and calibrated hydraulic rams on the top and bottom of the pier. Comparisons of predicted and measured values of skin friction showed agreement within 5%. Bonded resistance strain gages on the vertical steel reinforcement are the most reliable instrumentation method. The magnitude of skin friction for "point bearing" piers in sand in prototype installations may approach 20%-30% of the total load capacity. /ASCE/

Clemence, SP (Missouri University, Rolla); Brumund, WF (Georgia Institute of Technology) *ASCE Journal of the Geotechnical Engineering Div* Proceeding Vol. 101 No. GT6, ASCE #11369, June 1975, pp 537-550, 6 Fig., 4 Tab., 32 Ref., 2 App.

2A 099298

DESIGN FOR FROST DURABILITY

Factors responsible for impairment of durability are identified, and means by which protection may be provided are described. The conditions of high moisture content, prevented or retarded moisture flow and excessive cooling rate occur often in combination and are particularly dangerous. Provision of more camber, a higher crown or a steeper slope is needed to achieve good drainage of horizontal surfaces. In design, allowance has to be made for poor workmanship to prevent the formation of puddles. Waterproofing of concrete pavement eliminates the principle mode of moisture penetration. Success, however, hinges upon the provision of good drainage of roadbed and dryness of the material at the time of sealing. The presence of soluble chemicals in the pores should be avoided because they cover the vapour pressure of the liquid and therefore, for a given relative humidity, increases the degree of saturation. Frost protection in autumn and winter construction activities must be achieved by improving the properties of the building materials. "Hard-dried" bricks should be utilized if there is any likelihood of freezing. The dangers of frost action in concrete may be reduced by densification of the material by lowering the water-cement ratio of the mix.

Reprint of Paper No. 414, 2nd International CIB/RILEM Symposium on Moisture Problems in Buildings, Rotterdam, 10-12 September 1974.

Litvan, GG

National Research Council of Canada Tech Paper No. 432, Sept. 1974, 6 pp, 5 Ref.

PURCHASE FROM: National Research Council of Canada Montreal Road, Ottawa, Ontario K1A 0R6, Canada Orig. PC

NRCC 14592

2A 099465

APPLICATIONS OF FIBRE REINFORCED COMPOSITES IN MARINE TECHNOLOGY

A review is made of existing marine applications of fiber-reinforced composites. Problems arising in the design of marine-type composite structures, including evaluation and selection of materials, structural analysis, buckling behavior and performance of connections, are discussed with particular reference to large, high-performance GRP hulls. Suggestions are made on items of research and development needed in this field. The greatest scope for increased application of fiber-reinforced composites in the marine field appears to lie in construction of medium-size hulls in the 20 to 40 m range, including particularly fishing boats, together possibly with large patrol boats and service vessels for the offshore gas/oil industry. While design studies for larger ships have indicated that GRP tankers, trawlers and ferries of up to 80 m might prove economically viable, present cost figures suggest that GRP is unlikely to compete with welded steel construction in ships of over 50 m unless a special requirement arises, eg for carriage of corrosive cargo or, in the case of minesweepers, for a non-magnetic hull.

Compos-Stand Test and Des, Conf Proceeding, National Physics Laboratory, Teddington, England, April 8-9, 1974.

Smith, CS (Naval Construction Research Establishment)

IPC Science and Technology Press Limited Proceeding Apr. 1974, pp 54-69, 70 Ref.

ACKNOWLEDGMENT: EI

PURCHASE FROM: ESL Repr. PC, Microfilm

2A 099621

TECHNICAL DAYS DEVOTED TO ROADS IN CORSICA-PART 2-LIGHTLY-TRAFFICKED ROADS [Journées techniques de la route de Corse-Deuxième partie- Les routes économiques]

This article comments on papers dealing specifically with the constructional and administrative problems of lightly-trafficked roads. The first paper by remillon stresses the drawbacks of applying to lightly-trafficked roads pavement design and strengthening methods used for heavily-trafficked roads. Proposals are put forward for the extensive utilization of local materials with a view to realizing large savings in construction costs. The second report by ceintrey recommends the use of non-conventional materials for the construction of low-cost roads, and emphasizes the need for close cooperation between laboratory and in-situ tests when developing new construction techniques. The last two papers by cartier and lanore outline the experience of both authors in the administrative aspects of lightly-trafficked road construction in two departments in france (morbihan and dous). Discussions of the papers are appended. /TRRL/ [French]

Remillon, M (Viafrance); Ceintrey, M Cartier Lanore *Revue Generale des Routes et des Aerodromes* Vol. 43 No. 484, Feb. 1973, pp 41-47, Figs., 2 Tab.

ACKNOWLEDGMENT: Laboratoire Central des Ponts et Chaussées, Transport and Road Research Laboratory (IRRD 101054)

2A 099743

TREATMENT OF SOFT FOUNDATIONS FOR HIGHWAY EMBANKMENTS

For the objective appraisal of all applicable construction alternatives, the preliminary planning studies must include special foundation investigations. Right-of-way for some soft foundation construction alternatives may exceed usual requirements, and construction alternatives involving subsoil stabilization by consolidation require surcharge loading periods. The high costs of such additional investigations are, however, offset by the potential savings in construction costs. The applicable construction alternatives include (a) elevated structure, (b) embankment fill supported by piles, (c) excavation of soft soils and replacement by suitable fill materials, (d) subsoil stabilization with or without sand drains, and (e) no treatment whatsoever relying instead on specially detailed field investigations and design studies to achieve

uniform settlements. Each alternative can be evaluated based on factors such as construction cost, maintenance, ecological and environmental effects, fill availability, and disposal area availability. Where subsoil stabilization involves vertical sand drains, the type of drain influences the design procedures. Where nondisplacement drains are used, field permeability tests are desirable because they result in a somewhat higher field coefficient of consolidation that will reduce the estimated consolidation time. Field permeability values should be reduced to account for effects of embankment loading. Extensive field instrumentation should be required where subsoil stabilization by consolidation is used. Where subsoil consolidation techniques are used, field test sections are desirable to achieve maximum economy. Field test sections are also useful in assuring the technical feasibility of consolidation techniques where elevated structures or other techniques were preferred. The quality and amount of field inspection are especially important and can be related to the post construction behavior of the types of construction discussed.

Transportation Research Board NCHRP Synthesis No. 29, 1975, 25 pp, 19 Fig., 10 Tab., Photos., Refs., 2 App.

PURCHASE FROM: TRB Publications Off Orig. PC

2A 099752

SITE PAVING WITH FULL-DEPTH ASPHALT CONCRETE: FIRST STEP IN BUILDING CONSTRUCTION

The details are described of a cost-saving construction sequence which provides a guarantee that it can proceed without interruption by rain, snow or muddy conditions. The procedure consists of the construction upon a prepared subgrade, of a 4 to 6 in. thick, hot-mix asphalt concrete base course over the entire area that will ultimately be parking areas, service roadways, and buildings. Upon completion of all construction, a final wearing course is placed upon the hot-mix asphalt base. The prerequisites for site paving are set forth, and details are given of the composition of mixes, thickness, the asphalt bearing course, final asphalt concrete wearing course, and the excavation for structures.

Annales Agronomiques CL-12, May 1975, 4 pp, 2 Tab.

2A 125074

CHANNEL: FRENCH MINERS FIGHT CASCADE AS BRITISH MOLE BARES TEETH FOR PILOT

The author gives an account of progress that has been made (up to the end of 1974) with the channel tunnel. Progress that has been made by the French near Calais, where trouble has been encountered in the access tunnel (descenderie) through the ingress of 120 litres of water per second is described. Extensive grouting with bentonite and cement has failed to waterproof the tunnel and neither a small alpine roadheader nor a large Demag roadheader has been able to perform satisfactorily. A Robbins mole is now being tested and in order to bring it into use as soon as possible, an additional tunnel is being planned. Details are given of the progress made by the British near Dover, where both access tunnels (one 400m and the other 287m plus a 100m viaduct) and a 180m long assembly chamber have been driven, the latter 40m beneath the channel. The priestley 50m long tunnelling machine has also been assembled ready to commence work. Brief details are given of the proposed 3 phases of construction of the tunnel and the article includes information on the different conditions and policies in France and Britain. /TRRL/

Hayward, D *New Civil Engineer* No. 126, Jan. 1975, pp 19-22, 2 Fig., 6 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 212673)

PURCHASE FROM: Institution of Civil Engineers 26-34 Old Street, London EC1V 9AD, England Repr. PC

2A 125099

CRYOGENIC TREATMENT OF SHAFTS AND TUNNELS

One of the geotechnical processes able to contend with unstable or saturated soil conditions in civil or mining engineering, is that of soil-freezing. In this technique, a temporary conversion of the interstitial soil moisture forms a strong and impermeable frozen soil membrane around the excavation zone. With the development of cryogenic techniques, nitrogen is available in liquid form offering a rapid means of soil freezing. Typical applications of the technique include shaft deepening tunnel faces, sealing gaps in cofferdams

and wherever temporary structural support is needed. Two examples are given of the use of soil freezing on a sewer tunnelling project in Edinburgh. /TRRL/

Harris, GP (Foraky Limited) *Tunnels and Tunnelling* Vol. 6 No. 5, Sept. 1974, pp 69-70, 2 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 212703)

PURCHASE FROM: ESL Repr. PC, Microfilm

2A 125132

A CLIMATIC INDEX OF WEATHERING AND ITS APPLICATION IN ROAD CONSTRUCTION

Weathered rocks are the predominant natural road building materials in southern Africa and their performance depends very much on the type of rock and the climatic environment in which such rocks weather. Climatic conditions which lead either to the predominance of disintegration, due to physical weathering, or to decomposition, due to chemical weathering, are defined in terms of an n value which is expressed as twelve times the computed free-water evaporation during the warmest month divided by the total annual precipitation. The particular feature of the formula is the use of climatic parameters for one particular month as well as for the whole year. The impact of the n value on weathering, on soil formation and on secondary transformations of soils (pedogenic materials), as well as on human activities in engineering and agriculture, are briefly described and the n value is compared with the moisture index I of Thornthwaite. /Author/TRRL/

Weinert, HH (National Institute for Road Research, South Africa) *Geotechnique* Vol. 24 No. 4, Dec. 1974, pp 475-488, 4 Fig., 2 Tab., 22 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 212651)

2A 125162

FOURTEENTH WORLD CONGRESS-PRAQUE 1971-COMMITTEE FOR LOW COST ROADS-REPORT OF THE COMMITTEE AND GENERAL REPORT ON QUESTION 7: LIGHTLY-TRAFFICKED ROADS [Quatorzieme Congres Mondial-Prague 1971-Comite des routes economies-Rapport du comite et rapport general sur la Question VII routes a faible circulation]

This report summarizes replies obtained from 18 countries, it comprises nine chapters. Chapter 3 deals with the stabilization of pavements in tropical and subtropical countries. It is mainly concerned with the technical arrangements to be made for the design and construction of pavements stabilized with cement, lime or bitumen. Chapter 4 considers the use of non-traditional materials for the construction of pavements, special binders (lime, slag, fly-ash, emulsion, fillers), laboratory tests, and in-situ tests for studying the performance of non-traditional materials. Chapter 5 deals with the behaviour of pavements under traffic and their strengthening under subtropical and tropical conditions. It shows the need for a detailed knowledge of traffic characteristics, the influence of the climate and that of the nature of the materials. Visual observations and deflection measurements under load are used to evaluate the need for strengthening. The subject of chapter 6 is corrosion prevention in subtropical and tropical countries and emphasis is laid on the wide variety of means of preventing erosion. Chapter 7 studies the influence of secondary roads on the economic and social development. Chapter 8 examines the maintenance costs of roads with a daily traffic volume less than 100 vehicles. In chapter 9 the problems of the total cost of the transport of 1 tonne of freight to the user as a function of the type of vehicles is discussed, but there exist too few data on transport costs as a function of vehicle axle load. The number of the covering abstract of the conference is irrd abstract no. 100978. /TRRL/ [French]

Permanent International Association of Road Congr Conf Paper 1971, 116 pp, Figs., Tabs., Refs.

ACKNOWLEDGMENT: Laboratoire Central des Ponts et Chaussées, Transport and Road Research Laboratory (IRRD 100967)

2A 125180

COMPOSITION AND PHYSICO-MECHANICAL PROPERTIES OF BITUMEN [Constitution et proprietes physico-mecaniques des bitumes]

Following details of the manufacture of bitumen used in road construction from the distillation of petroleum, a study is presented of the composition

of bitumen: asphaltene, malthene (resin, ore), carboid and carbene, and of molecular masses (comprised between 600 and 1200). Separation methods are reviewed: by means of solvents, chromatography, and other techniques. Analytical methods are described; the physico-mechanical properties of bitumen are investigated from the rheological point of view: standard empirical tests, ductility and adhesion. The relation between composition and properties of bitumen is studied together with the evolution of bitumen in time by means of ageing tests and direct and indirect laboratory simulated ageing test methods. The evolution on bitumen on actual road is also investigated. The covering abstract of the conference is IRRD abstract no. 101124. /TRRL/ [French]

Taken from Journées d'information bitumes et enrobes bitumine.

Ajour Bicheron Durrieu Gaestel (Exxon International Incorporated); Grignard Lamathe Lesage (Petroles BP); Marvillet Quedeville (Shell Oil Company); Ramond Roger Stern (Petroles BP) Laboratoire Central des Ponts et Chaussées Conf Paper 1972, pp 21-139, Figs., Tabs., Refs.

ACKNOWLEDGMENT: Laboratoire Central des Ponts et Chaussées, Transport and Road Research Laboratory (IRRD 101126)

2A 125182

STUDY OF THE BEHAVIOUR OF METAL ALLOYS IN CONTACT WITH CONSTRUCTION MATERIALS [Etude du comportement des alliages métalliques au contact des matériaux de construction]

The authors define the nature and characteristics of concrete and use those data to conduct electro chemical tests and assess their results with a view to evaluating the resistance to corrosion of different metal alloys, which can come into contact with concrete. /TRRL/ [French]

Pequin, P Longuet, P Zelwer, A *Memoires Scientifiques de la Revue de Metallurgie* Vol. 70 No. 5, May 1973, pp 365-375, 10 Fig., 3 Tab., 20 Ref.

ACKNOWLEDGMENT: Laboratoire Central des Ponts et Chaussées, Transport and Road Research Laboratory (IRRD 101118)

2A 125241

AERIAL PHOTOGRAPHY: INTERPRETATION AND LOCALIZATION OF CONSTRUCTION MATERIAL DEPOSITS [Foto interpretacion y localizacion de materiales viales]

The authors recall that the interpretation of aerial photographs must rest on key factors which give an exact knowledge of regional characteristics: shape of slopes, width of valleys, drainage, erosion, colour of the soil, etc. The authors stress the limits and future possibilities of aerial photography in civil engineering. /TRRL/ [Spanish]

Romero, L Britos, J *Vialidad-Corrientes* No. 6, Oct. 1971, pp 43-46

ACKNOWLEDGMENT: Transportation & Soil Mechanics Laboratory, Spain, Transport and Road Research Laboratory (IRRD 101097)

2A 125272

SETTLEMENT IN THE VICINITY OF SHIELD-DRIVEN TUNNELS [Asentamientos en la vecindad de tuneles perforados con escudo]

Results are given of measurements of settlement taken in the proximity of shield-driven tunnels. A relation is established between settlement and the nature of the terrain, the driving process and the tunnel lining used. Attention is drawn to the consequences of shield driving for neighbouring structures. /TRRL/ [Spanish]

Tinajero, J Vieitez, L *Ingenieria* No. 2, Apr. 1972, pp 209-220, 14 Fig., 3 Ref.

ACKNOWLEDGMENT: Transportation & Soil Mechanics Laboratory, Spain, Laboratoire Central des Ponts et Chaussées, Transport and Road Research Laboratory (IRRD 100877)

PURCHASE FROM: Universidad Nacional Autonoma de Mexico Palacio de mineria, Apartado Postal M-6987, Mexico 1, D.F., Mexico Orig. PC

2A 125273

TUNNELS AND TERRAIN [Los Tuneles y el Terreno]

The author recalls the necessity for preliminary geological investigations in all civil engineering projects. To supplement these investigations, it is

recommended to use geophysical investigation techniques such as electrical and seismic methods. The problems of tunnel boring in different types of terrain are briefly reviewed, and several examples of tunnels in Spain are given: tunnels in granite, volcanic rock, metamorphic rock, slate, quartz, sand; pudding stone with a high content of siliceous materials, limestone and dolomite, limestone conglomerate and heterogeneous rock. /TRRL/ [Spanish]

Saez, A *Materiales Maquinaria y Metodos para la Construc* No. 88, Jan. 1972, pp 7-14

ACKNOWLEDGMENT: Transportation & Soil Mechanics Laboratory, Spain, Laboratoire Central des Ponts et Chaussées, Transport and Road Research Laboratory (IRRD 100817)

PURCHASE FROM: Materiales Maquinaria y Metodos para la Construc Maignon, 26 Barcelona 12, Spain Orig. PC

2A 125292

RIGID POLYURETHANE FOAM. THERMAL INSULATION MATERIAL USED IN CONSTRUCTION [Las espumas de poliuretano rigido como material para aislamiento termico en la construccion]

Rigid polyurethane foam is an excellent thermal and sound insulation material for use in construction, which weighs very little. This foam contains two liquid ingredients: resin and prepolymer. The three methods of manufacture are described: direct proportioning by hand, continuous-or intermittent-production machines, or spraying machine. Details are given of the physical and chemical characteristics of the product together with standards for the selection of the machine best suited to each particular case. The foam can be used for finishing concrete surfaces and metal parts in chemical plants for example. It can also be utilized in the repair of pavements damaged by deicing salts. A very thin layer of polyurethane foam affords very good insulation and high strength. /TRRL/ [Spanish]

Palomar, AS *Materiales Maquinaria y Metodos para la Construc* No. 91, Apr. 1972, pp 309-321, 10 Phot.

ACKNOWLEDGMENT: Transportation & Soil Mechanics Laboratory, Spain, Laboratoire Central des Ponts et Chaussées, Transport and Road Research Laboratory (IRRD 100861)

2A 125294

SAFETY IN THE CONSTRUCTION OF BITUMINOUS SURFACINGS [Seguridad de la construccion de pavimentos asfalticos]

The construction of bituminous surfacings requires three types of safety measures: measures relating to the material used, to the plant, and to the equipment. Practical recommendations are proposed for the safety of different operations: transport, sampling, cleaning and maintenance of the equipment, operation of plants, etc. /TRRL/ [Spanish]

Perez, AS *Alemas* No. 61, Apr. 1972, pp 43-46

ACKNOWLEDGMENT: Transportation & Soil Mechanics Laboratory, Spain, Laboratoire Central des Ponts et Chaussées, Transport and Road Research Laboratory (IRRD 100979)

2A 125295

PLASTIC MATERIALS IN CONSTRUCTION [El plastico en la construccion]

The main results of research into macromolecules were the development of synthetic resins, on which plastic materials are based. A study is made of plastic materials used in construction moulding, etc. The materials are classified into thermoplastic and thermostable materials. The main applications of plastic materials in the field of construction are cited, especially those of polyethylene and polyethylene foams. /TRRL/ [Spanish]

Palomar, E *Materiales Maquinaria y Metodos para la Construc* No. 93, June 1972, pp 555-569, 5 Tab., 4 Phot.

ACKNOWLEDGMENT: Transportation & Soil Mechanics Laboratory, Spain, Laboratoire Central des Ponts et Chaussées, Transport and Road Research Laboratory (IRRD 100874)

2A 125300

STEEL UNIT JOINTS BY MEANS OF EPOXY GLUE AND HIGH-STRENGTH BOLTS [Polaczenia Elementow Stalowych z Zastosowaniem Zywic Epoksydowych i Srub Sprezajacych]

Results are presented of tests on glued bolted and mixed joints. It was found that, the strength of mixed (glued and bolted) joints is greater by at least 50% than that of ordinary joints. /TRRL/ [Polish]

Falkowski, J Pancewicz, Z. *Inzynieria i Budownictwo* Vol. 331 No. 7, 1972, pp 271-275, 6 Fig., 3 Tab., 14 Ref.

ACKNOWLEDGMENT: Laboratoire Central des Ponts et Chaussees, Transport and Road Research Laboratory (IRRD 101081)

PURCHASE FROM: Wydawnictwa Czesopism Technicznych NOT Przesibi-orstwo Naczelnej Organizacji Tech, ul Mazowiecka 12, Warsaw, Poland Repr. PC

2A 125306

CRITICAL DEGREE OF SATURATION-A TOOL FOR ESTIMATING THE RESISTANCE OF CONSTRUCTION MATERIALS TO FROST [Degre Critique de saturation-un outil pour l'estimation de la resistance au gel des materiaux de construction]

The theoretical and experimental study of the effect of frost on porous and brittle construction materials showed the existence of critical degrees of saturation. The critical degree of saturation is a constant of the material which has a well defined value for a given type and quality of the material under study. It was shown that deterioration occurred after frost if the actual degree of saturation exceeds the value of the critical degree of saturation. It is possible to select a material as a function of its resistance to frost by comparing, for different materials, the critical degree of saturation and the degree of saturation actually reached under given conditions. The use of the critical degree of saturation helps to eliminate the lack of correlation existing in some cases between results obtained during frost tests and results obtained during utilization of the material. /TRRL/ [French]

Fagerlund, G (Lund University of Technology, Sweden) *Materiaux et Constructions, Essais et Recherches* No. 23, Sept. 1971, pp 271-285, Figs., Tabs., Refs.

ACKNOWLEDGMENT: Laboratoire Central des Ponts et Chaussees, Transport and Road Research Laboratory (IRRD 101077)

2A 125384

PENETRATION MACADAM AS A SURFACE TO MINIMIZE THE REFLECTED CRACKS FROM SOIL CEMENT BASE

This report on the stabilization of inferior materials for road base covers cement and lime stabilization, and describes experience which indicates that penetration macadam surface can minimize cracks. Penetration macadam can also prevent failure at the crack plane due to slab pumping action, and self-sealing can be expected with the right amount of applied bitumen. Design criteria are set forth and the construction method is detailed.

Rananand, N

Thailand Department of Highways Res. Rept. No. 6, June 1973, 13 pp, 8 Fig., 3 Tab., 6 Ref.

2A 125398

FIELD EVALUATION OF AN ASPHALT STABILIZED SAND PAVEMENT DESIGNED USING THE ELASTIC LAYERED SYSTEM

The preparation, design and construction are detailed, and the testing, design and performance evaluation are described of a research test road developed to determine thickness and mixture design procedures for stabilizing native sands with bituminous products. The test road includes two asphalt materials (an asphalt and liquid asphalt) and three thicknesses (90, 130, and 200 mm) of stabilized material based on predicted design lives. The data acquisition system measured three variables-strain (long term static and dynamic strains in the subgrade, subbase and stabilized sand pavement), temperature and traffic. The basic components of the measuring system were wire and induction coil strain sensors which utilize the principle of an electromagnetic couple between sensor pairs. The general sequence of installation of the data acquisition system included installation of the extensometers, the sensors in the extensometers, the sensors located under the pavement and temperature sensors in the pavement, and the sensors at the surface of the pavement. The dynamic test results recorded on magnetic

tape as analog data was converted to the digital form. A fully automated data processing procedure was developed using a computer program to interpret all the data and to produce all the digitized outputs such as maximum strains and loading rate. The evaluation of the data is detailed. The results presented here cover only one year of a study planned of 10 years. This preliminary report will be followed by periodic reports including an interim report after 5 years of field evaluation.

Stuart, E, III (Forest Service); Miyaoka, Y (Ministry of Roads, Japan); Skok, EL, Jr (Minnesota University, Minneapolis); Wenck, NC (Hickock (Eugene A) and Associates) *Association of Asphalt Paving Technologists Proc Conf Paper* Vol. 43 1974, pp 77-109, 17 Fig., 6 Tab., Photos., 10 Ref.

PURCHASE FROM: Minnesota University, Minneapolis 155 Experimental Engineering Building, Minneapolis, Minnesota, 55455 Orig. PC

2A 125400

THE CONSTITUTION AND QUALITY OF PAVING GRADE ASPHALTS PRODUCED BY AIR BLOWING DISTILLATION RESIDUES OF KUWAIT AND "LIGHT ARABIAN" CRUDE OIL

The constitution and physical behavior of asphalts from Kuwait and light Arabian crude oil were studied, the manner in which they were affected by blowing at high temperature with air was investigated, and improved methods for refinery blowing operation are suggested. The Kuwait residue gives satisfactory paving grade materials but improved resistance to hardening is obtained if the blowing is done at the lowest practicable temperature. This is because the reduction of the temperature changes the nature of the chemical reactions taking place; polymerization takes place rather than intramolecular condensation. The light Arabian residue gives paving grade materials with less satisfactory performance than those from the former source, and lack naphthemic structures. After blowing, this shows a high "shear susceptibility" and low ductility particularly after treatments simulating the coating of hot aggregate. The chemical reactions taking place are mainly by intramolecular condensation and reduction of the blowing temperature does not produce any significant improvement in resistance to hardening.

Dickinson, EJ (Australian Road Research Board) *Association of Asphalt Paving Technologists Proc Conf Paper* Vol. 43 1974, pp 132-161, 16 Fig., 4 Tab., 11 Ref.

PURCHASE FROM: Minnesota University, Minneapolis 155 Experimental Engineering Building, Minneapolis, Minnesota, 55455 Orig. PC

2A 125485

THE A31 NANCY-METZ-THIONVILLE MOTORWAY. SECTION 1 WITHIN THE DEPARTMENT OF MEURTHE ET MOSELLE [L'Autoroute A31 Nancy-Metz-Thionville. 1-Partie comprise dans le Departement de Meurthe et Moselle]

The a31 motorway, which will link nancy, metz and thionville, is in the process of completion. It was built in sections the order of which was governed by local traffic requirements. Details are given of the section in the meurthe et moselle, its alignment, earthworks, and the solutions adopted in difficult terrain and in the proximity of mines. The associated structures are described together with the asphaltic concrete pavement, which comprises A gravel-slag roadbase. Costs are quoted, and statistical data on traffic and safety are included. Mention is made of the labour force needed. /TRRL/ [French]

Schluck, H *Revue Generale des Routes et des Aerodromes* Vol. 42 No. 479, Sept. 1972, pp 39-64, Figs., Tabs., Photos.

ACKNOWLEDGMENT: Central and Regional Labs of Bridges & Highways, Fr, Transport and Road Research Laboratory (IRRD 100911)

2A 125512

FORECASTING SERVICEABILITY LOSS OF FLEXIBLE PAVEMENTS

Pavement performance data collected in Research Project 2-8-62-32. "Extension of AASHO Road Test Results," are analyzed in this study. Serviceability loss of three flexible pavement types due to fatigue, swelling, shrinkage and thermal cracking are correlated to many environmental, traffic, time, design and construction material variables. A "two-step constrained select regression procedure" is developed to examine the effect that each variable has on pavement serviceability loss. Stochastic reliability

concepts are applied to evaluate the expected value and variance of the serviceability loss. /FHWA/

Lu, DY Lytton, RL Moore, WM
Texas Transportation Institute Final Rpt. RR-57-1F, Nov. 1974, 79 pp
Study 2-8-74-57

ACKNOWLEDGMENT: Federal Highway Administration (S0360)
PURCHASE FROM: NTIS Repr. PC, Microfiche

PB-244603/AS

2A 125554
DEVELOPMENTAL TRENDS IN SWEDEN IN THE ROAD CONSTRUCTION PROCESS [Naagra Utvecklingstendenser Inom Vaegbyggnadsprocessen i Sverige]

Traffic policy and traffic safety targets are supplemented by sub-targets in the form of standard criteria for the service functions of a road. These criteria must be complied with at all stages of planning and construction at lowest cost. Demands for economy in road construction necessitate a review of present standard criteria. Construction and maintenance costs must be optimised. Scarce resources must be carefully managed on the grounds of economy, environmental considerations and the scarcity of natural construction materials. This scarcity demands flexibility in planning and design. Modern aids such as computers must be utilised to consider all variables. There must be better knowledge of the properties of construction materials, groundwater and climatic conditions, and systematic investigations of rock materials which will be used more extensively. An analytical model is being constructed which can be used for all pavement types and will permit evaluation of alternative constructions. Stabilisation must be further examined. Reinforcement and improvement will increase at the expense of new construction, and standard criteria must therefore be established. Studded tyres cause extensive wear; surface dressing is a promising remedy. In view of high bitumen costs, the viability of concrete roads /TRRL/ [Swedish]

Bronge, I *Vag-Och Vattenbyggaren* No. 5, 1974, 3 pp, 3 Phot.

ACKNOWLEDGMENT: National Swedish Road & Traffic Research Institute, Transport and Road Research Laboratory (IRRD 213091)
PURCHASE FROM: National Swedish Road & Traffic Research Institute Drottning Kristinas, Vaeg 25, Repr. PC

2A 125578
BREAKTHROUGH UNDER THE TYNE

This article gives a brief account of the construction of the 2.2 million tyne siphon tunnel which is part of a 60 million scheme to clean up the tyne. The tunnel was driven from both ends because of the complicated and confused geological conditions and because of the fissured state of the strata following coal mining activities. Blasting techniques were used in the largely unfissured sandstone at the south bank, whilst a conventional shield working in compressed air was used at the north drive. A strict regime of advance probing was carried out so that no large water-bearing fissures would be unexpectedly encountered and the tunnel was lined with a conventional cast iron segmental lining, an air pressure of 0.17n/m² being employed in the north section to reduce the ingress of water. In order to balance air pressures before breakthrough a steel bulkhead was constructed in the south drive and holes were bored through from the north drive into the pocket between bulkhead and face. /TRRL/

Gosney, J *Contract Journal* Vol. 263 No. 4976, Jan. 1975, p 21, 2 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 212637)

2A 125787
COST AND BENEFITS OF ROAD, DUST CONTROL IN SEATTLE'S INDUSTRIAL VALLEY

The paving of gravel roads with an average daily traffic (ADT) over 15 is a least cost method for reducing suspended particulate in the air in Seattle. It is also a good business investment when the ADT exceeds 100. In a study done in Seattle's Duwamish Valley the impact of road dust on air quality was measured by obtaining dust emission factors for vehicles traveling at 10, 20, and 30 mph on gravel as well as dusty paved roads. Nineteen miles of gravel roads and 110 miles of dusty paved roads contributed 2700 tons/year of particulate, of which 700 tons were below 10 microns. Paving or oiling

such roads will produce benefits of \$3,881,000 yearly in household cleaning, health care, sewer, vehicle operation, and road maintenance costs as well as an increase in property values.

Roberts, JW *Air Pollution Control Association, Journal of* Vol. 25 No. 9, Sept. 1975, pp 948-952, 24 Ref.

2A 125827
SUBSURFACE EXPLORATION FOR UNDERGROUND EXCAVATION AND HEAVY CONSTRUCTION

Proceedings include 27 papers that cover various aspects of subsurface exploration for tunneling, highways, dams, and other heavy construction. Following is a list of titles and authors of the paper presented: Engineering Measurements. By Eugene L. Foster, State of Practice-Subsurface Investigation for Highway Tunnels. By David S. Gedney. Important Ground Parameters in Soft Ground Tunneling. By Ronald E. Hewer. Underground Excavation: Geologic Problems and Exploration Methods. By Andrew H. Merritt. Exploration and Geologic Prediction for Underground Works. By Lloyd B. Underwood. Exploration for Soft Ground Tunnels-A New Approach. By Birger Schmidt. Subsurface Investigation System Planning for Highway Tunnels. By James L. Ash, Bruce E. Russell and Robert R. Rommel. Recommended Borehole Investigation System for Soft Ground. By Stephen Alsop. Engineering Applications of Electrical Geophysical Methods. By George V. Keller. New Applications of Seismic Investigations of Engineering Problems. By Phillip Roming. Acoustic Techniques Suitable for Use in Soil. By D.L. Hipkins and L.A. Whitney. Acoustical Holography as a Tool for Geologic Prediction. By Ted O. Price. Status of Ground-Probing Radar and Some Recent Experience. By John C. Cook. Subsurface Video Pulse Radars. By David L. Moffatt. Continuous Subsurface Profiling by Impulse Radar. By Rexford M. Morey. Overview of Horizontal Borehole Geophysical Techniques (Applicable in Subsurface Exploration for Underground Excavation and Heavy Construction). By Llewellyn A. Rubin. Recent Developments in Earthwork Instrumentation. By Raymond A. Forsyth and Kenneth Jackura. Measurement of In-Situ Stress in Soils. By Peter J. Huck and Madan M. Singh. Development of a Special Instrument for the In-Situ Measurement of the Strength and Stiffness of Soils. By B. Peter Wroth and John M.O. Hughes. Self-Boring Placement Method of Soil Characteristics Measurement. By Francois Baguelin, Jean Francois Jezequel and Alan Le Mehaute. Minor Principal Stress Measurements in Marine Clay with Hydraulic Fracture Tests. By Michael Bozozuk. Indirect Determination of In-Situ Stress Ratios in Particulate Materials. By Geoffrey E. Blight. Benefits of Tunnel Measurements. By Larry H. Heflin. Identification of R&D Needs for Subsurface Explorations in the Coal Mining Industry. By Alphonse of Earth Dam Foundations. By John P. Bara. Subsurface Explorations in the Coal Mining Industry. By Alphonse C. Van Besien. What's Ahead in Subsurface Exploration. By Madan M. Singh.

Subsurf Explor for Underground Excavation and Heavy Constr, Spec Conf, Proc, Pap, New Engl Coll, Henniker, NH, 11-16 August 1974.

American Society of Civil Engineers 1974, 404 pp

ACKNOWLEDGMENT: EI
PURCHASE FROM: ASCE Repr. PC

2A 126194
GROUND WATER AND URBAN PLANNING. REPORT FROM STEGA 1966-73 [Grundvatten och Byggande. Stegas Arbete 1966-73]
Knowledge of groundwater conditions is essential in designing building structures, particularly when foundations are complex and at great depth. Drops in the water table can lead to serious damage to ground and buildings. This project comprised questionnaire surveys, groundwater measurements in reference areas, damage due to settlement near Stockholm, measurements of water table and settlements in new development areas, groundwater problems near tunnels and deep excavations, a computer model for groundwater, a land cost index, effect of groundwater on vegetation, and bacterial decomposition of foundation timber. In a Stockholm suburb, serious settlements occurred in an area built on postglacial clay; piles buckled and there was corrosion. In another Stockholm area, settlement damage is so extensive that repair costs amount to 50% of property value. Several tunnelling projects are in progress in this area. Water table conditions before and after construction were studied in two model areas. Some tunnelling and deep excavation projects were investigated. A drop in water table can affect vegetation; timber piles which had always been below the water table suffer bacterial decomposition. The group compiled building geological maps comprising geological and geotechnical data and also

foundation and land costs index maps based on these. /TRRL/ [Swedish]

Lindskoug, NE Nillson, LY
National Swedish Institute for Building Research R&D Rept. R20:1974,
1974, 164 pp, Figs., 18 Tab., Photos.

ACKNOWLEDGMENT: Transport and Road Research Laboratory
(IRRD-213447)

PURCHASE FROM: National Swedish Institute for Building Research Valhal-
lavagen 191, Stockholm, Sweden Repr. PC

2A 126287

INTERIM SPECIFICATIONS AND METHODS ADOPTED BY THE AASHTO SUBCOMMITTEE ON MATERIAL 1975

Revisions and additions to Part I (specifications) and Part II (test methods) of the Eleventh Edition of Transportation Methods are presented. The interim specifications include revisions to such subjects as oil asphalt filter, zinc coated corrugated iron or steel culverts and underdrains, welded steel wire fabric for concrete reinforcement, cut-back asphalt, portland cement and steel forgings, and carbon and alloy for general industrial use. Mild-to-medium strength carbon-steel castings; copper sheet, strip, plate and rolled bar; and requirements for delivery of rolled steel plates, shapes, sheet piling and bars for structural use are the subject of other interims. Revisions are also proposed for M 168-751; M 169-751; M 177-751; M 181-751; M 196-751; M 198-751; and M 205-751. Other revisions relate to columbium-vanadium steels; epoxy adhesives; reinforced concrete culvert, storm drain, and sewer pipe; field applied coating; precoated galvanized steel; thermoplastic traffic line. Interims are issued for plastic drainage pipe or tubing; alloy steel bolts; and dowel bars. The interim methods revisions relate to sieve analysis of mineral filler; solubility of bituminous materials and organic solvents; flash and fine points; softening point of asphalt and tar in ethylene glycol; and organic impurities in fine aggregate. Replacements are proposed for T 78-74; T 89-68; T 196-74; T 201-74; T 228-68; The liquid limit of soils, aggregate resistance to abrasion, specific gravity of soils, extraction of bitumen, air-entraining additions to portland cement, and the air content of freshly mixed concrete are the subject of further revisions. Revisions are also proposed of articles covering the viscosity of asphalts, thin-walled tube sampling of soils, diamond core drilling, specific gravity of semi-solid bituminous materials, skid resistance, lock seam corrugated pipe, hollow stem auger borings, soil bore pressure, and testing coated dowel bars.

American Assn of State Hwy and Transp Officials 1975, 113 pp, Figs.,
Tabs.

2A 126291

CONCRETE PRACTICE

This publication which provides guidance to those concerned with construction and day-to-day supervision of concrete work, deals with materials, mixes, properties of concrete, site production, reinforcement, prestressing, formwork, curing, finishing, testing and accuracy of construction. A list of relevant British Standards, Codes of Practice and other publications are also included. The typical properties required by, or inherent in concreting materials (cements, aggregates, water, and admixtures) are outlined. The specifications, workability, strength, grades, permitted margins, and design of concrete mixes are detailed. Prescribed/standard mixes, nominal mixes, effect of mix constituents, batching and trial mixes are reviewed. The strength, deformation and durability (permeability, frost resistance and resistance to chemical attack) of concrete are considered, and the series of operations which must be performed on the raw materials in order to turn them into the finished product are discussed. These operations include access, storing materials, batching, mixing, transport, placing, and compacting. Construction joints and concreting in cold and hot weather are also discussed. The details are outlined of prestressed concrete, formwork, curing, finishing and testing of concrete and concreting materials. Comments are made on sources of inaccuracies, the setting out measuring operation, the accurate adjustment of precast components and the dependence on formwork of the accuracy of in-situ construction.

Barnbrook, G Dore, E Jeffery, AH Keen, R Parkinson,
JD Sawtell, DL Shacklock, BW Spratt, BH
Cement and Concrete Association May 1975, 63 pp, 34 Fig., 21 Tab.,
Refs.

ACKNOWLEDGMENT:

PURCHASE FROM: Cement and Concrete Association 52 Grosvenor Gar-
dens, London SW1W 0AQ, England Repr. PC

2A 126292

REPORT ON EMISSIONS FROM ASPHALT HOT MIXES

A comprehensive analysis was performed of 8 sets of samples of emissions originating from petroleum asphalt during the hot-mix process for preparation of asphalt. Samples were collected on 4 days at two locations involving four asphalt cements of varying characteristics from three refineries. All gaseous substances, vapors and particulates associated with asphalt including hydrocarbons, carbon monoxide, nitrogen dioxide, volatile sulphur compounds, ozone, aldehydes, phenols, metals and polynuclear aromatics were identified using recognized sampling techniques and analytical procedures. The results of these analyses indicate that no significant air pollution or employee health problems can be expected or associated with these emissions. The gaseous substances and particulates were at extremely low concentrations, and were well within the current OSHA standards for workroom conditions. Despite the exaggerated sampling conditions, the asphalt emissions compare favorably with national air quality standards promulgated by EPA. Test data indicate no significant difference in the amount or composition of emissions from asphalt from different sources or used in different hot mix plants. The results suggest that the TLV limit for asphalt (petroleum) fumes is too limiting and not accurately defined. The results also indicate that health hazards will not result from polynuclear aromatics in emissions from hot-asphalt paving mixes. Substantial difference is noted between petroleum asphalt and coal tar, and it is suggested that these two materials be not placed in the same category by regulatory agencies.

Presented at the Division of Petroleum Chemistry, Inc. American
Chemical Society, Chicago, Illinois Mtg., August 1975.

Puzinauskas, VP Corbett, LW (Exxon Research and Engineering
Company)

Asphalt Institute May 1975, 20 pp, 7 Fig., 8 Tab., 12 Ref.

2A 126833

JOINT EFFORT TO IMPLEMENT RESTRICTED PERFORMANCE SPECIFICATIONS IN PENNSYLVANIA

One of the key elements in the Pennsylvania Department of Transportation program for the implementation of statistically based restricted performance specifications for highway construction material is concerned with the necessary education of department and industry personnel. This paper discusses the experiences of Pennsylvania Department of Transportation and Pennsylvania State University in the past 2 years in their joint effort to provide the first phase of the training required. The background information for the series of training courses and for the development of a quality-control manual, the guidelines that were set up for the courses, and the objectives of each course session are discussed. The experiences and insight gained as a result of the first 5 courses in the series are discussed by relating some of the observations that participants made about the course itself and also about the proposed program of implementation that Pennsylvania Department of Transportation will follow. The objective of the paper is to share these experiences with other state departments of transportation that are at similar stages in the implementation of these types of specifications.

Willenbrock, JH (Pennsylvania State University, University Park) *Trans-
portation Research Record* No. 529, 1975, pp 60-74, 2 Ref.

PURCHASE FROM: TRB Publications Off Orig. PC

2A 127336

QUALITY CONTROL OF BITUMINOUS PAVING FROM THE BEGINNING

The origin of modern controls and the resulting variability was studied in an effort to develop a better understanding of control systems. Practices with sheet asphalt in 1900 are mentioned and pavements built under patents issued to F.J. Warren are described; these include Bitulithic, Warrenite, Warrenite-Bitulithic, Topeka, and Black Bass. The quality control system used by Warren Brothers (illustrated by typical Bitulithic specification) controlled aggregate gradation, bitumen content, mixing coating, workability, overheating and compaction. Important requirements in which federal specifications differ from Warren specifications include the following: master ranges for aggregate gradation and asphalt content; job mix formula and tolerances, including mix temperature delivered to the job; temperature controls of bitumen aggregate, mixing, and mix at the plant; weather and limitations, detailed plant requirements; machine laydown; detailed roller and rolling requirements; and smoothness requirement. Variability by design is considered and variability in construction is discussed. Patented

pavement, gradation and bitumen content, gradation, asphalt content and density of modern pavements are detailed. The limitation of variability is discussed. It is urged that controls should distinguish between satisfactory and unsatisfactory pavements. Satisfactory control can be maintained without excluding good construction and unnecessarily increasing costs. Controls should be tailored to accommodate the characteristics of different mixtures, the requirements of the pavement, and the conditions encountered in construction. Either the conventional process control system or the newer end result specifications can be made to function satisfactorily for modern construction.

Proceedings of the meeting held in Houston, Texas, February 1973.

Tunnick, DG (Warren Brothers Company) *Association of Asphalt Paving Technologists Proc* Vol. 42 1973, pp 440-481, 18 Fig., 5 Tab., 25 Ref.

2A 127337

ACTUAL APPLICATION OF END RESULT SPECIFICATIONS AND THE ROLE OF COMMERCIAL TESTING LABORATORIES IN APPLYING THEM

This report explains what an end result specification may consist of; how it can be applied; and what role commercial testing laboratories can play in applying it. The end result specification as applied on asphaltic concrete mixtures in Louisiana is outlined, and the duties and responsibilities of technicians is discussed. Sixteen projects were evaluated in the study of the effects of end result specifications. It was found that the standard deviation for the percentage of pay per project as based on 100 percent of contract unit price was 1.99 percent at a 95 percent confidence level. This indicates the contractor should receive at least 95 percent pay at least 95 percent of the time. The total tons of mix evaluated was 544,348 of which 7,223 tons of mix or 1.3 percent resulted in the contract unit price. Approximately 30,211 tons of mix or 5.5 percent resulted in the contractor receiving 95 percent of the contract unit price. There were no penalties at 50 percent or remove. There was total of 724 lots involved in all of the projects, of which 64 lots resulted in penalties. Approximately 93.7 percent of the failing lots were due to deficiencies in roadway density and only 6.3 percent due to deficiencies in Marshall Stability. End result specifications appear to be a satisfactory and workable means of defining the responsibilities of all the persons involved, as well as, ensuring a quality end product on asphaltic concrete projects.

Proceedings of the meeting held in Houston, Texas, February 1973.

Arena, PH, Jr (Delta Testing and Inspection, Incorporated) *Association of Asphalt Paving Technologists Proc* Vol. 42 1973, pp 482-498, 2 Fig., 3 Tab., 2 App.

2A 127474

DOUBLE-TUBE TREMIE USES AMBIENT WATER TO PROTECT MIX

The tremie system described here used a clip valve and surrounding water to empty the tremie tube and keep it dry-between discharges. The double tremie system consists of an outer pipe with slits along its walls that permit water to flood the systems annular space between tubes, and an inner plastic tube of textured 2-mm-thick PVC, reinforced with nylon fiber to increase the tube's strength and life. The equipment is designed for placing concrete underwater over a wide area by repeated resetting of a small number of pipes without endangering the quality of the finished concrete. As falling concrete inflates the plastic tube, a dip valve in its bottom end opens to discharge mix. When concrete stops falling, water entering the outer pipe through the slits squeezes remaining concrete from the inner tube. The bottom valve immediately seals the tube after final mix is discharged. With the tube squeezed flat and the valve closed, the tremie system can be repositioned for continued concreting, without fear of introducing water that might dilute or segregate the mix. Details are outlined of the successful placing of 33,000 yd. of concrete underwater for a dry-dock flooring using the double-tube method. Three double-tube tremies mounted on a 90-ft-long, 40-ft-wide raft assembled from plugged steel pipes handled the concreting. Nine men handled the tremie pipes; six others attended pumps and slicklines, and each 740-yd load was placed in a 10-hr shift.

Cryogenics Vol. 57 No. 9, Sept. 1975, pp 54-55, 4 Fig.

2A 127501

STANDARDISED FLEXIBLE PAVEMENT DESIGN FOR RURAL ROADS WITH LIGHT TO MEDIUM TRAFFIC

An empirical approach to pavement design is presented together with introductory notes on the standard specifications of the Rhodesian Ministry

of Roads and Road Traffic. Definitions are presented and aspects such as design economics, essential geology, expansive soils, collapsing soils and drainage are covered. The specifications also cover soil grouping classification for design purposes, compaction, climate, design traffic, and construction materials. Other aspects included in the specifications are: termite workings and rock bars, and barriers; surfacings; urban roads; use of symbols for roadbed and subgrade preparation; and design cuts and fills. The preparation of the roadbed and subgrade and the pavement design of minor rural roads with single land surfacing and major rural road with at least 2 bituminous traffic lanes are detailed Tables and figures are presented and design examples are described.

Mitchell, RL Vander Merwe, CP Geel, HK
Ministry of Roads and Road Traffic, Rhodesia SR 1, June 1975, 70 pp, 11 Fig., 3 Tab., Photos., Refs.

PURCHASE FROM: Ministry of Roads and Road Traffic, Rhodesia Coghlan Building, Fourth Street, Salisbury, Rhodesia Orig. PC

2A 127502

WRAPPING IT UP WITH NYLON FABRIC FORMS

Techniques with nylon fabric forms are described which are adaptable to erosion control, underwater concreting, encasing piles, lining tunnels, producing drains and other uses. These nylon forms are flexible containers that can be filled by pressure injection with fluid fine-aggregate concrete. They permit controlled bleeding of mix water through the fabric, which reduces the water cement ratio. This causes rapid stiffening, produces high strength, and provides exceptional durability. The double-wall fabric comes in two designs: a quilted type capable of relieving hydrostatic pressure, and another type with a uniform cross-section for use where the primary objective is impermeability and a low coefficient of hydraulic friction.

Concrete Construction Vol. 20 No. 9, Sept. 1975, pp 389-390, 9 Fig.

2A 127514

UNSURFACED EARTH AND GRAVEL ROADS REFERENCES

Three hundred and ninety references are presented here which are drawn from the period of the late forties to the present (1975). The references cover the field of unsurfaced earth and gravel roads, and highway maintenance. The construction and maintenance of dirt roads, soil aggregate roads, forest roads, dustproofing, water proofing, oiled gravel roads, and chemical stabilization of roads are some of the subjects covered. References are provided on low-cost roads, asphalt pavements, engineering materials, soil movements, the use of shale and various aspects of materials engineering. Among many other topics information is also provided on predictive models for vehicle operating, road capability studies, the influence of geology on forest road construction, insulation, mountain roads, and rural road administration.

Forest Service 1975, 30 pp, 390 Ref.

2A 127527

PAVEMENT DESIGN AND THE DECISION-MAKING PROCESS

The history of pavement design is briefly reviewed, and development in and future prospects for utilizing systems engineering in the decision-making process is discussed. Pavement design has evolved from the use of standard sections of different categories of soil, climate, and traffic conditions to that of empirical relationships between structural designs, materials, traffic, climate, and subgrade conditions based on test programs such as the AASHO Road test. Recently, interest has been expressed in the concept of total cost analysis. A Systems Analysis Model for Pavements (SAMP5) is one approach to considering initial construction, operation, and user costs in the decision making process. The SAMP6 program (an improvement of SAMP5) requires 12 classes of variables: program control and miscellaneous; environmental (2) and serviceability (3) traffic and reliability (2); constraint; traffic delay; maintenance; cross-section, cost model and shoulder; tack coat, prime coat, bituminous materials; wearing surface, overlay, pavement material; and shoulder layer material. The SAMP6 program operation normally considers between 1,000 and 2,000 different trial designs. The output of the SAMP6 is provided in 3 parts: summary of input data; summary of the best design strategy for each material and larger combination; and the best design strategy in order of increasing total cost per square yard of traffic lane. Illustrations of the application of SAMP6 include a comparative study of the economics of staged construction and planned rehabilitation versus the "no-overlay" or strong initial construction ap-

proach, and a study of the effect of fluctuating material costs on optimum design. The operational SAMP6 program provides decision-makers with the capability of comprehensively selecting optimum strategies and updating decisions as conditions change.

Proceedings from a conference on Utilization of Graded Aggregate Base Materials in Flexible Pavements, March 25-26, 1974, Oak Brook Hyatt House, Oak Brook, Illinois.

Smith, HA
National Crushed Stone Association, National Sand and Gravel Association, National Slag Association 1974, pp II 1-12, 1 Fig.

2A 127532 IMPORTANCE OF ACTUAL BEHAVIOR IN SHAPING DESIGN CRITERIA

This paper which describes the Corps of Engineers continuing program of pavement condition evaluation, stresses the need to examine the performance of full scale pavements to verify design criteria, and lists 14 modifications to the the Corps' CBR design system. The elements of behavior or design are discussed and include the analytical model which describes the manner in which the parameters controlling desing interact; the constitutive behavior which relates the stress, strain or equivalent behavior of the individual elements or materials of which the pavement is constructed; and the terminal condition description considered to represent failure. The CBR test was adapted as a means of assessing the strength of materials in flexible pavements. To provide the comparisons between full scale pavements under traffic with expected behavior as predicted by the design method, the Corps of Engineers undertook two efforts. The first which gives immediate comparisons, in the full scale accelerated traffic tests, many of which have been conducted to establish or extend the CBR design methods. A survey program was undertaken to provide information on the behavior of pavements in serving their intended purpose. Actual pavement characteristics in relation to design considerations (layer thickness, characteristics of materials, strength, bituminous surfacings and stabilized layers, subgrade strength) traffic loading, special contributing factors (such as construction deviations, swelling soil, etc.), and the observable pavement condition should be studied and compared with prior examinations in an attempt to determine at what point in its overall life the pavement is at the time of examination. Based on the data, a design can be projected using existing pavement characteristics, and this will indicate an expected part of the total pavement life to be used.

Proceedings from a conference on Utilization of Graded Aggregate Base Materials in Flexible Pavements, March 25-26, 1974, Oak Brook Hyatt House, Oak Brook, Illinois.

Ahliwan, RG (Waterways Experiment Station)
National Crushed Stone Association, National Sand and Gravel Association, National Slag Association 1974, pp VIII-9, 11 Ref.

2A 127535 PANEL DISCUSSION ON PERFORMANCE OF PAVEMENT WITH GRADED AGGREGATE BASES

Experiences in four states which make extensive use of graded aggregates for all classes of highways are discussed, and case histories of specific project are described by the representatives from Maryland and North Carolina. Virginia's ongoing program of evaluation of typical pavements and the installation of a number of experimental sections on heavily travelled segments of primary highway are detailed, and the development and successful use of graded aggregate, which has generally composed two thirds or more of the total depth of flexible pavement structures in Kentucky is reviewed. The Kentucky system (in which the top 1/3 is asphaltic concrete) is producing very good riding quality properties and a substantial base system. The initial roughness values are taken for each of the major sections of roadway, and roughly annual evaluations after that. Flexibility and variety are highlighted in North Carolina where untreated aggregate bases, treated full-depth bases and concrete bases are utilized. In Maryland, where the performance of graded aggregate bases had been satisfactory, the design procedure reflects two factors involving traffic loads, subgrade support, regional climatic conditions and material availability. In Virginia, considerable use is made of the controlled strip method for checking density, particularly in stone bases. Comments are made on the use of 10 to 15 percent minus 200 mesh material, and experience with performance surveys. The performance survey covered the following items: traffic and the variation in traffic; structural capability; roughness and visual defects (weighted heavier than others).

Proceedings from a conference on Utilization of Graded Aggregate Base Materials in Flexible Pavements, March 25-26, 1974, Oak Brook Hyatt House, Oak Brook, Illinois.

Drake, WB Berrier, LH Greene, WB Fielding, RV
National Crushed Stone Association, National Sand and Gravel Association, National Slag Association 1974, X-1-XIII-4, 7 Fig.

2A 127536 PRODUCTION CONTROL SYSTEMS IN THE AGGREGATE INDUSTRIES

The point is made that different plants make their subbase differently according to plant flow design, gradation requirements of the using agencies, quantities etc. In the southern states, bases and/or subbases are pugmilled. Pugmilling results from a combination of coarse and fine aggregate gradations which may or may not conform to standard aggregate sizes. In a recent Georgia project, 3 sizes of aggregate were blended utilizing a 3/4" aggregate, 1 1/2" crusher run and screenings. In West Virginia, 3/4" stone and = 1/2" screenings were found to be unsuitable and the screenings were split on a 4 1/2 mesh screen; this gave better control at the pugmill. In New York state, all subbase and/or base material is produced through the aggregate plant and the resulting gradation is that which is eventually shipped to a construction site. The New York subbase specification permits a graded aggregate having a top size which is suitable for the construction of the project. The aggregate producer determines what top size is needed, develops a gradation band for that material, and then is held to a tolerance band on this material. The material can be no more than 1 1/4 inch or less than 3/4 inch where the subbase material is crusher run stone at a job site. For pit run blended or processed materials other than crushed run stone, the top size is based on the type of work to be performed and how the material is to be used. The point is made that in some states graded aggregate is used only as subbase, beneath bases that are stabilized with asphalt or other additives; in such cases, gradation control is not required to be as close as where the materials are designed to serve as a heavy duty base course. Subbase material is distinguished from quality controlled base materials as described in ASTM Specification D 2940.

Proceedings from a conference on Utilization of Graded Aggregate Base Materials in Flexible Pavements, March 25-26, 1974, Oak Brook Hyatt House, Oak Brook, Illinois.

Martin, JP (General Crushed Stone Company)
National Crushed Stone Association, National Sand and Gravel Association, National Slag Association 1974, pp XIV-1-10, 1 Fig.

2A 127664 SURFACE TREATMENT TIPS

In an effort to highlight essential factors vital to achieving consistent quality results, and to aid those engaged in surface treatment construction, information is presented which, although applicable to all types of surface treatment, is primarily concerned with those treatments that consist of a sprayed application of asphalt covered with a layer of aggregate of as uniform a size as practicable. Important aspects of equipment, materials, job planning, the surface treatment operation, and multiple surface treatments are noted. The distributor should be equipped with a calibrated dipstick marked in gal. per inch (litre/cm) of length, to check the quantity of asphalt in each load, and the amount used for each application. The distributor should also be equipped with an accurate thermometer so that temperature of the asphalt can be determined at the time of application. Common problems associated with the asphalt distributor are described and solutions are suggested. The aggregate spreader and rollers are also described. Characteristics of asphalt required for good surfaces are noted, and recommendations with respect to the grades of asphalt to be used and the application rates for asphalt and aggregate under various conditions are noted. Comments are made regarding pre-job planning and work schedule. The preparation of the surface, spraying the asphalt, spreading the aggregate and rolling are the surface treatment operations detailed here. The success of multiple surface treatments depends upon the nesting of particles, and the distribution of the asphalt through the mass. Helpful tips are given.

Asphalt Institute CL-14, Sept. 1975, 5 pp, 2 Tab.

2A 127666

MATERIALS OPTIONS WITH RESPECT TO ENERGY RELATED SHORTAGES

The energy shortage has forced assessment of alternative highway material sources such as coal tars, non-petroleum based materials, resins, and recycled substances. The use of emulsions, of sulfur as a binder, more insitu stabilization and binders from wood resins is also investigated.

Halstead, WJ *American Highway & Transportation Magazine* Vol. 54 No. 3, July 1975, pp 18-19

2A 127758

DAMAGE DUE TO VIBRATION [Skadlig Inverkan av Vibrationer]

The report contains six lectures held at a symposium arranged by the Swedish Geotechnical Institute. The items are: 1. Ground vibrations and their harmful effects- influence of vibratory compaction equipment. 2. Ground vibrations generated by trains-their influence on buildings and people. 3. Road traffic-induced vibrations. 4. Safe rock blasting. 5. Vibrations-damage and responsibility. 6. Relation between traffic-generated vibrations, their frequencies, particle motion displacements, velocities and vehicle speeds. See IRRD Abstracts Nos. 214778 to 214782 for summaries. /TRRL/ [Swedish/English]

Swedish Geotechnical Institute Conf Paper No. 56, 1974, 95 pp, Figs., 5 Tab., 14 Phot., Refs.

ACKNOWLEDGMENT: National Swedish Road & Traffic Research Institute, 7

PURCHASE FROM: Swedish Geotechnical Institute Banergatan 16, S-115-26 Stockholm, Sweden Repr. PC

2A 127800

THE SUSPENSION BRIDGE-ITS HISTORY AND DEVELOPMENT

This paper traces the history and development of the suspension bridge, by chronological examples, from primitive beginnings to the present day. Brief details are given of structures which represented major advances in the technique of suspension bridge design and construction, or in the adoption of new materials. The author states, that with present technology, and when justified economically, spans of 2000M or more could be considered today. Notes are given describing erection methods used for various phases of the construction of recent bridges. These include tower erection and the design of temporary footbridges for the construction of the main cables, details of anchorages and main cable saddles, the spinning of main cables, the design of the suspended deck and roadway surfacing. The effect of different bridge designs on the erection methods are emphasized. /TRRL/

Knox, HSG *Society of Engineers, Journal of* Vol. 65 No. 1, 1974, pp 55-71, 4 Fig.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 214347)

2A 127899

STEPPING OUT ACROSS SIBERIA

This article draws attention to the special problems of construction in arctic conditions, particularly the problem of summer thawing of the permafrost which leads to ground heave and displaces piled foundations. An outline is presented of the method used to form structural foundations for the railway which was begun in December 1974. A deep hole is drilled into the ground, a prefabricated ferro-concrete pile is lowered into it, and concrete is poured into the narrow free space remaining inbetween. The concrete forms a strong bond between the pile and the surrounding, still-frozen soil. However, larger structures require far more extensive foundation works with subsequent subsidence problems if undertaken during the summer season. Mention is made of the use of refrigeration piles, and of the hydraulic method of transport of the ballast required for the project. /TRRL/

Contract Journal Vol. 266 No. 5008, Aug. 1975, pp 22-23, 2 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 215164)

PURCHASE FROM: IPC Building and Contract Journals, Limited 32 Southwark Bridge, London SE1, England Repr. PC

2A 127903

DUBAI BUILDS A MAJOR DESERT HIGHWAY

This article describes the construction of a 9 M wide transpeninsular highway beginning in Dubai, and eventually linking with Shinas. Details are given of the Dubai drydock facility being built by the Costain-Taylor Woodrow joint venture, which requires 2.4M M3 of rock for the breakwaters and 1.2M tons of aggregate for concrete; the aggregates are brought in from quarriers. A new road is being constructed between these quarriers are part of the drydock contract. The first section of the road goes through sand and desert, and the second through gravel plains and foothills of the mountains. The first section requires a subbase the second does not. A hard surface is now completed all the way to Hatta, and the 150,000 M3 of subbase was obtained from 5 borrow pits along the route. Flood water courses are traversed by 18 Irish bridges and 9 culverts. Mention is made of the shortage of water and the difficulty of finding labour due to the existice conditions. /TRRL/

Walford, D *Highways and Road Construction* Vol. 43 No. 1786, June 1975, p 21, 2 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 214491)

2A 127926

IMMERSED-TUBE TUNNELS

This article gives a general account of the use of immersed tube tunnels with particular reference to the Hong-Kong cross harbour tunnel designed by British engineers and the proposed Tees tunnel which is likely to be the first of its developed in the USA does not closely match the envelope this type of tunnel and the conditions under which it can be constructed. The two alternative types, steel shell and the European developed concrete box, are discussed. The former developed in the usa, does not closely match the envelope required by traffic and hence has to be located at a greater depth. However if ventilation is required the segmental spaces can be used for this purpose. Steel shell construction is also favoured by a combination of low material costs combined with high labour costs. The Hong Kong bridge is of the steel shell type, is 1536 metres long and has four lanes. The tube comprised two steel shells linked by diaphragms and keel concrete, later filled with tremie concrete. The units, weighing about 6,000 tons, varied in length from 99 to 113 metres. They were placed by an all purpose screed and lay barge using laser beam for alignment. The proposed Tee's tunnel is of rectangular concrete box construction, 915 metres long and with four lanes. It will normally be self ventilating, but fans can be used under exceptional traffic conditions. The article outlines the proposed method of construction which involves manufacture of the units on a casting bed and their subsequent placement by means of a lowering dock. /TRRL/

Culverwell, DR (Freeman Fox and Partners) *Consulting Engineer* Vol. 39 No. 4, Apr. 1975, pp 47-53, 3 Fig., 4 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 214484)

2A 127929

FIELD SUPERVISORS&DUTIES AND RESPONSIBILITIES. VOLUME 1, CONTRACT ROADWORKS

This publication which is intended to help those responsible for the supervision of roadworks carried out by contract, covers general aspects, details of sampling, testing and site tests, and provides an inspection guide. The general aspects briefly reviewed here include public relations, documents and records, preliminary works, order of work, materials, emergencies, contract payments and cleaning up. Abbreviated instructions(must be supplemented by instructions from the engineer) are set forth for sampling materials encountered in roadworks. These materials include soils and pavement materials, tars and bituminous materials, precast concrete drainage structures, concrete constituents, concrete mix, paint, and the dispatch of samples. Aggregate tests and concrete tests are detailed and matters for inspection are listed. The latter include provision for traffic, protection of the public and property, safe construction practices, access to and security of abutting properties, public utilities, setting out, earthworks, drainage, pavements, surfacing, roadside furniture, and closing of works.

Svenska Vagforeningen May 1975, 24pp, 1 Fig., 1 Tab., 2 App

2A 127958

FLYASH PAVEMENTS, RUNWAYS TO TAKE OFF?

Considerations of energy, ecology and economics have prompted an examination of available technology for the use of flyash as a paving component. The economics of useage, however, varies and flyash use must be custom-engineered. Two example projects are described: the airport project at Newark, New Jersey, and the Port of Portland project. At Newark flyash was used as both aggregate and cementitious components. Costs for the flyash and lime were about half that of cement. Only half the manpower required with conventional methods was needed on this project. At the Port of Portland, flyash was not cheap and pozzolan (volcanic ash) was used. A brochure on the state-of-the-art and a user manual on the use of flyash is being prepared by the Federal Highway Administration. It is emphasized that the properties of flyash must be clearly understood in order that cost savings may be effected.

Fairweather, V *ASCE Civil Engineering* Vol. 45 No. 8, Aug. 1975, pp 57-58

2A 127960

BRIDGE DECKS

This is the second of two articles on short span bridges. The first, in the July issue, described cost-cutting ideas in design. This article focuses on bridge decks: expansion joints, open steel grid decking, timber decks, the Iowa Method of deck construction (a very low permeability concrete overlay), waterproof membranes, plastic and wax sealing of deck concrete, and various approaches to protecting the rebars from corrosion-galvanizing, epoxy coating, stainless cladding, etc. /ASCE/

Godfrey, K.A., Jr *ASCE Civil Engineering* Vol. 45 No. 8, Aug. 1975, pp 60-65, 2 Fig., 1 Tab., 10 Phot.

2A 127962

PLASTIC PIPES, PROS AND CONS

A comprehensive examination has been undertaken of the criteria for thermoplastic piping for residential plumbing systems. Four thermoplastics that are widely used for residential plumbing are: acrylonitrile-butadiene-styrene (ABS) and polyvinyl chloride (PVC) for drain, waste, and vent systems; chlorinated PVC for hot-and cold-water distribution systems; and polyethylene (PE) for underground water service piping. These corrosion-resistant, lightweight piping have some potential disadvantages, the most serious of which is the potential it offers for spread of fire, smoke, and toxic gases in a burning building. Five endurance tests have been performed and it is concluded that drain-waste-vent piping systems with lateral penetration sizes of 5 centimeter diameter or less should meet the 1-hour fire resistance test in wood-stud-and-gypsum-board walls provided the hole around the piping where it penetrates the wall is sealed and the studspace is of sufficient depth so the piping hubs do not penetrate the walls. Provided certain precautions are taken, plastic piping for residential plumbing can be an effective substitute for metallic piping in selected wall and chase construction.

Dimensions NBS Vol. 59 No. 9, Sept. 1975, 3 pp, 1 Fig., 6 Ref.

2A 127993

PROPERTY SPECIFICATIONS OF ROCK AS BUILDING MATERIAL [Varudeklaration av Byggnadsmaterialet Berg]

With the increased number of underground construction projects as a background, the author points out the need for acquiring improved knowledge of the properties of rock before design work begins. General characteristics of igneous, metamorphic and sedimentary rocks are briefly described. It is not enough to classify the technical properties of the mineral components of the various types of rock. To give a complete picture of the rock masses it is necessary to describe their imperfections due to external processes, mainly disintegration, cracking and crushing. /TRRL/ [Swedish]

Morfeldt, CO *Vag-Och Vattenbyggaren* No. 8-9, 1974, pp 19-22, 2 Fig., 4 Phot.

ACKNOWLEDGMENT: National Swedish Road & Traffic Research Institute, Transport and Road Research Laboratory (IRRD-214774)

PURCHASE FROM: National Swedish Road & Traffic Research Institute Fack, S-581 01 Linköping, Sweden Repr. PC

2A 128166

USE OF THE FLY-ASH FROM THE THERMO ELECTRIC POWER STATION IN KOSOVO FOR THE STABILIZATION OF SOIL IN ROAD CONSTRUCTION [Leteci Pepee Termoelektrane Kosovo u Izradi Kolovoznih Podloga Kompleksnom Stabilizacijom Tla]

This report outlines the use of fly-ash as a binder when lime is added to it. This binder added to clayey soil ensures satisfactory stability of roadbases. /TRRL/ [Jugoslav]

Braunovic, P Tomas-Popovic, A (INST PUTEVE BEOGRAD) Institut Za Puteve R&D Rept. Apr. 1973, pp 7-14, Figs., Tabs., Refs.

ACKNOWLEDGMENT: Central and Regional Labs of Bridges & Highways, Fr, Transport and Road Research Laboratory (IRRD-101191)

2A 128302

EXPERIENCES WITH AND CONSTRUCTION OF LIGHT-WEIGHT AGGREGATE CONCRETE STRUCTURES IN THE NETHERLANDS [Expériences et réalisations de structures en betons de granulats légers aux pays-bas]

The study days organized by the Association Francaise du Boeton (French concrete association), 15 and 16th November 1972, the following papers were presented. Influence of the strain/stress chart of lightweight concrete on the behaviour of structures; observations on the cost of lightweight concrete; lightweight concrete; techniques of laying structural lightweight concrete in the Netherlands; use of lightweight structural concrete in the construction of buildings; use of lightweight structural concrete in the construction of bridges in the Netherlands. /TRRL/ [French]

Annales de l'Institut Tech du Batiment Travaux Pub No. 311, Nov. 1973, pp 109-176, Figs., Tabs., Phots., Refs.

ACKNOWLEDGMENT: Central and Regional Labs of Bridges & Highways, Fr, Transport and Road Research Laboratory (IRRD 101457)

2A 128562

RECYCLED MATERIALS REJUVENATE RURAL ROAD

In an effort to rejuvenate county roads at low cost, a rural road has been ripped up, its 2700 tons of asphalt materials crushed and reprocessed and then used to repave within the existing right-of-way. The \$98,000 experimental work to repave the 1-mile segment consisted of 3 stages. In the first stage, the 22-ft wide surface was ripped, crushed in place, the asphaltic material was windrowed and then hauled 12 miles to the asphalt plant where they were stockpiled. A Cat 14 grader with rippers and a Cat DW 20 equipped with Hyster compactor wheels were used. The second stage consisted of subbase preparation using materials already in place in right-of-way. The 4-in. thick calcium chloride treated base was ripped and windrowed and pushed to each side. In this way, elevation was reduced about a foot as the width of the road was increased. Foreslopes were changed from between 1-1/2:1 and 1:1 to 3:1. When completed the new pavement will be 22 ft wide with 6-ft shoulders on each side. The base materials consisted of 25 percent clay and 75 percent gravel, and had once been treated with calcium chloride. The third stage included processing the recycled materials through a drum mixer at a conventional hotmix plant. It was found necessary to add virgin asphalt. The experimental mile was divided into 4 test sections: 1/2 mile had an additional 2-1/2 percent new asphalt; next quarter mile had 3-1/2 percent added; next eight mile had 4-1/2 percent; and the last eight had 4-1/2 percent with 30 percent of minus 3/4 inch limestone. Further details and plans for the future are outlined.

Roads and Streets Vol. 118 No. 10, Oct. 1975, 2 pp, 3 Fig.

2A 128582

RECYCLING OLD PAVEMENTS CAN BE ECONOMICAL FOR COUNTY ROADS

No Abstract

Better Roads Vol. 45 No. 10, Oct. 1975, pp 26-28, 3 Phot.

2A 128665

"NEW APPROACHES" TO CONCRETE FORMING

The main thrust of this program has been to change concrete forming operations from the traditional stick-built system, with its heavy reliance on labor and material, to one that utilizes prefabricated components shipped to the project site. The prefabricated forming systems are either selected and purchased by a special forming staff from systems and methods available on

the open market, or from the company's own shop which can build specific components based on designs submitted for a particular application. The selection of forming systems has been made a function of management at the company level. The "New Approaches Program" has led to savings in labor costs. Reducing material expenses, increasing productivity at the project site and improving job estimate reliability are other benefits.

Bolton, E. *Constructor* Vol. 57 No. 11, Nov. 1975, pp 18-22, Photos.

2A 128798
DEMONSTRATION PROJECT NO. 37. DISCARDED TIRES IN HIGHWAY CONSTRUCTION

This project will demonstrate the feasibility of using the rubber from discarded tires in various highway construction and maintenance operations. The project will include the following: a slide tape presentation explaining the general concept of the project; explanation of the project details and answering of pertinent questions; technical assistance for the construction of demonstration installations; and the negotiation of agreements for the construction of these installations with participating agencies. Laboratory and field tests have indicated that the performance of several asphaltic materials can be improved by incorporating proper amounts of recycled rubber. When these materials are applied at select locations, the overall improved performance should economically justify their use. The asphalt rubber materials which show the most promise include seal coats, joint and crack fillers and strain relieving interlayers. A rubberized seal coat can resist reflective cracking when placed over a fatigue cracked surface. The strain relieving interlayer is placed between an existing cracked surface and an overlay. It is primarily intended to reduce and delay the reflection of thermal cracking through thin bituminous concrete overlays.

Federal Highway Administration 2 pp

2A 128800
DEMONSTRATION PROJECT NO. 34. CATHODIC PROTECTION

In an effort to acquaint field personnel with the theory of cathodic protection and assist in the design, construction and operation of a cathodic protection system, a demonstration project is being offered which will include an introductory slide presentation, assistance in development of a work plan and work schedule, assistance in locating material sources, assistance in the electronic circuitry and system design, and assistance during construction and post construction evaluation periods. Cathodic protection involves the external application of a direct current to the surface of the top mat of steel in sufficient amounts to overcome the internal current flow between the anode and cathode. A sacrificial anode is provided and allowed to corrode and the reinforcing steel becomes the cathode. Cathodic protection (CP), has been used for many years to control corrosion of buried pipe lines and structures in salt water environments, to protect piers, pilings and other underground installations. Promising results have been obtained in test installations of CP systems on bridge decks to control corrosion of the reinforcing steel.

Federal Highway Administration 2 pp

2A 129128
KARL TERZAGHI AND THE CHICAGO SUBWAY

Terzaghi's engagement on the Chicago Subway, 1939-1941, influenced his decision to take up permanent residence in the United States and had a strong impact on the development of applied soil mechanics. So-called squeeze tests, in which the settlements and subsurface movements were correlated with construction procedures, permitted improvements in construction methods and decreases in lost ground. Measurement of loads in bracing of open cuts led to better understanding of behavior of soft clay in undrained shear. Full-scale test sections provided basis for more economical design of permanent tunnel lining. All these activities evolved under Terzaghi's stimulation and in turn helped formulate his conceptions of the ways in which soil mechanics should be applied in practice.

Peck, RB (Illinois University, Urbana) *ASCE Engineering Issues-J of Prof Activities* Vol. 101 No. 4, Oct. 1975, pp 477-484, 10 Ref.

ACKNOWLEDGMENT: EI
PURCHASE FROM: ESL Repr. PC, Microfilm

2A 129341
HIGHWAY TRANSPORTATION'S RESPONSE TO ENERGY CONSERVATION

The following two aspects of energy conservation are considered: (1) petroleum conservation versus other energy conservation, and (2) short term versus long term responses. Suggested ways of accomplishing petroleum conservation are the 55 mph national speed limit, more energy efficient vehicles, carpools, and better traffic management. Savings of energy other than petroleum are to be accomplished through substitution of present lighting installations by more efficient lighting sources such as high pressure sodium vapor lamps, reduced energy consumption in offices, utilization of innovative materials and construction methods, and curtailing the use of highway vehicles. Most of the above suggestions are considered to be short term responses. Long term responses are foreseen in the development of new energy sources. Potential for this lies in the fields of solar, nuclear, geothermal, hydraulic and magnetic energy, which can provide not only abundant energy, but can insure that it will be free of contaminating side effects.

Federal Highway Administration Dec. 1975, 12 p

PURCHASE FROM: DOT Repr. PC

2A 129447
STANDARD SPECIFICATIONS FOR HIGHWAYS, BRIDGES, AND MUNICIPAL UTILITIES

This publication gives a complete set of standard specifications and drawings used for highways, bridges and Municipal Utilities. It outlines descriptions, materials, construction and measurement for typical individual projects. /RTAC/

Department of Public Works, Canada Standard 1969, Figs., Tabs.

ACKNOWLEDGMENT: Roads and Transportation Association of Canada
PURCHASE FROM: Roads and Transportation Association of Canada 1765 St Laurent Boulevard, Ottawa, Ontario K1G 3V4, Canada Repr. PC

2A 129453
ROAD CONSTRUCTION GUIDE [Guide de Construction Routiere]

This second edition of the Road Construction Guide offers the necessary requirements for road construction to enable it to adequately serve the road user during its design life. The fundamental principals and complete and well stated. This construction guide outlines the exact requisites in an understandable and usable fashion. It outlines the specification with respect to pavement, soils, materials and construction. /RTAC/ [French]

Tessier, GR
Quebec Ministry of Transport, Canada Text Book 1973, 218 pp, 42 Fig., Tabs., 24 Phot.

ACKNOWLEDGMENT: Roads and Transportation Association of Canada
PURCHASE FROM: Roads and Transportation Association of Canada 1765 St Laurent Boulevard, Ottawa, Ontario K1G 3V4, Canada Repr. PC

2A 129473
SILT BARRIERS AS EROSION POLLUTION CONTROL IN A LARGE RECREATIONAL LAKE

Soil erosion from urban development and Interstate highway construction during the winter and spring of 1972 and 1973 resulted in extensive runoff pollution of Lake Jackson, a large recreational lake in northern Florida. Turbidity levels in mid-lake reached levels of 180 Jackson turbidity units, and portions of the lake reached turbidity levels exceeding 500 Jackson turbidity units. Floating silt barriers were deployed in 2 arms of the lake by the Florida Department of Transportation to abate the movement of turbid waters into the main body of the lake. Sediment core analyses were performed to determine the extent of sedimentation that had occurred, and water turbidity was monitored to determine the effectiveness of the silt barriers. Clay and silt fines were found to be the major factor in creating turbid conditions in the lake. Erosion controls were effective in controlling movement of sand-size sediments, but they were ineffective in controlling clays and silts. The silt barriers were up to 93 percent effective in preventing the movement of suspended silt and clay into the main body of the lake.

Rivers, EG Allen, CJ (Florida Department of Transportation) *Transportation Research Record* No. 551, 1975, pp 12-24, 12 Fig., 1 Tab., 15 Ref.

PURCHASE FROM: TRB Publications Off Orig. PC

2A 129681

CONCRETE POLYMER MATERIALS DEVELOPMENT IN THE U.S.

Concrete-polymer materials are new to the construction scene having been developed in the last 10 years. The three basic types of materials are polymer-impregnated concrete, polymer-concrete, and polymer-cement concrete. Most of the research has been focused on polymer-impregnated concrete. All three types of materials have considerable potential, however. The process or method for producing each material is reviewed. The properties of each are summarized, and past and current research is briefly reviewed. Potential applications are presented. (a). The number of the covering abstract of the conference is IRRD abstract no. 213776. /TRRL/ Presented at the First Australian Conference on Engineering Materials.

Fowler, DW (Texas University, Austin); Depuy, GW (Bureau of Reclamation)
New South Wales University, Australia Conf Paper No Date, 16 pp, 1 Fig., 3 Tab., 8 Phot., 15 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 213782)

2A 129859

BEHAVIORS OF BRACED CUT

The results of field measurement and analysis of an open cut in a weak reclaimed deposit are reported. The field measurement is carried out during the construction of a tunnel by open-cutting and analysis is done by finite element method with many extreme assumptions. The results show good agreement between measurement and analysis in spite of insufficient exploratory boring and soil test and extreme assumptions.

Tarumi, H *Railway Technical Research Institute* Quart Rpt. Vol. 16 No. 3, Sept. 1975, pp 107-110, 9 Fig.

ACKNOWLEDGMENT: Japanese National Railways
PURCHASE FROM: Ken-yusha 1-45-6, Hikari-cho, Kokubunji, Tokyo, Japan Repr. PC

2A 130560

INSTALLATION OF A SAND-TIRE INERTIAL BARRIER SYSTEM IN CONNECTICUT

The Connecticut Department of Transportation, in cooperation with the Federal Highway Administration, has installed a Tire-Sand Inertial Barrier System at the junction of Routes 2 and 17 in Glastonbury. This system utilizes scrap tires as containers for the sand mass and supports fabricated from 55-gallon (208.1 liter) paint drums. Design, fabrication and construction details are presented for the selected test site. /FHWA/

Lane, KR
Connecticut Department of Transportation, (HPR-343) Intrm Rpt.
FHWA-RD-75-50408, Aug. 1975, 25 pp

ACKNOWLEDGMENT: Federal Highway Administration (S0408)

2A 130588

TECHNOLOGY FOR USE OF INCINERATOR RESIDUE AS HIGHWAY MATERIAL--IDENTIFICATION OF INCINERATOR PRACTICES AND RESIDUE SOURCES

A survey was made of present municipal incineration practices in the United States and other countries. Previous world-wide research and development work on the use of incinerator residues as highway material is summarized. The types, quantities, and locations of municipal incinerator residues produced in this country were determined. The predominant factors affecting residue quality are the nature of the burning action and the degree of burn-out. Six basic types of incinerator residues were identified according to a classification system based on incinerator design. At the present time there are 141 incinerator plants and one pyrolysis plant in operation in 22 states plus the District of Columbia. Most of these plants are located in the northeastern states. These plants produce approximately 5.5 million tons of residue per year. Well burned out residue types 1 and 2 comprise 25 percent of the residue total. The incinerator residues available in the United States could supply from 1 to 9 percent of the annual highway aggregate requirements of the states in which the incinerators are located. /FHWA/

Pinzola, D Collins, RJ
Valley Forge Laboratories, Incorporated, (FIRL-3951) Intrm Rpt.
FHWA-RD-75-81, July 1975, 87 pp

Contract DOT-FH-11-840

ACKNOWLEDGMENT: Federal Highway Administration (M-0258)
PURCHASE FROM: NTIS Repr. PC, Microfiche

2A 130712

SUMMARY REPORT ON THE FEASIBILITY OF USING HIGHWAY LITTER IN HIGHWAY CONSTRUCTION AND MAINTENANCE

The technical and economic feasibility of using highway litter in highway construction and maintenance was investigated. A research team gathered information and made technical and economic assessments of sixteen potential uses of highway litter. A major finding was that if highway litter is considered by itself none of the potential uses investigated would be economically feasible at the present time. In order to be economically feasible, highway litter should be combined with other solid wastes in order to provide either sufficient quantities or lower the unit cost of processing required. Other major findings were that six potential uses were assessed to be both technically and economically feasible, providing the litter is combined with other solid wasters. These six uses are landfill operations, aggregate replacement for base and subbase, aggregate replacement for stabilized materials, induced trench, vehicle impact attenuators, and maintenance materials. (Modified author abstract)

Presented at the Annual Meeting of the American Association of State Highway Officials, December 5-10, 1971

Galloway, BM Ledbetter, WB Epps, JA
(34C1 013) Sumry Rpt. FHWA-RD-72-44, Dec. 1971, 31 pp

Contract DOT-FH-11-7692

ACKNOWLEDGMENT: Federal Highway Administration
PURCHASE FROM: NTIS Repr. PC, Microfiche

PB-224685/8GA

2A 131069

RECYCLED ASPHALT PAVEMENTS, KOSSUTH COUNTY

The history of past policies is briefly reviewed, and the procedures and operations are outlined of the Kossuth County paving program. The construction operations consisted of 7 phases. (1) Salvaging recyclable material was initiated by a Cat 14 motor grader with rear mounted ripper to scarify the pavement to a depth of 4.5 inches. The material was then broken up and hauled to the plant site for crushing. (2) One half of the roadway containing only gravel-clay base was scarified (to 4 inches), windrowed, moved and stockpiled on top of the unscarified base. The remaining half was worked in the same manner. (3) Widening of the roadbed followed. (4) The subbase construction was a routine procedure using the salvaged windrowed gravel base. (5) According to specifications, the salvaged asphalt was now crushed to a maximum size of 2 inches. The percentage of virgin asphalt to be added was determined. (6) Processing of the recycled asphalt consisted of the mixing operation and the lay down operation. (7) The final surfacing placed upon the recycled base was a standard 3-inch Type B Class I Asphaltic Concrete. The factors that must be considered in projects of this nature, relate to pavement performance, economics, environment, and conservation. It is observed that the recycled material is nearly as good as new, and any potential problems may be resolved. The costs involved in this project are discussed and the ways in which recycling could be an economical process are pointed out. Pollution is noted to be a problem while conservation of fuel is an advantage associated with this project.

Hewnely, RP
Iowa Department of Transportation, (HR-176) Nov. 1975, 29 pp, Tabs.

2A 138059

SLIPFORM PAVERS PROVE THEIR VERSATILITY

Slipform pavers were developed in Iowa to pave thin 6-in. (150-mm) concrete pavements just 10-ft (3-m) wide for country farm-to-market roads. Since the first mile of road was built in 1949, slipform paving techniques and equipment have revolutionized concrete paving. In recent years, slipform pavers have placed pavements up to 50-ft (15.2-m) wide, slab thicknesses up to 20-in. (510-mm), and have made record production runs of up to 16,000 cu yd (12,200 cu m) of concrete in one working day, or over 4 miles (6.5-km) of two-lane pavement. On a high-speed test track project, a slipform paver placed a 47-ft (14.3-m) wide slab with superlevation designed for 140-mph (225-kn/h) speeds on the semicircular end sections. Slipform pavers have

also been used to construct curb and gutter sections, concrete median barriers, bicycle paths, railroad slabs for supporting rails, and concrete guideways for personal rapid transit systems.

Presented at the October 21-25, 1974, ASCE Annual and National Environmental Engineering Convention, Kansas City, Missouri.

Ray, GK Lokken, EC Packard, RG (Portland Cement Association)
ASCE Journal of Transportation Engineering Proceedings Vol. 101 No. TE4,
ASCE #11725, Nov. 1975, pp 721-736, 20 Fig.

2A 200206

HIGHWAY PAVING: WHICH WILL IT BE-ASPHALT OR CONCRETE?

SOME OF THE VARIABLES INVOLVED IN THE NECESSARY DECISION- MAKING FOR ASPHALT OR CONCRETE HIGHWAY PAVEMENTS ARE DISCUSSED. IT IS POINTED OUT THAT EVEN WHEN COMPARATIVE FIGURES ARE AVAILABLE, THE CIRCUMSTANCES AND CONDITIONS UNDER WHICH A ROAD IS BUILT MAY BE SO SPECIALIZED THAT THE RESULTS CANNOT BE SAFELY GENERALIZED TO APPLY EVERYWHERE. COSTS VARY CONSTANTLY FROM AREA TO AREA & ARE DEPENDENT ON THE LOGISTICS OF SUPPLY, THE PRICE OF AGGREGATE, STEEL, LABOR & OTHER ELEMENTS IN THE POTENTIAL BID PRICE. THE TYPE & VOLUME OF TRAFFIC TO BE CARRIED WILL AFFECT THE THICKNESS OF THE PAVEMENT REQUIRED TO SUPPORT IT EFFICIENTLY AND ECONOMICALLY. COST PER MILE FIGURES ARE AFFECTED BY THE DEGREE OF CONTRACTOR INTEREST IN A JOB, THE EXTENT OF HIS EXPERIENCE, CLIMATE, THE TYPE, CONDITIONS, AVAILABILITY AND PROXIMITY OF MACHINERY AND EQUIPMENT AND ESTIMATED MAINTENANCE COSTS. IT IS CONCLUDED THAT THE INFLATIONARY SPIRAL, SHORTAGE OF MATERIALS, NEW DEVELOPMENTS IN MACHINERY, METHODS AND DESIGN CALL FOR AN OPEN MIND AND AN ALMOST DAILY REAPPRAISAL OF THE FACTORS WHICH INFLUENCE DECISION MAKING.

World Construction, Apr. 1968

2A 200924

PAVING BY CALGARY CITY FORCES COST 25% MORE THAN CONTRACTORS JOBS

THIS ARTICLE IS A REPORT ON A STUDY CARRIED OUT IN THE CITY OF CALGARY. IT COMPARES THE COSTS OF PAVING WORK DONE BY CITY FORCES AGAINST THAT DONE BY PRIVATE CONTRACTORS. IT WAS CONCLUDED THAT CONTRACTORS CAN DO THE WORK 25% CHEAPER. EQUIPMENT AND PERSONNEL INFLEXIBILITY, AS WELL AS A POOR COST ACCOUNTING SYSTEM, WERE BLAMED FOR THE DISCREPANCY. /CGRA/

Heavy Construction News /Canada/ Apr. 1966

2A 201895

REPORT OF INVESTIGATION OF LOW COST IMPROVED ROADS

A CANVASS WAS MADE OF ROAD BUILDERS, STATE HIGHWAY COMMISSIONS, HIGHWAY ENGINEERS, AND TECHNICAL PUBLICATIONS TO DETERMINE CURRENT KNOWLEDGE, NEED, AND COST WITH RESPECT TO TREATED AND UNTREATED IMPROVED ROADS WITH AN ADT OF 300-1500 VEHICLES. CHAPTER 5 OF THE REPORT COMPRISES NINE ARTICLES, APPENDED AS A SUPPLEMENT, THAT ARE ABSTRACTED SEPARATELY. THE CONTENTS ARE AS FOLLOWS: (1)-SUMMARY STATEMENT OF CONCLUSIONS, STRONG INDICATIONS, AND SUGGESTED FUTURE RESEARCH. (2)-PRACTICAL APPLICATION OF FINDINGS. (3)-DIGEST OF FINDINGS: CONSTRUCTION AND MAINTENANCE MATERIALS, CONSTRUCTION METHODS AND CLASSIFICATION OF LOW COST ROAD SURFACES, MAINTENANCE METHODS, CONSTRUCTION AND MAINTENANCE COSTS, SELECTION OF TYPE AND TYPICAL CROSS SECTION, EFFECTS OF CLIMATE AND SOIL ON TYPE, SERVICE, TRAFFIC, AND CONSTRUCTION AND MAINTENANCE EQUIPMENT. (4)-PRESENTATION OF FINDINGS: SAND-CLAY SURFACES, CHERT, SHALE, AND DISINTEGRATED GRANITE SURFACES, GRAVEL SURFACES, TRAFFIC BOUND SURFACES OF GRAVEL,

SLAG, AND STONE, MACADAM, LIMEROCK, MARL, CALICHE, BASE AND SURFACE, MISCELLANEOUS UNTREATED SURFACES, NONBITUMINOUS DUST PREVENTIVES, SINGLE AND DOUBLE BITUMINOUS TREATMENTS AND PENETRATION METHODS, MIXED-IN-PLACE BITUMINOUS SURFACES (FINE AGGREGATE, TYPE I AND II COARSE AGGREGATES), COLD-LAID PREMIXED BITUMINOUS SURFACE, NATURAL ROCK ASPHALT SURFACE, COLD-LAID MODIFIED OR "PUDDLE" BITUMINOUS MACADAM, BITUMINOUS MACADAM (HOT PENETRATION METHOD), HOT-LAID PREMIXED BITUMINOUS SURFACE, AND MISCELLANEOUS SURFACES (PRINCIPALLY LIME TREATMENTS OF CLAY). (5)-SUPPLEMENTARY DISCUSSIONS: THE LOW COST ROAD PROBLEM, TRAFFIC BOUND ROADS AS FOUNDATIONS FOR SUBSTANTIAL PAVEMENTS, SELECTION OF MATERIALS FOR BASE AND SURFACE TREATMENT, UNTREATED SURFACES OF SAND-CLAY, CHERT, AND GRAVEL, LOW COST IMPROVED ROADS IN WISCONSIN, TREATMENT OF LOW COST ROADS, PUDDLE MACADAM USING SOFT SANDSTONE, CONSTITUENTS OF A LOW COST ROAD, AND MAINTENANCE METHODS AND EQUIPMENT FOR LOW COST IMPROVED ROADS.

Conner, CN *Highway Research Board Proceedings* 1928

2A 202557

UTILIZATION OF PHOTO INTERPRETATION IN THE HIGHWAY FIELD

PHOTO INTERPRETATION IS BEING USED IN THE HIGHWAY FIELD FOR THE LOCATION OF CONSTRUCTION MATERIALS, EVALUATION OF SOILS AND GEOLOGY AND PREPARATION OF ENGINEERING SOIL MAPS EVALUATION OF GROUND CONDITIONS, DRAINAGE STUDIES AND MAPS LAND USE STUDIES, TRAFFIC SURVEYS AND ANALYSIS, PLANNING SUB-SURFACE EXPLORATION, AND HIGHWAY CONDITION AND DAMAGE STUDIES.

Rib, H *Highway Research Record, Hwy Res Board* 1966

2A 202689

THE ENGINEERING SIGNIFICANCE OF LANDFORMS

INFLUENCES OF THE LAND UNIT OR LAND FORM UPON THE DESIGN, CONSTRUCTION, AND MAINTENANCE OF HIGHWAYS ARE DESCRIBED. SPECIFIC SOLID ROCK AND MOISTURE CONDITIONS EXISTING IN THE LAND FORM ARE IMPORTANT. A GIVEN LAND FORM POSSESSES A DISTINCTIVE TYPE OF RELIEF, THE TEXTURE OF THE SOIL VARIES IN A PRESCRIBED WAY AND GROUND WATER AND SOIL MOISTURE FOLLOW TYPICAL TRENDS. LAND FORMS INFLUENCE THE QUALITY AND TYPE OF GRADING, PRE-DETERMINE THE DRAINAGE REQUIREMENTS AND FIX THE SOIL OR ROCK CONDITIONS. EMPHASIS IS PLACED ON THE PHYSICAL CHARACTERISTICS OF THE MATERIALS THAT COMPOSE THE LAND FORMS, AND THE INTER-RELATIONSHIP OF THE RELIEF, SOIL, ROCK AND GROUND WATER CHARACTERISTICS. AERIAL AND GROUND PHOTOGRAPHS HAVE BEEN USED TO ILLUSTRATE INDIVIDUAL FORMS AS WELL AS TO IDENTIFY THE VARIATIONS THAT OCCUR WITHIN EACH UNIT AREA. SOIL SURVEY OBJECTIVES ARE ANALYZED IN THE FOLLOWING LAND FORMS: (1) SOLUBLE LIMESTONES, (2) WIND-TRANSPORTED MATERIALS, (3) GLACIATED REGIONS, (4) ARID REGIONS, AND (5) LANDSLIDES. CHARACTERISTICS OF THE LAND FORM UNDER STUDY CONDITIONS OF TOPOGRAPHY, SOIL, WATER, AND BEDROCK PROVIDE CONDITIONS TO DETERMINE DESIGN METHODS AND CONSTRUCTION PROCEDURES.

Belcher, DJ *Highway Research Board Bulletin* Nov. 1948

2A 202717

LOCATING AND MAPPING GRANULAR CONSTRUCTION MATERIALS FROM AERIAL PHOTOGRAPHS

DATA COVERING TEN YEARS OF MAPPING GRANULAR CONSTRUCTION MATERIALS FROM AERIAL PHOTOGRAPHS WERE SUMMARIZED. DURING THIS PERIOD 2,165 GRANULAR-MATERIAL PROSPECTS WERE MAPPED. INDIVIDUAL DEPOSITS,

MAPPED FROM THE PHOTOS AND CHECKED ON THE GROUND, RANGE IN QUALITY FROM DIRTY GRAVELLY SAND TO CLEAN COARSE GRAVEL AND IN QUANTITY FROM A FEW HUNDRED TO SEVERAL HUNDRED THOUSAND CU YD. DATA FROM 75 CONSTRUCTION PROJECTS COVERING 32,000 SQ MI OF SEARCH AREA INDICATE THAT AIRPHOTO INTERPRETATION TECHNIQUES YIELD REMARKABLY GOOD RESULTS WHEN THE INTERPRETATION IS CARRIED OUT BY EXPERIENCED PHOTOANALYSTS FAMILIAR WITH AIRPHOTO PATTERNS OF GRANULAR DEPOSITS IN THE REGION BEING SEARCHED. AS A PROSPECTING TOOL, THE AIRPHOTO TECHNIQUE IS FAST AND ECONOMIC. RESULTS FROM TEN YEARS AIRPHOTO MAPPING SHOW THAT THE AREAL EXTENT AND QUALITY OF DEPOSITS CAN BE RELIABLY PREDICTED IN A HIGH PROPORTION OF CASES. THE METHOD PARTICULARLY AIDS FOLLOW-UP SUBSURFACE INVESTIGATIONS BY PIN-POINTING WHERE TO EXPLORE IN THE FIELD, AT THE SAME TIME INDICATING WHAT TO EXPECT IN TERMS OF MATERIAL QUALITY AND QUANTITY. THE NEED TO DISCOVER GRANULAR CONSTRUCTION MATERIALS IS POINTED OUT. PERTINENT DATA FROM CONSTRUCTION PROJECTS ON WHICH GRANULAR AIRPHOTO SEARCHES WERE MADE IS PRESENTED. PROSPECTING PROBLEMS FACING THE GROUND-INVESIGATOR ARE REVIEWED AND A BRIEF DISCUSSION IS MADE OF CUSTOMARY GRANULAR-SEARCH METHODS USED IN LOCATING GRANULAR CONSTRUCTION MATERIALS. A SUMMARY OF THE MORE COMMON GRANULAR LAND FORMS FOUND IN THE PLAINS AREA OF WESTERN CANADA AND THEIR IDENTIFYING FEATURES IN AERIAL PHOTOGRAPHS ARE PRESENTED. IN EACH PROJECT AREA SURVEYED, THE LAND FORM CONTRIBUTING THE GREATEST QUANTITY OF HIGH-QUALITY AGGREGATE IS TABULATED. TABLES AND OTHER STATISTICAL DATA ILLUSTRATE THE FREQUENCY OF OCCURRENCE OF VARIOUS GRANULAR LAND FORMS IN PARTS OF WESTERN CANADA. INFORMATION IS PRESENTED TO INDICATE, FOR DIFFERENT GEOLOGIC ENVIRONMENTS, THE PERCENTAGE OF PHOTO-IDENTIFIED DEPOSITS THAT ARE COMMONLY SUITABLE AS SUBBASE, BASE COURSE, AND WEARING-COURSE MATERIAL. THE ACCURACY OF AIRPHOTO INTERPRETATION PREDICTIONS IS ASSESSED IN TERMS OF THE TRAINING, EXPERIENCE, AND JUDGMENT OF THE PHOTO-INTERPRETER. /AUTHOR/

Mollard, JD Dishaw, HE *Highway Research Board Bulletin* 1958

2A 202738
USING AERIAL PHOTOS TO LOCATE GRANULAR FILL MATERIAL

THE RELIABILITY OF USING AERIAL PHOTOGRAPHIC INTERPRETATION AS ONE OF THE FASTEST AND MOST ECONOMIC METHODS OF LOCATING GRANULAR MATERIALS IS DESCRIBED AND DEMONSTRATED. THE INVESTIGATION COVERS THE IDENTIFICATION FEATURES OF GRANULAR DEPOSITS AND A LIST OF DIFFERENT TYPES OF GRANULAR LANDFORMS. AERIAL AND GROUND PHOTOGRAPHS SHOW THE FEATURES DESCRIBED. EXAMPLES ARE GIVEN TO DEMONSTRATE THE PROCEDURES USED BY THE ARMY CORPS OF ENGINEERS, TULSA DISTRICT, IN LOCATING GRANULAR FILL MATERIAL FROM AERIAL PHOTOGRAPHS FOR SEVERAL CONSTRUCTION PROJECTS. SEVEN PILOT PROJECTS, WHICH CAN BE EXTRAPOLATED TO OTHER AREAS, WERE SELECTED FROM AERIAL PHOTOGRAPHS AS POTENTIAL SOURCES OF GRANULAR MATERIAL. A 2-DAY FIELD EXPLORATION SHOWED THAT SIX SITES CONTAINED GRAVEL SUITABLE FOR USE IN GRILLED ROLLED BASE COURSES. /AUTHOR/

Neely, D Abdel-hady, M *Am Soc Civil Engr J Construction Div* Oct. 1968

2A 202752
GRAVEL PROSPECTING BY USE OF AERIAL PHOTOGRAPHIC INTERPRETATION

GEOLOGY, AERIAL PHOTOGRAPHIC INTERPRETATION, AND GEOPHYSICS ARE DESCRIBED AS A RESEARCH UNIT FOR THE RECONNAISSANCE AND EXPLORATION OF SAND AND

GRAVEL DEPOSITS SITUATED IN AN ECONOMICALLY IMPORTANT LOCATION TO THE INTERSTATE HIGHWAY SYSTEM IN NORTH DAKOTA. THIS RESEARCH HAS BECOME NECESSARY DUE TO A RAPIDLY DIMINISHING AGGREGATE SUPPLY COMPARED WITH A GREATLY INCREASED HIGHWAY CONSTRUCTION PROGRAM. THE PROCEDURE IS PRESENTED FOR GRAVEL SEARCH IN A LIMITED CRITICAL AREA. AVAILABLE PUBLISHED GEOLOGIC LITERATURE IS STUDIED AND THEN A COMPLETE COVERAGE PROVIDED BY AERIAL PHOTOS. AFTER ARRIVING AT THE FIELD OF LOCATION DESIGNATED ON THE AERIAL PHOTOGRAPH, A SMALL MOBILE DRILLING UNIT IS POSITIONED AND A TEST BORING MADE. OTHER PROBES ARE MADE TO ESTABLISH THE LOCATION AND THE APPROXIMATE AVERAGE THICKNESS OF THE DEPOSIT OVER THE AREA. AT PRESENT, IT IS THE POLICY TO TEST AND DETERMINE THE QUALITY AND QUANTITY OF A SAND AND GRAVEL SOURCE USING A LARGE POWER DRIVEN HYDRAULIC AUGER, BUT FUTURE PLANS CALL FOR USE OF EARTH RESISTIVITY EQUIPMENT TO ASSIST IN THE FIELD EXPLORATION.

Kasper, RJ *Highway Research Board Bulletin* 1959

2A 202755
INTRODUCTION TO PHOTOGRAMMETRY AND AERIAL SURVEYS

THE USE OF PHOTOGRAMMETRY AND AERIAL SURVEYS IN HIGHWAY ENGINEERING IS REVIEWED. SOME OF THE ADVANTAGES OF AERIAL SURVEYS IN HIGHWAY ENGINEERING ARE: (1) THEY PROVIDE AMPLE QUALITATIVE INFORMATION PERTAINING TO PHOTOGRAPHY, SOILS, DRAINAGE, AND LAND USES, (2) THEY PROVIDE THE MEANS TO MEASURE THE QUANTITATIVE DATA FOR PROPERTY BOUNDARIES, FOR SITES OF CONSTRUCTION MATERIALS, AND FOR ALL FACILITIES THAT WILL BE AFFECTED BY THE FUTURE HIGHWAY, (3) THEY PROVIDE A MEANS OF CORRELATING TO THE TYPE AND INTENSITY OF LAND USE THE LAND-USE AND TRAFFIC-GENERATION FACTORS AS DEVELOPED FROM ORIGIN AND DESTINATION TRAFFIC STUDIES, (4) THEY SAVE MAN-DAYS ON SURVEYS AND ON DESIGN, (5) THEY MAKE INACCESSIBLE AREAS ACCESSIBLE, (6) THEY ELIMINATE THE NEED OF ON-THE-GROUND FLAGGING OF ROUTES IN THE RECONNAISSANCE SURVEY STAGES AND OF STAKING P-LINES IN THE PRELIMINARY SURVEY STAGE, (7) THEY ELIMINATE ANY NEED FOR CUTTING TREES AND OTHER VEGETATION FOR RECONNAISSANCE SURVEY PURPOSES AND FOR STAKING P-LINES AND MEASURING PROFILES AND CROSECTIONS, (8) THEY PERMIT THE COMPLETION OF DESIGNS AND ESTABLISHMENT OF THE LOCATION FOR YEAR-S-IN- ADVANCE PROCUREMENT OF RIGHTS-OF-WAY, (9) THEY IMPROVE THE POSSIBILITIES OF REDUCING OR ELIMINATING INTERFERENCE WITH PRESENT LAND USE BY AVOIDING SEVERENCES AND USING THE LESS VALUABLE LANDS, (10) THEY SERVE AS A RELIABLE GUIDE FOR LOCATION OF SECTION LINES AND PROPERTY LINES, AND FOR TYING RIGHTS-OF-WAY LINES AND OTHER PROPERTY LINES TOGETHER BY DESCRIPTION IN THE USE OF PLANE COORDINATE TIES TO GROUND SURVEY MARKERS, (11) THEY PROVIDE DIMENSIONS FOR ELECTRONIC METHODS OF COMPUTATION TO ASCERTAIN EXCAVATION AND EMBANKMENT QUANTITIES AND DETERMINE PAY QUANTITIES ON CONTRACT CONSTRUCTION, (12) THEY REDUCE TIME-CONSUMING RECONNAISSANCE SURVEYS ON THE GROUND BY ENABLING ENGINEERS TO BRING THE TOPOGRAPHY AND LAND USE INTO THE OFFICE FOR INTENSIVE AND EXTENSIVE EXAMINATION AND EVALUATION, (13) THEY MAKE DETERMINATION AND COMPARISON OF FEASIBLE ROUTE ALTERNATIVES EASY TO ACCOMPLISH IN A RELIABLE AND FACTUAL MANNER, (14) THEY ASSURE THAT THE BEST ROUTE AND THE BEST LOCATION ON THAT ROUTE HAVE BEEN DETERMINED THROUGH FULL CONSIDERATION OF EVERY ASPECT OF THE CONTROLS OF LOCATION AND DESIGN, AND (15) THEY ARE EFFECTIVE AND EFFICIENT METHODS OF MAKING CONDITION AND INVENTORY SURVEYS. IT IS CONCLUDED THAT RESULTS OBTAINED BY FULL USE OF PHOTO-

GRAMMETRY AND AERIAL SURVEYS ARE MUCH BETTER THAN THOSE OBTAINED BY GROUND SURVEYS ONLY.

Pryor, WT *Highway Research Board Bulletin* 1957

2A 202857

NEEDED RESEARCH ON ASPHALTIC ROAD MATERIALS

THE TERM "ASPHALTIC MATERIALS," AS USED IN THIS DISCUSSION, COVERS THE RANGE OF LIQUID, SEMI-SOLID, AND SOLID ASPHALTIC PRODUCTS USED IN ROAD CONSTRUCTION. IN CHEMICAL COMPOSITION, ASPHALTIC MATERIALS ARE VARIED AND COMPLEX AND ALMOST NUMBERLESS VARIETIES MAY RESULT FROM DIFFERENT MATERIALS AND METHODS OF REFINING. SOME TESTS FOR ASPHALTIC MATERIALS ARE INTENDED TO MEASURE CERTAIN QUALITIES DIRECTLY, OTHERS ARE IDENTIFICATION TESTS. FURTHER RESEARCH IS NECESSARY TO DETERMINE IN WHICH CATEGORY SOME TESTS BELONG. INVESTIGATION IS ALSO NEEDED TO DETERMINE IF TESTS INTENDED TO MEASURE QUALITY ACTUALLY DO SO. THERE IS EVIDENCE TO SHOW THAT DUCTILITY TESTS AND TESTS DESIGNED TO CONTROL SUSCEPTIBILITY TO TEMPERATURE CHANGES ARE NOT DIRECTLY RELATED TO SERVICE BEHAVIOR. A HIGH DEGREE OF DURABILITY IS VERY IMPORTANT AND LITTLE CONCERNING THIS QUALITY CAN BE FORETOLD FROM PRESENT TEST METHODS. FURTHER RESEARCH IS NEEDED TO DETERMINE HOW THE CHARACTERISTICS OF THE CRUDE OILS INFLUENCE THE QUALITY OF THE FINISHED PRODUCTS. CLOSELY ALLIED WITH THESE QUESTIONS ARE THE PROBLEMS WHICH ARISE FROM DIFFERENT METHODS OF REFINING, HEATING, MIXING AND PLACING ASPHALTIC MATERIALS ALTER THEIR CHARACTERISTICS. IT IS NECESSARY TO DETERMINE TO WHAT EXTENT SUCH CHANGES MAY BE PERMITTED WITHOUT DAMAGE TO THE QUALITY OF THE FINISHED PRODUCT. IT IS ALSO NECESSARY TO STUDY THE INTER RELATION BETWEEN ASPHALTIC MATERIALS, AND THE AGGREGATES. STUDY IS ALSO NEEDED ON NEW USES FOR BITUMINOUS MATERIALS SUCH AS STABILIZATION OF SOILS. WHEN THE DETAILS OF NEEDED RESEARCH ARE CONSIDERED THE PROBLEM BECOMES ENORMOUSLY COMPLEX. THE COMBINED EFFORTS OF ALL INTERESTED IN THE PRODUCTION AND USE OF THESE MATERIALS ARE REQUIRED IF RESULTS ARE TO BE ACHIEVED IN A REASONABLE LENGTH OF TIME. /AUTHOR/

Kelley, EF Crum, RW DISCUSSEER Lang, FC
DISCUSSEER Cattell, RA DISCUSSEER Campbell, LC
DISCUSSEER Boyd, JE DISCUSSEER Baskin, CM DISCUSSEER *Highway Research Board Proceedings* 1935

2A 202932

CONSTRUCTION MATERIALS IN DELTA AREAS

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Orr, DG Quick, JR *Photogrammetric Engineering* Apr. 1971

2A 202962

AERIAL PHOTOGRAPHIC INTERPRETATION OF ROAD CONSTRUCTION MATERIALS IN SOUTHERN AFRICA WITH SPECIAL REFERENCE TO ITS POTENTIAL TO INFLUENCE ROUTE LOCATION IN UNDEVELOPED TERRITORIES

THE DEVELOPMENT OF THE USE OF AERIAL PHOTOGRAPHIC INTERPRETATION IN MATERIALS INVESTIGATIONS FOR RURAL ROAD PROJECTS IN THE VARIOUS TERRITORIES OF SOUTHERN AFRICA IS BRIEFLY REVIEWED. REFERENCE IS THEN MADE TO A TECHNIQUE FOR THE QUICK AND RELIABLE MATERIALS APPRAISAL OF LARGE TRACTS OF COUNTRY FOR ROAD LOCATION PURPOSES: A TECHNIQUE IN WHICH AERIAL PHOTOGRAPHIC INTERPRETATION IN DIRECT TERMS OF ENGINEERING SIGNIFICANCE PLAYS A MAJOR ROLE. THE METHOD IS ILLUSTRATED BY DETAILING TWO SPECIFIC PROJECTS FROM THE TERRITORY OF SOUTH WEST AFRICA, IN WHICH IT IS SHOWN THAT THE DISTRIBUTION OF HIGH-QUALITY ROAD BUILDING MATERIALS CAN BE A DEFINITE ROUTE LOCATION CRITERION IN UNDEVELOPED COUNTRIES, AND THAT WITH THE DEVELOPMENT OF A RAPID AND DEPENDABLE TECHNIQUE OF TERRAIN EVALUATION, IT IS NOW FEASIBLE TO TAKE THIS CRITERION INTO ACCOUNT. FINALLY, ATTENTION IS FOCUSED ON ONE OR TWO IMPORTANT ASPECTS OF AERIAL PHOTOGRAPHIC INTERPRETATION APPLICABLE TO THE MATERIALS PLANNING AND ROUTE LOCATION OF ROADS. /AUTHOR/

Caiger, JH

Photogrammetria /Neth/ Vol. 25 No. 5/6, Apr. 1970, pp 151-76, 4 Fig, 2 Tab, 11 Phot, 17 Ref

2A 203120

MARYLAND ENGINEERING SOIL STUDY

THIS FINAL REPORT DESCRIBES RESEARCH IN ENGINEERING SOIL MAPPING OF MARYLAND, PERFORMED BY THE CIVIL ENGINEERING DEPARTMENT OF THE UNIVERSITY OF MARYLAND IN COOPERATION WITH MARYLAND STATE ROADS COMMISSION AND THE DEPARTMENT OF COMMERCE, BUREAU OF PUBLIC ROADS. TO SATISFY THE RESEARCH SPECIFICATION REQUIRING PRESENTATION, FOR THE HIGHWAY SOILS ENGINEER, OF DETAILED KNOWLEDGE OF SURFACE, SUBSURFACE, CLIMATIC AND MATERIALS CONDITIONS, SIX MAPS WERE PREPARED FOR EACH COUNTY, AS FOLLOWS: /1/ ENGINEERING SOIL MAP AND PROPERTY TABLES, /2/ ENGINEERING GEOLOGY MAP WITH SUPPORTING TABLES, /3/ SLOPE MAP, /4/ MATERIALS PROSPECTING MAP AND TABLES, /5/ AGGREGATE SOURCES MAP AND TABLES, AND /6/ DRAINAGE PATTERN MAP. IN PREPARATION OF THE COUNTY ENGINEERING SOIL MAPS, MARYLAND STATE ROADS COMMISSION SOIL SURVEY DATA WERE USED AND NO FIELD SAMPLING OR LABORATORY TESTS WERE MADE. ENGINEERING SOIL MAP UNIT BOUNDARIES WERE PLOTTED USING CORRELATION BETWEEN THE ENGINEERING SOIL SURVEY TEST RESULTS AND THE COUNTY AGRICULTURE SOIL MAP UNIT BOUNDARIES. OTHER MATERIAL CONFIRMING THIS CORRELATION WAS CONSULTED. PARTICULAR EMPHASIS WAS MADE TO ROCK IN CUTS AND TO MATERIAL TOO WET FOR USE. A COMPLETE MAPPING SYSTEM IS ALSO DESCRIBED WHICH PERMITS REPRODUCTION OF MAPS FOR FIELD USE FROM MASTERS, PROJECTION-OVERLAY SCALE-PROBLEM-FREE PLANNING AND DESIGN CENTER, A REVISION PROCEDURE FOR CONTINUITY OF THE SOILS KNOWLEDGE, A KEY FEATURE IN FILING, FOR READY REFERENCES, THOUSANDS OF MAPS ON MICROFILM IN APERTURE CARDS.

Piper, HW

Maryland University

ACKNOWLEDGMENT:

2A 203257

ROADS DEVELOPMENT IN SAUDI ARABIA

THE PROGRAM OF ROAD DEVELOPMENT STARTED IN 1963 IN SAUDI ARABIA. THE PRIMARY AND SECONDARY ROAD NETWORKS ARE DESCRIBED. THE TOTAL LENGTH OF MAIN

ASPHALTED ROADS AT PRESENT IS 5,927 KM. THIRTY-ONE NEW ROAD PROJECTS, TOTALLING 3,098 KM, ARE UNDER CONSTRUCTION AND 3,416 KM MORE ARE UNDER DESIGN OR READY TO BE ADVERTISED TO TENDER. MOST OF THE ASPHALT USED FOR CONSTRUCTION IS PRODUCED LOCALLY BY THE ARABIAN AMERICAN OIL COMPANY REFINERY AT RAS TANURA. THE GRADES OF ASPHALT PRODUCTS USED WERE STANDARDIZED TO FOUR TYPES: PENETRATION ASPHALT 60-70 FOR HOT MIX WEARING COURSES, RC-2 CUTBACK FOR THE TACK COATS, RC-4 IN ASPHALTIC STABILIZED BASES AND MC-1 CUTBACK FOR THE PRIME COAT. A PLEA IS MADE FOR FOREIGN CONSTRUCTION COMPANIES TO COME TO SAUDI ARABIA AND PARTICIPATE IN THIS DEVELOPMENT WORK.

Communications Ministry /Saudi Arabia/ Oct. 1967

2A 203345

COORDINATION OF METHODS IN HIGHWAY LOCATION AND DESIGN

APPROXIMATE LOCATIONS OF EACH NEW HIGHWAY FACILITY ARE DETERMINED FROM RECONNAISSANCE SURVEYS. THE RECONNAISSANCE PLAN WITH A TOPOGRAPHIC SHEET IS PRESENTED TO THE GEOLOGIST WHO PREPARES A GEOLOGIC STRIP MAP ALONG THE LINES SHOWN. THIS GEOLOGIC MAP INFORMS THE ENGINEER REGARDING THE KINDS OF SOIL MATERIALS, THE LOCATION OF BEDROCK OUTCROPS, AND THE VARIOUS LAND FORMS TO BE TRAVERSED BY THE HIGHWAY. LOCATIONS WHERE SEISMIC EXPLORATIONS ARE NECESSARY ARE INDICATED. A GEOLOGIC SURVEY IS CONDUCTED TO INDICATE ALL AVAILABLE SOURCES OF HIGHWAY CONSTRUCTION MATERIALS: TRAP ROCK GRAVEL, SAND, ETC. SOME OF THE SPECIFIC APPLICATIONS OF GEOLOGICAL INTERPRETATIONS AND SEISMIC EXPLORATIONS TO THE LOCATION AND DESIGN OF HIGHWAYS IN MASSACHUSETTS ARE DESCRIBED.

Delano, GH *Highway Research Board Bulletin* Nov. 1948

2A 203420

THE WASHO ROAD TEST PART 1: DESIGN, CONSTRUCTION, AND TESTING PROCEDURES

CONTENTS: BACKGROUND AND GENERAL DESCRIPTION HISTORICAL INFORMATION COOPERATING AGENCIES DESCRIPTION OF PROJECT CONSTRUCTION AND CONSTRUCTION CONTROL SUBGRADE SUBGRADE AND BASE ASPHALTIC-CONCRETE SURFACING TEST VEHICLES AND OPERATIONS VEHICLES TEST LOADS OPERATIONS SPEED PROFILES TRAFFIC GUIDE LINES TIRE PRINTS INSTRUMENTATION, PROCEDURES AND GENERAL RESEARCH INSTRUMENTATION AND PROCEDURES CLIMATE AND ALLIED MEASUREMENTS MEASUREMENT OF PERMANENT DEFORMATIONS MEASUREMENT OF ELASTIC DEFLECTIONS SPECIAL DEFLECTION STUDIES GENERAL STUDIES ORIGIN AND CHARACTERISTICS OF MATERIALS APPENDIX A: ANALYSIS OF CONSTRUCTION CONTRACT APPENDIX B: SUMMARY OF CONSTRUCTION COSTS APPENDIX C: CONTROL AND INSPECTION OF SUBGRADE CONSTRUCTION APPENDIX D: CONTROL AND INSPECTION OF GRAVEL PLANT AND SUBBASE AND BASE CONSTRUCTION APPENDIX E: CONSTRUCTION AND CONTROL OF BITUMINOUS SURFACING AND STUDIES OF THE ASPHALTIC CONCRETE APPENDIX F: SUBGRADE MOISTURE CONTENT STUDIES APPENDIX G: IDENTIFICATION AND STABILITY TESTS ON TYPICAL SUBGRADE SOIL APPENDIX H: TRANSVERSE POSITION OF TEST VEHICLES

Highway Research Board Special Reports 1954

2A 203440

EXAMINATION OF THE REPORT OF THE TECHNICAL COMMITTEE ON PAVEMENT DESIGN

THE SESSION ON GENERAL HIGHWAY MATTERS WAS OPENED BY M. ANDRE SACCASYN OF BELGIUM WHO PRESENTED A REPORT PROPOSING SUBJECTS AND QUESTIONS WHICH BENEFIT FROM INTERNATIONAL EXCHANGE OF INFORMATION. THESE INCLUDED: (1) PERFORMANCE OF EXPERIMENTAL ROADS UNDER CLIMATIC CONDITIONS OF DIFFERENT

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Perm Intl Assoc Road Congresses Proc 1967

2A 203480

FAILURE STUDY OF AN OVERLOADED 96 IN. CONCRETE PIPE

A THREE-YEAR OLD 96-INCH SEWER IN SAN DIEGO, DESIGNED FOR APPROXIMATELY 13 FEET OF COVER, WAS ABANDONED BECAUSE OF OVERLOAD FROM THE CONSTRUCTION OF A NEW 40-50-FT HIGHWAY EMBANKMENT. THE PORTION OF THE PIPE AFFECTED BY THE SURCHARGE WAS STUDIED THROUGH FAILURE. THE PIPE FAILED AS EXPECTED AND BEHAVED THEREAFTER AS A FLEXIBLE CONDUIT. THERE WAS A MARKED VARIANCE IN THE RELATIVE DISTORTION OF THE PIPE AT DIFFERENT LOCATIONS; APPARENTLY BECAUSE OF DIFFERENCES IN THE BEDDING AND COMPRESSIBILITY OF THE LAYER OF SOIL SURROUNDING THE PIPE. IT WAS CONCLUDED THAT A PIPE LOCATED IN COMPRESSIBLE SOIL (EITHER NATURAL GROUND OR EMBANKMENT) AND SUBJECTED TO SURCHARGE, CAN BE OVERLOADED BECAUSE OF THE GENERATION OF PASSIVE EARTH PRESSURES. THE USE OF COMPENSATING COMPRESSIBLE BACKFILL IS SUGGESTED, AND A FORMULA IS PROPOSED FOR ESTIMATING THE STRENGTH OF PIPE REQUIRED IN SUCH CASES. IT WAS FOUND THAT THIS PARTICULAR PIPE, LOCATED IN A SATURATED SOIL, EXPERIENCED A SIGNIFICANT STRENGTH GAIN IN A 3-YEAR, 10-MONTH PERIOD. /AUTHOR/

Smith, T Shirley, EC Smith, RE
California Dept Transportation Feb. 1970

GRAMMETRY AND AERIAL SURVEYS ARE MUCH BETTER THAN THOSE OBTAINED BY GROUND SURVEYS ONLY.

Pryor, WT *Highway Research Board Bulletin* 1957

2A 202857

NEEDED RESEARCH ON ASPHALTIC ROAD MATERIALS

THE TERM "ASPHALTIC MATERIALS," AS USED IN THIS DISCUSSION, COVERS THE RANGE OF LIQUID, SEMI-SOLID, AND SOLID ASPHALTIC PRODUCTS USED IN ROAD CONSTRUCTION. IN CHEMICAL COMPOSITION, ASPHALTIC MATERIALS ARE VARIED AND COMPLEX AND ALMOST NUMBERLESS VARIETIES MAY RESULT FROM DIFFERENT MATERIALS AND METHODS OF REFINING. SOME TESTS FOR ASPHALTIC MATERIALS ARE INTENDED TO MEASURE CERTAIN QUALITIES DIRECTLY, OTHERS ARE IDENTIFICATION TESTS. FURTHER RESEARCH IS NECESSARY TO DETERMINE IN WHICH CATEGORY SOME TESTS BELONG. INVESTIGATION IS ALSO NEEDED TO DETERMINE IF TESTS INTENDED TO MEASURE QUALITY ACTUALLY DO SO. THERE IS EVIDENCE TO SHOW THAT DUCTILITY TESTS AND TESTS DESIGNED TO CONTROL SUSCEPTIBILITY TO TEMPERATURE CHANGES ARE NOT DIRECTLY RELATED TO SERVICE BEHAVIOR. A HIGH DEGREE OF DURABILITY IS VERY IMPORTANT AND LITTLE CONCERNING THIS QUALITY CAN BE FORETOLD FROM PRESENT TEST METHODS. FURTHER RESEARCH IS NEEDED TO DETERMINE HOW THE CHARACTERISTICS OF THE CRUDE OILS INFLUENCE THE QUALITY OF THE FINISHED PRODUCTS. CLOSELY ALLIED WITH THESE QUESTIONS ARE THE PROBLEMS WHICH ARISE FROM DIFFERENT METHODS OF REFINING, HEATING, MIXING AND PLACING ASPHALTIC MATERIALS ALTER THEIR CHARACTERISTICS. IT IS NECESSARY TO DETERMINE TO WHAT EXTENT SUCH CHANGES MAY BE PERMITTED WITHOUT DAMAGE TO THE QUALITY OF THE FINISHED PRODUCT. IT IS ALSO NECESSARY TO STUDY THE INTER RELATION BETWEEN ASPHALTIC MATERIALS, AND THE AGGREGATES. STUDY IS ALSO NEEDED ON NEW USES FOR BITUMINOUS MATERIALS SUCH AS STABILIZATION OF SOILS. WHEN THE DETAILS OF NEEDED RESEARCH ARE CONSIDERED THE PROBLEM BECOMES ENORMOUSLY COMPLEX. THE COMBINED EFFORTS OF ALL INTERESTED IN THE PRODUCTION AND USE OF THESE MATERIALS ARE REQUIRED IF RESULTS ARE TO BE ACHIEVED IN A REASONABLE LENGTH OF TIME. /AUTHOR/

Kelley, EF Crum, RW DISCUSSEER Lang, FC
DISCUSSEER Cattell, RA DISCUSSEER Campbell, LC
DISCUSSEER Boyd, JE DISCUSSEER Baskin, CM DISCUSSEER *Highway Research Board Proceedings* 1935

2A 202932

CONSTRUCTION MATERIALS IN DELTA AREAS

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Orr, DG Quick, JR *Photogrammetric Engineering* Apr. 1971

2A 202962

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Caiger, JH

Photogrammetria /Neth/ Vol. 25 No. 5/6, Apr. 1970, pp 151-76, 4 Fig, 2 Tab, 11 Phot, 17 Ref

2A 203120

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Piper, HW

Maryland University

ACKNOWLEDGMENT:

2A 203257

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Communications Ministry /Saudi Arabia/ Oct. 1967

2A 203345

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Delano, GH *Highway Research Board Bulletin* Nov. 1948

2A 203420

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Highway Research Board Special Reports 1954

2A 203440

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Perm Intl Assoc Road Congresses Proc 1967

2A 203480

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Smith, T Shirley, EC Smith, RE
California Dept Transportation Feb. 1970

2A 203502

THE APPLICABILITY OF A TERRAIN CLASSIFICATION AND EVALUATION SYSTEM TO ROAD AND MILITARY ENGINEERING PROBLEMS IN AUSTRALIA

FOLLOWING ATTEMPTS TO MODIFY EARLIER LAND CLASSIFICATIONS FOR ENGINEERING USE, THE PATTERN UNIT COMPONENT EVALUATION (PUCE) SYSTEM OF TERRAIN CLASSIFICATION HAS BEEN PROPOSED, BASED UPON EASILY RECONIZABLE AND DEFINABLE NATURAL FEATURES. THE SYSTEM RELATES ENGINEERING PROPERTIES TO THE TERRAIN AND ACTS AS A (1) BASE FOR THE VALID EXTRAPOLATION OF TERRAIN PROPERTIES FROM ONE AREA TO ANOTHER, AND (2) FILE INTO WHICH ALL KNOWLEDGE OF ENGINEERING SIGNIFICANCE CAN BE COLLATED, STORED AND RETRIEVED FOR FUTURE USE. THE CLASSIFICATION SYSTEM HAS FOUR LEVELS OF GENERALIZATION. VIZ. PROVINCE, TERRAIN PATTERN, TERRAIN UNIT, TERRAIN COMPONENT, ALL OF WHICH ARE DEFINED. A BASIC PREMISE OF THE SYSTEM IS THAT ONCE THE PROPERTIES OF ONE EXAMPLE OF ANY MEMBER OF A CLASS HAVE BEEN ESTABLISHED, THEN THOSE PROPERTIES REMAIN SIMILAR OVER ALL OCCURRENCES OF THAT MEMBER HENCE, WHILE THE TERRAIN REMAINS CONSISTENT, PREDICTION OF PROPERTIES CAN BE MADE ENGINEERING APPLICATIONS OF THIS PRINCIPLE MAY BE MANY AND VARIED. PREDICTION IN TERMS OF APPROPRIATE LEVEL IN THE CLASSIFICATION COULD BE MADE OF: ROUTE LOCATION, GRADE LINE LOCATION EARTHMOVING QUANTITIES, EARTHMOVING EQUIPMENT, BRIDGING AND CULVETTING FREQUENCIES BEHAVIOR OF NATURAL MATERIALS AS SUBGRADE, LOCATION OF NATURAL MATERIALS FOR USE AS PAVEMENT CONSTRUCTION MATERIALS, AND BEHAVIOR OF NATURAL MATERIALS AS PAVEMENT CONSTRUCTION MATERIALS. THE MILITARY ENGINEER MAY FACE SIMILAR PROBLEMS IN CONSTRUCTION OF THE MANY FACILITIES REQUIRED BY AN ARMY. IN ADDITION HE MUST MAKE AN ASSESSMENT OF THE TRAFFICABILITY OF THE NATURAL SURFACE. THE PUCE PROGRAMME OFFERS A BASIS FOR THE RECORDING AND EXTRAPOLATION OF EXPERIENCE OF GROUND MOBILITY ON LARGE AND SMALL AREAS OF TERRAIN. /AUTHOR/

Aitchison, GD Grant, K
Australian Road Research Board Paper No 452, 1968

2A 203569

RESEARCH STUDIES IN CONNECTION WITH DESIGN FEATURES OF THE FLORIDA TURNPIKE

THE 110-MILE, 4-LANE, LIMITED-ACCESS FLORIDA TURNPIKE WAS OPENED TO TRAFFIC ON 25 JANUARY 1957. THE DESIGN AND CONSTRUCTION OF THE FACILITY ENCOUNTERED A NUMBER OF MAJOR PROBLEMS. THESE PROBLEMS ARE OUTLINED, THEIR PECULIARITIES ARE RECORDED, AND THE STUDIES, EXPERIMENTATION, AND ANALYSIS ARE DESCRIBED ON WHICH RECOMMENDATIONS FOR POLICY DETERMINATION OF THE FLORIDA TURNPIKE AUTHORITY WERE BASED. THE PROBLEMS DISCUSSED ARE (1) A THICK LAYER OF OOLITIC LIMESTONE IN THE LOWER HALF OF THE HIGHWAY, (2) SEEPAGE OF FINE SAND THROUGH PRECAST-CONCRETE PIPE JOINTS, (4) DESIGN OF SIGN SUPPORTS TO WITHSTAND WINDS UP TO HURRICANE FORCE, (2) LOCATION OF MEDIAN SERVICE AREAS, AND (6) RIGHT-OF-WAY ACQUISITION.

Bergendoff, RN *Highway Research Board Proceedings* 1958

2A 203651

GEOTECHNICAL PROJECT AND QUALITY CONTROL OF HIGHWAY CONSTRUCTION IN AN ISLAND /IN PORTUGUESE/

THIS PROJECT CONCERNS THE BEHAVIOR OF PAVEMENTS CONSTRUCTED BY NON-STANDARD TECHNIQUES NECESSITATED BY DIFFICULTIES IN OBTAINING MATERIALS ON ITAPARICA ISLAND (BAHIA STATE). THE TWO METHODS EM-

PLOYED WERE THE USE OF FINE AGGREGATES AND CATIONIC EMULSIONS FOR COLD-MIX ASPHALT SURFACING AND THE APPLICATION OF TECHNIQUES TO AVOID THE INCONVENIENCES ASSOCIATED WITH THE USE OF 'MASSAPE' CLAYEY SOILS IN EARTHWORKS.

Tavares, NETO P
Road Research Institute /Brazil/ 1971

ACKNOWLEDGMENT: Road Research Institute /Brazil/

2A 203910

TUNNELLING ON THE NEW ROME METRO BETWEEN LARGO LOLLI ALBANI AND STAZIONE TERMINI

A DESCRIPTION IS GIVEN OF THE DESIGN AND CONSTRUCTION OF THE 10.3 KM EXTENSION TO THE UNDERGROUND RAILWAY IN ROME. THE EXTENSION CONSISTED OF 5.9 KM. OF DOUBLE-TRACK SUBSURFACE RAILWAY LINE, CONSTRUCTED BY THE CUT-AND-COVER METHOD, AND 4.4 KM. OF TWO SINGLE-TRACK TUNNELS EXCAVATED BY MECHANICAL SHIELDS. FOR ABOUT 2 KM., THE TUNNELS PASS THROUGH SOILS OF VOLCANIC ORIGIN, TUFF AND POZZOLANA, THEN AFTER CROSSING A TRANSITION ZONE OF DIFFERENT LAYERS, THROUGH A ZONE OF SANDY, SILTY OR SILTY-CLAYEY STRATA KNOWN AS "MAREMMANO". DETAILS ARE INCLUDED OF THE CONSTRUCTION METHODS AND EQUIPMENT USED FOR BORING AND LINING THE TUNNELS. /TRRL/

Berti, P Pamjn, JM *Tunnels & Tunnelling /UK/* Vol. 4 No. 5, Sept. 1972, pp 430-5, 5 Fig, 6 Phot

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

2A 204063

FIELD HYDROLOGY INVESTIGATIONS FOR RIVER CROSSINGS

A COMPREHENSIVE FIELD INVESTIGATION IS A NECESSARY PREREQUISITE TO THE CONSTRUCTION OF A BRIDGE AT A RIVER SITE. SUCH ASPECTS AS TERRAIN, SOIL TYPES, RIVER CHARACTERISTICS, DEGRADATION AND EROSION AND DEPOSITION MUST BE CONSIDERED. INFORMATION CAN BE GAINED BY EXAMINING EXISTING BRIDGES. THE FLOOD-WATER-LINE AS WELL AS ANY DAMAGE DUE TO ICE OR DEBRIS JAMS WILL BE EVIDENT. FURTHER INFORMATION MAY BE GATHERED FROM INTERVIEWS WITH LOCAL RESIDENTS WHO MAY BE AWARE OF A RIVERS PECULIARITIES WHICH ARE NOT EVIDENT FROM SOIL INVESTIGATIONS. AERIAL PHOTO-GRAMMETRY MAY ALSO BE AN ASSET IN DETERMINING A RIVERS FORMER BED OR CURRENT CHARACTERISTICS. /CGRA/RRL/

Harris, JD
Ontario Dept Hwys, Downsview /Canada/ 1965

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 204094

DISTRIBUTION OF SOIL PRESSURES ON CONCRETE PIPE

THE SOIL PRESSURES ON A 24-IN. OD CONCRETE PIPE BURIED IN A 6-FT WIDE BY 7-FT LONG BY 7-FT DEEP STEEL SOIL CONTAINER WERE MEASURED WITH 16 PRESSURE CELLS MOUNTED IN THE PIPE. LOADS WERE APPLIED TO THE SOIL SURFACE WITH A LARGE UNIVERSAL TESTING MACHINE. GRAPHICAL REPRESENTATIONS OF THE SOIL PRESSURE DISTRIBUTIONS ARE GIVEN FOR SIX DIFFERENT SUPPORT CONDITIONS AND SEVERAL CONCLUSIONS ARE DRAWN REGARDING THE SUPPORT CONDITIONS THAT PRODUCE THE MOST DESIRABLE PRESSURE DISTRIBUTIONS. THE PRESSURE DISTRIBUTIONS FOR SIX SPECIFIC BEDDING CONDITIONS REPRESENT A RANGE OF CONDITIONS THAT WILL BE USEFUL TO DEVELOP ANALYTICAL PRESSURE DISTRIBUTIONS FOR FIELD BEDDING CONDITIONS IF THE SOIL TYPES AND RELATIVE COMPRESSIBILITIES OF THE BEDDING AND FOUNDATION MATERIALS ARE CONSIDERED. /AUTHOR/

Pettibone, HC Howard, AK *Am Soc Civil Engr J Pipeline Div* July 1967

2A 204470

INVESTIGATION OF POROUS PAVEMENTS FOR URBAN RUNOFF CONTROL

LABORATORY STUDIES DEMONSTRATED THE TECHNOLOGICAL AND ECONOMIC FEASIBILITY OF OPEN-GRADED ASPHALT CONCRETE AS POROUS PAVEMENTS TO CONSERVE WATER, TO REDUCE LOADS ON COMBINED SEWERS AND TREATMENT PLANTS, AND TO MITIGATE URBAN RUNOFF AS A DESTRUCTIVE ENVIRONMENTAL FACTOR. LABORATORY STUDIES OF CANDIDATE MATERIALS REVEALED A POROUS ASPHALTIC CONCRETE CONTAINING 5.5% ASPHALT BY WEIGHT AND AGGREGATE GRADED TO ALLOW A WATER FLOW OF 76" PER HOUR TO BE THE OPTIMAL POROUS ROAD MATERIAL. MATERIALS TESTING FOR STABILITY, DURABILITY, AND FREEZE-THAW SUSCEPTIBILITY PROVED THIS MATERIAL SUITABLE FOR USE IN ROAD CONSTRUCTION. MAJOR DESIGN PARAMETERS CONSIDERED WERE THE LOAD-BEARING CAPACITY AND PERMEABILITY OF THE SUBGRADE, EXPECTED MAXIMUM PRECIPITATION AND DEPTH OF FROST PENETRATION.

Thelen, E
Franklin Institute Mar. 1972, 142 pp

2A 205046

STABLE SHOULDERS

THE FOLLOWING POINTS CONCERNING SHOULDERS SHOULD BE CONSIDERED WHENEVER A HIGHWAY DESIGN PLAN IS UNDER CONSIDERATION: (1) COST OF DIFFERENT TYPES OF SHOULDERS VARY OVER A CONSIDERABLE RANGE; (2) DEPENDENT UPON THE TYPE OF HIGHWAY, WHICH IS RELATED TO THE TRAFFIC LOADS, A GIVEN SHOULDER WILL PROVIDE ADEQUATE STABILITY AND BEST VALUE FOR MONEY EXPENDED; (3) STABILIZED TURF SHOULDERS HAVE A DEFINITE PLACE ON MODERN HIGHWAYS; (4) STABILIZED TURF COVERINGS; (5) STABILIZED TURF SHOULDERS ARE RELATIVELY ECONOMICAL TO CONSTRUCT AND TO MAINTAIN; (6) MORE INFORMATION IS NEEDED CONCERNING THE CAUSE OF BUILD-UP OF STABILIZED TURF SHOULDERS AND A SERIES OF TESTS, DESIGNED TO DETERMINE WHY BUILD-UP TAKES PLACE, IS OFFERED FOR CONSIDERATION. TYPICAL COST DATA ARE GIVEN FOR A NUMBER OF SHOULDER TYPES: ASPHALTIC CONCRETE, CEMENT-STABILIZED SOIL, BITUMINOUS STABILIZATION, IMPROVED STONE, GRAVEL, OILED SURFACES, AND TRANSITION STRIP (MODIFIED PANETRATION MACADAM). /AUTHOR/

Nikola, HC *Highway Res Bd Roadside Dev Com Reports* 1952

2A 205239

FACTORS INVOLVED IN THE USE OF HERBACEOUS PLANTS FOR EROSION CONTROL ON ROADWAYS

ROADWAY CONSTRUCTION ANNUALLY RESHAPES THOUSANDS OF ACRES OF LAND IN THE UNITED STATES. HIGH RATES OF SOIL LOSS AND RESULTING SEDIMENT YIELDS FROM CONSTRUCTION SITES HAVE CAUSED A SERIOUS EROSION PROBLEM. ALTHOUGH AN EXCELLENT JOB IS BEING DONE TO STABILIZE AND BEAUTIFY INTERSTATE AND PRIMARY HIGHWAYS, SECONDARY ROADS REMAIN A PROBLEM. NUMEROUS SOIL MATERIALS ARE BEING EXPOSED THAT COMMONLY HAVE PHYSICAL AND CHEMICAL PROPERTIES UNFAVORABLE TO PLANT GROWTH, THEREBY MAKING ROADWAY STABILIZATION DIFFICULT. THE BASIC PRINCIPLES FOR ESTABLISHING VEGETATION ARE PRESENTED ALONG WITH A RECOMMENDATION THAT, WHERE FEASIBLE, SLOPES STEEPER THAN 3:1 BE FLATTENED. VARIOUS PLANTING METHODS AND REQUIREMENTS FOR SELECTING PLANT SPECIES ARE DISCUSSED, EMPHASIZING THE NECESSITY FOR MULCHING AND MAINTAINING ESTABLISHED VEGETATION. /AUTHOR/

Turrelle, JW *Highway Research Board Special Reports* No. 135, 1973, pp 99-104, 1 Tab, 6 Ref

2A 205258

EROSION PREVENTION AND TURF ESTABLISHMENT MANUAL

THE MANUAL IS DIVIDED INTO THREE SECTIONS WHICH PERMIT EASY EXTRACTION OF MATERIAL PERTINENT TO EACH PHASE OF TURF ESTABLISHMENT. BACKGROUND INFORMATION IS PRESENTED IN THE SECTION ENTITLED "PHILOSOPHY OF EROSION PREVENTION". SPECIFIC INSTRUCTIONS FOR EACH AREA OF INTEREST ARE PROVIDED IN TWO SECTIONS DEALING WITH PRECONSTRUCTION AND CONSTRUCTION PROCEDURE. THE FORMER SECTION PROVIDES INFORMATION ON PRELIMINARY AND DETAIL DESIGN AND WILL BE OF INTEREST TO DISTRICT SOIL ENGINEERS AND MAINTENANCE PERSONNEL. THE IMPLEMENTATION AND USE OF EROSION PREVENTION AND TURF ESTABLISHMENT ITEMS ARE COVERED IN THE SECOND SECTION WHICH WOULD BE RELEVANT TO CONSTRUCTION AND MAINTENANCE PERSONNEL.

Foot, LE Kill, DL Bolland, AH
Minnesota Department of Highways 1970, 44 pp, 44 Fig, 7 Tab

2A 205299

FROST DESIGN PRACTICE IN CANADA-AND DISCUSSION

THIS PAPER DISCUSSES THE METHODS BEING USED BY CANADIAN HIGHWAY ENGINEERS TO COMBAT FROST ACTION. IT WAS COMPILED FROM INFORMATION SUPPLIED BY THE TWO FEDERAL AGENCIES CONCERNED WITH PAVEMENT DESIGN FOR ROADS AND AIRFIELDS AND THE HIGHWAY DEPARTMENTS OF THE PROVINCIAL GOVERNMENTS. A DESCRIPTION IS GIVEN OF THE VARIED CLIMATIC, SOIL, AND TRAFFIC CONDITIONS AND OF THE TYPE AND EXTENT OF FROST DAMAGE ENCOUNTERED. A SURVEY OF FROST DESIGN AND CONSTRUCTION PRACTICES FOR FLEXIBLE PAVEMENTS, RIGID PAVEMENTS, AND HIGHWAY STRUCTURES IS GIVEN. THE PRESENT STANDARDS OF FROST DESIGN PRACTICE ARE REVIEWED, AND PROBLEM AREAS REQUIRING RESEARCH ARE INDICATED. /AUTHOR/

Armstrong, MD Csathy, TI Burn, KN *Highway Research Record, Hwy Res Board* 1963

2A 205309

CONSTRUCTION TOLERANCES FOR CONCRETE IN HIGHWAY STRUCTURES

CONSTRUCTION TOLERANCES FOR CONCRETE NOW GENERALLY SPECIFIED OR RECOMMENDED IN VARIOUS DESIGN STANDARDS ARE DISCUSSED. THE NEED FOR NEW TOLERANCE CRITERIA, AND A BASIC APPROACH TO TOLERANCING AS A FUNCTION OF DESIGN, ARE PROPOSED, TAKING INTO ACCOUNT SERVICE REQUIREMENTS, STRUCTURAL INTEGRITY, AND APPEARANCE OF CONCRETE CONSTRUCTION.

Anderson, AR *Highway Research Record, Hwy Res Board* 1965

2A 205319

AIRPORT PAVING

THIS CIRCULAR GIVES AIRPORT PAVING GUIDANCE TO THE PUBLIC. THE PRINCIPLES DESCRIBED ARE ACCEPTABLE IN ACCOMPLISHING A PROJECT MEETING THE ELIGIBILITY REQUIREMENTS OF THE FEDERAL AID AIRPORT PROGRAM. DATA ARE PROVIDED FOR THE DESIGN AND CONSTRUCTION OF PAVEMENTS AT CIVIL AIRPORTS, INCORPORATING THE INFORMATION CONTAINED IN AC 150/5320-8 AND IN AIRPORT PAVING 1956 /AND THE 1962 REPRINT/. THE PRINCIPAL CHANGES LISTED ARE A/ NEW DESIGN CURVES FOR AIRCRAFT WEIGHING LESS THAN 30,000 POUNDS, B/ THE PORTION DEALING WITH REINFORCED CONCRETE IS EXPANDED, AND C/ A REDUCTION IN PAVEMENT THICKNESS IS RECOMMENDED WHEN CEMENT TREATED BASE COURSE IS USED.

Federal Aviation Administration /US/ June 1964

ACKNOWLEDGMENT: National Asphalt Pavement Association NAPA4076, 3C25017014

2A 205323

DESIGN, CONSTRUCTION AND PERFORMANCE OF ASPHALT AIRPORT PAVEMENTS

A DETAILED REVIEW OF CURRENT CANADIAN AIRPORT PRACTICE FOR /1/ FLEXIBLE PAVEMENT DESIGN, /2/ DESIGN CONSIDERATIONS INVOLVING /A/ ASPHALT CEMENT BINDER, /B/ AGGREGATE GRADING AND CHARACTERISTICS /C/ FILLER, /D/ ASPHALTIC CONCRETE MIXES WITH AND WITHOUT ASBESTOS FILLER, /E/ SPECIAL APPLICATIONS INVOLVING TAR EMULSION SLURRY SEAL, AND PLANT MIXED ASPHALTIC OVERLAYS, /3/ CONSTRUCTION PRACTICES INCLUDING MIXING, LAYING AND COMPACTION, AND /4/ EVALUATION OF THE PERFORMANCE OF ASPHALTIC CONCRETE AIRPORT SURFACES. TWO APPENDICES COVER CURRENT SPECIFICATIONS USED BY THE DEPARTMENT OF TRANSPORT. /NAPA/

Sebastyan, GY *Canadian Tech Asphalt Assoc Proc* Nov. 1964

NAPA4206, 4C25017074

2A 205333

CONCRETE OVERLAYS ON ASPHALT PAVEMENTS

DESIGN CRITERIA AND PERTINENT CONSTRUCTION DETAILS ARE PRESENTED ON THE USE OF CONCRETE OVERLAYS ON ASPHALT PAVEMENTS. SOME PROJECTS THAT HAVE BEEN BUILT ARE DESCRIBED AND INFORMATION ON THE PERFORMANCE OF SOME CONCRETE OVERLAYS IS PROVIDED.

Westall, WG *Highway Research News, Hwy Res Board* Feb. 1966

2A 205445

THE SELECTION AND USE OF FOREST ROAD BUILDING MATERIALS-A LITERATURE REVIEW

FIELD OBSERVATION OF SOME FOREST ROADS BY THE AUTHORS HAS PROVIDED SOME ADDITIONAL INFORMATION ON SOME SPECIFIC CONSTRUCTION AND MAINTENANCE PROBLEMS. THE AUTHORS NOTE THE READY AVAILABILITY OF PUBLISHED INFORMATION ON WELL ESTABLISHED PRINCIPLES OF ROAD CONSTRUCTION AND RECOMMEND ITS EXTENSION INTO THE CONSTRUCTION OF FOREST ROADS. THE AUTHORS ALSO RECOMMEND AN EVALUATION OF EXISTING ROADS TO DETERMINE THE PRACTICALITY AND MEANS OF IMPROVING THEM. THEY SUGGEST THAT BETTER USE OF EVEN INFERIOR MATERIALS CAN BE MADE THROUGH BETTER COMPACTION DRAINAGE, AND WITH SOME SOILS-STABILIZATING ADDITIVES. METHODS TO ALLEVIATE FROST ACTION ARE DISCUSSED. A MAJOR RECOMMENDATION IS THAT A DESIGN PROCEDURE FOR FOREST ROADS BE DEVELOPED. TO THIS END A SUGGESTED RESEARCH PROGRAM IS OUTLINED. /CGRA/

Mcfarlane, HW Paterson, WG Dohaney, WJ
Pulp & Paper Research Institute /Can/ Apr. 1968

ACKNOWLEDGMENT: Canadian Good Roads Association

2A 205502

LABORATORY TESTS WITH A HEAVY-DUTY ROLLING LOAD MACHINE

THIS PAPER DESCRIBES A HIGH-CAPACITY ROLLING LOAD TESTING MACHINE AND THE RESULTS OF TESTS PERFORMED WITH IT OVER THE LAST THREE YEARS AT WEST VIRGINIA UNIVERSITY. THE TESTING MACHINE IS BEING USED FOR THE EVALUATION OF BASECOURSE MATERIALS IN A SIMULATED HIGHWAY. CONSIDERABLE ECONOMY IN ROAD AND HIGHWAY CONSTRUCTION COULD BE REALIZED IN WEST VIRGINIA IF SOME CONSTRUCTION METHOD WERE DEVISED THAT WOULD UTILIZE THE STATE'S ABUNDANT AND WELL-DISTRIBUTED SUPPLY OF SANDSTONE. THE BEST EVALUATION WOULD COME FROM HIGHWAYS CONSTRUCTED OF SUCH MATERIALS, AN EVALUATION EXPENSIVE IN BOTH TIME AND MONEY. A PROPERLY DESIGNED ROLLING LOAD TESTING MACHINE, ALONG WITH A CAREFULLY PLANNED TESTING PROGRAM, MIGHT REDUCE THE COST IN BOTH

ASPECTS. OPINION AS TO THE USEFULNESS OF ROLLING LOAD MACHINES OR TEST TRACKS OVER THE PAST SEVERAL YEARS HAS BEEN DIVIDED. ONE MACHINE HAS BEEN ABANDONED WHILE ANOTHER VERY LARGE MACHINE HAS BEEN CONSTRUCTED RECENTLY AT WASHINGTON STATE UNIVERSITY. CIRCULAR TRACKS ARE IN USE AT THE UNIVERSITY OF ILLINOIS AND AT THE AMERICAN OIL COMPANY IN WHITING, INDIANA. /AUTHOR/

Haynes, RR Worrell, DT *Highway Research Record, Hwy Res Board*
1967

2A 205518

GENERAL HIGHWAY MATTERS-BELGIUM

A REVIEW IS PRESENTED OF RESULTS OBTAINED FROM RESEARCH FOR THE PERFECTING OF AN OBJECTIVE METHOD FOR THE DIMENSIONING OF HIGHWAYS. THE MULTI-LAYER ELASTIC AND VISCO-ELASTIC SYSTEMS ARE STUDIED. THE THEORETICAL AND EXPERIMENTAL RESULTS (PHOTOELASTICITY) OBTAINED, ALTHOUGH RESTING ON THE SIMPLIFIED HYPOTHESIS OF WORK (ELASTICITY AND LINEAR VISCOELASTICITY) PERMIT BETTER UNDERSTANDING OF THE MECHANICAL BEHAVIOR OF MULTI-LAYER SYSTEMS SUBMITTED TO THE ACTION OF EXTERNAL FORCES. THE PHYSICAL AND MECHANICAL PROPERTIES OF HIGHWAY MATERIALS ARE INFLUENCED BY SEASONAL CONDITIONS OF THESE PROPERTIES. THE STUDY OF EXPERIMENTAL HIGHWAYS HAS PERMITTED THE COMPARISON OF THE QUALITIES OF THE MATERIALS IN THE DIFFERENT FOUNDATIONS (STONE, COATED MATERIALS). THE STUDY ON EXPERIMENTAL HIGHWAYS ALSO PERMITTED ESTABLISHMENT OF CONCRETE SLABS AND OF AN EMPIRICAL FORMULA ON THE INFLUENCE OF THE NUMBER OF PASSAGES OF VEHICLES. RESEARCH HAS CONTRIBUTED THE COEFFICIENT OF FRICTION OR RUGOSITY AS A FUNCTION OF CERTAIN FACTORS: THE SPEED OF THE TEST WITH THE AGE OF THE SURFACINGS. A GOOD CORRELATION EXISTS BETWEEN THE PERCENTAGE OF VOIDS OF BITUMINOUS MACADAMS AND THE DARCY COEFFICIENT OF PERMEABILITY K IN CM/SEC. A METHOD OF MEASUREMENT IN SITU OF THE SPEED OF PERCOLATION HAS BEEN PERFECTED.

De, HENAU A Persoons, J Reichert, J Romain, J Verstraeten, J
Perm Intl Assoc Road Congresses Proc 1967

2A 205522

STRUCTURAL DESIGN OF FLEXIBLE PAVEMENTS EXPERIMENTAL RESEARCH PROGRAM IN MEXICO

AN EXPERIMENTAL RESEARCH PROGRAM IS CONDUCTED ON FLEXIBLE PAVEMENT THICKNESS DESIGN FOR LOW TRAFFIC HIGHWAYS IN MEXICO. RESEARCH IS CONDUCTED ON SPECIALLY CONSTRUCTED ROADS. THE THREE PROJECTS UNDER STUDY COMPRISE 20 DIFFERENT STRUCTURAL DESIGNS, AND A TOTAL OF 80 FIELD SECTIONS. THE MAIN VARIABLES ARE: (1) THICKNESS OF BASE COURSE, WITH 2 LEVELS (10 AND 20 CM) AND (2) THICKNESS OF SUBBASE COURSE, WITH 3 OR MORE LEVELS (0,10,20 AND 30 CM) DEPENDING ON THE PROJECT. THE EXISTING PAVEMENTS IN THE HIGHWAY NETWORK ARE STUDIED. THE FACTORIAL EXPERIMENT CONSISTS OF 9 PRIMARY CONTROL COMBINATIONS, EACH WITH 16 EXPERIMENTS, GIVING A TOTAL OF 144 SECTIONS FOR THE PERFORMANCE SURVEY. THE MAIN VARIABLES ARE: (1) CLIMATE, WITH 3 LEVELS: OPTICAL, STEPPE, AND SUBTROPICAL, AND (2) SUBGRADE STRENGTH, WITH THREE LEVELS: LOW, MEDIUM, AND HIGH. RESEARCH IS CONDUCTED ON PAVEMENT BEHAVIOR OF FIELD SECTIONS IN THE HIGHWAY NETWORK AND STUDY OF FULL-SCALE MODELS IN THE LABORATORY. A CIRCULAR TEST TRACK IS PLANNED FOR THE LATTER TEST. EXPERIMENTATION IS CONDUCTED WITH NON-DESTRUCTIVE TEST METHODS TO ESTIMATE PERFORMANCE. THE CHLOE PROFILOMETER HAS BEEN USED WITH SATISFACTORY RESULTS WHEN THE TEXAS FORMULA IS APPLIED TO DETERMINE PRESENT SERVICEABILITY INDEX. BENKELMAN BEAM REBOUND DEFLECTIONS ARE POOR INDI-

CATORS OF COMPOSITE STRENGTH IN THE STUDIED PAVEMENTS. REPEATED FIELD PLATE BEARING TESTS, USING A 30.5 CM DIAMETER RIGID PLATE ARE PROGRAMMED TO ESTIMATE THE BEHAVIOR OF PAVEMENTS AND TO OBTAIN QUALITATIVE INFORMATION BOTH ON COEFFICIENTS OF RELATIVE STRENGTH FOR PAVEMENT MATERIALS AND ON AXIAL LOAD EQUIVALENCY FACTORS FOR REGIONAL CONDITIONS. SOME OF THE MATHEMATICAL MODELS DEVELOPED BY THE AASHO ROAD TEST HAVE BEEN FOUND USEFUL FOR RESEARCH.

Caballero, SC Menchaca, LM *Permitt Assoc Road Congresses Proc* 1967

2A 205526

CALCULATION AND DESIGN OF FLEXIBLE PAVEMENTS-POLAND

IN THE CURRENT PRACTICE OF THE DESIGN OF PAVEMENT STRUCTURES, A FEW EMPIRICAL METHODS (PI/IBD, THE MODIFIED METHOD OF THE ASPHALT INSTITUTE AND THE METHOD OF ELASTIC DEFLECTIONS) ARE APPLIED. IN POLAND: THE STRENGTHENING OF FROST-DAMAGED PAVEMENTS IS, IN THE MAJORITY OF CASES, CARRIED OUT IN SUCH A MANNER AS TO INCREASE THE THICKNESS OF THE EXISTING STRUCTURE BY MEANS OF ASPHALTS OR STABILIZED BASE MATERIAL AND ASPHALT. IN ORDER TO MAKE THE METHODS FOR CALCULATING THE THICKNESS OF PAVEMENT STRUCTURES MORE ACCURATE, THERE IS A TENDENCY IN POLAND TOWARDS THE ESTABLISHMENT OF A METHOD OF DESIGN BASED ON THE MODULI OF ELASTICITY OF THE SOIL AND OF THE MATERIALS OF CONSTRUCTION, WHILE AT THE SAME TIME TAKING INTO ACCOUNT, IN THE CONSTRUCTION OF FLEXIBLE PAVEMENTS, THE DISTRIBUTION OF THE TENSILE AND SHEAR STRESSES. DATA PRESENTED DEMONSTRATE THAT THE REPRODUCTION OF A CONCRETE ROAD OR AIRFIELD RUNWAY ON A GREATLY REDUCED SCALE CAN BE CARRIED OUT BY SIMPLIFYING THE PROBLEM SO THAT IT IS REDUCED TO A 2-COURSE SYSTEM, KNOWN AS A SLAB RESTING ON AN ELASTIC SUBGRADE. IN THAT CASE, THE MODEL OF THE PAVEMENT WILL BE THE RESULT OF ACCEPTING A THEORETICAL SYSTEM FOR THE SLAB AND THE SUB-GRADE BASED ON THE FINDINGS OF THE THEORY AND THE CONTENT OF THE HYPOTHESES DETERMINING THE SHARE OF THE SUB-GRADE IN THE OPERATION OF THE STRATIFIED SYSTEM. DURING THE REPRODUCTION OF THE METHOD OF BRINGING ABOUT THE DEFLECTION OF THE SLAB, TERMED INFINITE, WITHIN THE LIMITS OF THE ELASTIC DEFORMATIONS OF THE SLAB AND THE SUB-GRADE, BETTER CONFORMITY WITH ACTUAL CONDITIONS WAS OBTAINED FOR TESTS ON MODELS CONDUCTED IN ACCORDANCE WITH THE FIRST SYSTEM, THAT IS TO SAY, IN ACCORDANCE WITH WINKLER'S PRINCIPLES FOR THE THEORETICAL MODEL OF THE SUB-GRADE. THE ESTIMATION OF THE ELASTICITY CHARACTERISTICS OF THE MODEL OF THE SUB-GRADE BY ITS DETERMINATION AS A VALUE OF THE RIGIDITY RADIUS CONSTITUTES A CONSIDERABLE SIMPLIFICATION OF THE MODEL TESTS ON SLABS RESTING ON AN ELASTIC SUB-GRADE ACCORDING TO WINKLER.

Wojciechowski, H *Perm Intl Assoc Road Congresses Proc* 1967

2A 205527

GENERAL HIGHWAY MATTERS-ITALY

THE PRINCIPLES FOR THE DESIGN OF ROADS AND HIGHWAYS ARE IN AN EVOLUTIONARY STAGE IN ITALY. THE AASHO EXPERIMENTS HAVE PERMITTED HIGHWAY ADMINISTRATIONS TO DRAW CONCLUSIONS FOR DESIGN AND CONSTRUCTION OF THE ROAD. MOST SUPERSTRUCTURES OF ROADS AND HIGHWAYS ARE OF A FLEXIBLE TYPE, THE THICKNESS OF WHICH IS DETERMINED BY THE CBR METHOD AND CORRESPONDING GRAPHS. EMPIRICAL AND THEORETICAL METHODS SUCH AS THAT OF IVANOV AND MEASUREMENT BY DEFLECTOMETER ARE ALSO USED. RIGID HIGHWAYS, EXCEPT AT AIRPORTS AND MILITARY AIRPORTS ARE SELDOM USED IN ITALY. NUMEROUS SERIES OF RUGOSITY MEASURE-

MENTS OF STATE ROADS WERE CONDUCTED TO AID RESEARCH INTO THE CAUSES OF THE DIVERSITY OF VALUES ON THE SAME TYPE OF HIGHWAYS AND THEIR VARIATIONS WITH TIME AND TEMPERATURE. A PROFILOMETER WAS BUILT FOR RECORDING THE TRANSVERSE PROFILE OF THE HIGHWAY. A DRAINAGE METHOD IS DESCRIBED IN SOIL CONSISTING OF PEAT AND OTHER ORGANIC SUBSTANCES WHERE THE CREATION OF HOLES 42 CM IN DIAMETER FILLED WITH SAND AND THEN COVERED WITH A LAYER OF SAND HAS PERMITTED SUB-SOIL WATER TO MOVE TO THE SURFACE BY CAPILLARITY WHERE IT IS THEN COLLECTED INTO DITCHES. ANOTHER DRAINAGE METHOD FOR THE CONSOLIDATION AND STABILIZATION OF SLIP MOVEMENTS BY INDIVIDUAL DRAINING SPURE IN THE FORM OF AN A IS DESCRIBED. THE CONSTRUCTION OF THE ITALIAN MOTORWAY NETWORK HAS REQUIRED SPECIAL WINTER MAINTENANCE ON THE HIGHWAYS. RESEARCH IS CONDUCTED: (1) TO AVOID BY PREVENTATIVE MEANS, THE FORMATION OF ICE ON THE ROADS SURFACE, (2) TO MAINTAIN THE CARRIAGEWAY FREE FROM SNOW, AND (3) TO OBTAIN BEHAVIOR APPROPRIATE TO THE METEOROLOGICAL SITUATION AT THE TIME FROM THE USERS. THESE FIRST DEMANDS WERE ACHIEVED WITH CHEMICAL SOLVENTS (SODIUM CHLORIDE AND CALCIUM CHLORIDE) SPREAD ON THE HIGHWAY BEFORE THE FORMATION OF FROST OR ICING. THE SECOND WAS ACCOMPLISHED BY THE CONTINUOUS CLEARING OF THE SNOW BY MECHANICAL MEANS, AND THE THIRD BY A SPECIAL SIGNAL SYSTEM AND THE DISTRIBUTION OF INFORMATIVE LEAFLETS AT THE POINTS OF ENTRY. TO AVOID BUMPS FOR MOTOR VEHICLES PASSING FROM THE LEVEL OF A BRIDGE TO THE LEVEL OF THE ORDINARY ROAD SURFACE, STUDIES FOLLOWED BY EXPERIMENTAL RESEARCH WERE CARRIED OUT AND A SPECIAL NEOPRENE JOINT WAS OBTAINED.

Colabich, GF *Perm Intl Assoc Road Congresses Proc* 1967

2A 205528

GENERAL HIGHWAY MATTERS-INDIA

IN INDIA, RIGID PAVEMENT DESIGN IS GENERALLY BASED ON WESTERGAARD AND THOMLINSON ANALYSES FOR LOAD AND TEMPERATURE STRESSES RESPECTIVELY, OR ON THE PICKETTS' CORNER FORMULA. WHERE THE NECESSARY TESTING FACILITIES ARE NOT AVAILABLE, AD-HOC THICKNESSES AS TENTATIVELY RECOMMENDED BY THE INDIAN ROADS CONGRESS ARE USED. A NEW METHOD OF DESIGN BASED ON ULTIMATE LOAD THEORY HAS BEEN FORMULATED, AND NEW TYPES OF CONSTRUCTION AIMED AT REDUCING THE PAVEMENT COST, SUCH AS BRICK-SANDWICHED CONCRETE PAVEMENTS, LIME-PUZZOLANA CONCRETE UNDERLAYS FOR CONCRETE PAVEMENTS AND BAMBOO-REINFORCED SOIL CEMENT UNDERLAYS FOR CONCRETE AND FLEXIBLE PAVEMENTS, HAVE BEEN EVOLVED. WHILE THE DESIGN OF FLEXIBLE PAVEMENTS IS BASED ON THE C.B.R. DESIGN CURVES OF ROAD RESEARCH LABORATORY, U.K., THE CURRENT TREND IS TO BASE THE DESIGN ON THE C.B.R. VALUES DETERMINED AT THE WORST EXPECTED MOISTURE CONTENT AS FAR AS POSSIBLE AND NOT AT SATURATION. EMPHASIS HAS BEEN PLACED ON THE USE OF COMPACTED SOIL IN LOWER LAYERS OF THE PAVEMENT, AND MEHRA'S METHOD OF SOIL STABILIZATION HAS BEEN SUCCESSFULLY UTILIZED ON AN INCREASINGLY LARGE SCALE. WORK HAS ALSO BEEN UNDERTAKEN TO ESTABLISH THICKNESS EQUIVALENCY FACTORS FOR DIFFERENT ROAD CONSTRUCTION MATERIALS, BASED ON THEIR LOAD DISPERSION CHARACTERISTICS, AND DETERMINATION OF DESIGN WHEEL LOADS FOR DIFFERENT CATEGORIES OF ROADS. EXPERIMENTAL WORK IS IN PROGRESS, WITH REGARD TO THE PROVISION OF OVERLAYS FOR STRENGTHENING EXISTING THIN CONCRETE PAVEMENTS AND A METHOD OF DESIGN FOR WATERBOUND MACADAM OVERLAYS WITH THIN BITUMINOUS SURFACINGS HAS BEEN EVOLVED FOR ROADS CARRYING MEDIUM TRAFFIC. THE GENERAL ORDER OF RIDING QUALITY ON DIFFERENT TYPES OF ROADS IN INDIA IS ENUMERATED. GENERAL MAINTEN-

NANCE PRACTICES ADOPTED IN INDIA ARE DESCRIBED.
/AUTHOR/

Mehra, SR *Perm Intl Assoc Road Congresses Proc* 1967

2A 205563

DEVELOPMENTS IN THE APPLICATION IN PRACTICE OF A FUNDAMENTAL PROCEDURE FOR THE DESIGN OF FLEXIBLE PAVEMENTS

THE EVALUATION OF EXISTING PAVEMENTS AND THE DESIGN OF AIRFIELD PAVEMENTS ARE BRIEFLY DISCUSSED FROM THE POINT OF VIEW OF A FUNDAMENTAL DESIGN APPROACH. THE DEVELOPMENT AND THE VALIDITY OF THE APPROACH ARE DISCUSSED IN THE LIGHT OF SUBSEQUENT LABORATORY AND FIELD INVESTIGATIONS. A NEW COMPUTER PROGRAM WHICH GIVES THE PRINCIPAL STRESSES AND STRAINS AT ANY POINT WITHIN A MULTI-LAYER ELASTIC SYSTEM PERMITS CONSIDERATION TO BE GIVEN TO THE INFLUENCE OF MULTI-WHEEL ASSEMBLIES AND TO THE SHEAR STRESSES IN THE VARIOUS STRUCTURAL LAYERS UNDER LOAD. TRENDS, DEDUCED USING ELASTIC THEORY, FOR SURFACE DEFLECTIONS AND THE STRESS DISTRIBUTION IN COMPOSITE CONSTRUCTIONS (INCORPORATING CEMENT BOUND BASE LAYERS) ARE BRIEFLY DISCUSSED. THE FUNDAMENTAL DESIGN APPROACH IS DEFINED AS A PROCEDURE IN WHICH THE THEORETICAL STRESS DISTRIBUTION IN ELASTIC LAYERED SYSTEMS AND THE IN-SITU DYNAMIC PROPERTIES OF THE CONSTRUCTION MATERIALS ARE APPLIED TO THE DESIGN OF PRACTICAL ROAD STRUCTURES. THE DESIGN OF A STRUCTURE IS CARRIED OUT BY SELECTING SUITABLE THICKNESSES OF ASPHALT AND UNBOUND GRANULAR MATERIALS SO THAT, UNDER THE DESIGN LOAD, THE CRITICAL STRESSES OR STRAINS DO NOT EXCEED PERMISSIBLE VALUES FOR THE DIFFERENT MATERIALS. THE IN-SITU DYNAMIC MODULI OF THE CONSTRUCTION MATERIALS, AND THE STRESSES OR STRAINS THAT CAN BE PERMITTED TO DEVELOP WITHIN THEM MUST BE KNOWN IN ORDER TO DO THIS. DISCUSSIONS ARE PRESENTED ON DESIGN CURVES FOR SPECIFIED LIFE OF MIXED TRAFFIC LOADINGS, APPLICABILITY OF ELASTIC THEORY TO ROAD BEHAVIOR AND GENERAL COMMENTS ON DESIGN. THE DISCUSSIONS PRESENTED ON A VARIETY OF ASPECTS OF FLEXIBLE PAVEMENT DESIGN SERVE TO ILLUSTRATE THE COMPLEXITY OF THE PROBLEMS WHICH REMAIN TO BE OVERCOME. THE ELASTIC THEORY EMPLOYED DOES NOT WHOLLY REPRESENT THE BEHAVIOR OF THE MATERIALS USED, YET IT PERMITS RATIONAL GUIDELINES TO BE DEVELOPED. MODIFICATIONS ARE NEEDED CONCERNED WITH THE MAXIMUM SHEAR STRESSES DEVELOPED AT ANY POINT IN THE STRUCTURE. THE MINIMUM SHEAR STRENGTH THEORETICALLY REQUIRED AT ANY POINT IN THE UNBOUND GRANULAR LAYERS CAN NOW BE CALCULATED AND DESIGN CURVES SHOULD BE EXTENDED TO COVER THIS ASPECT.

Dormon, GM Edwards, JM *Intl Conf Struct Design Asphalt Pvmts* Aug. 1967

2A 205570

APPENDIX I TO TECHNICAL COMMITTEE ON TESTING OF ROAD MATERIALS

THE CONCEPT OF COEFFICIENT OF STRENGTHENING AND STRENGTH CAPACITY IS ANALYZED. AN EQUATION IS INTRODUCED SHOWING THAT THE THICKNESS OF A LAYER OF COATED MATERIAL FOR STRENGTHENING A PAVEMENT IS RELATED TO THE REDUCTION IN DEFLECTION OF A PAVEMENT. AN EQUATION IS GIVEN FOR THE STRENGTHENING CAPACITY. A RELATIONSHIP IS GIVEN OF THE MODULI OF DEFORMATION IN DOUBLE LAYER DESIGN. THE CONCEPT OF STRENGTHENING CAPACITY CAN BE APPLIED TO OTHER MATERIALS TREATED IN THE SAME WAY AS THE CEMENT STABILIZED GRAVELS OR GRAVEL-SLAG MIXES. A RELATIONSHIP HAS NOT BEEN FOUND BETWEEN THE STRENGTHENING CAPACITY OF THE GRAVEL-SLAG MIXES, WHICH IS MUCH GREATER THAN THE STRENGTHENING CAPACITY OF COATED MATERIALS.

Perm Intl Assoc Road Congresses Bull 1967

2A 205597

THE INCORPORATION OF DECOMPOSED GRANITE IN THE DESIGN AND CONSTRUCTION OF PAVEMENTS IN HONG KONG

THE DESIGN AND CONSTRUCTION OF ROADS AND AIRFIELDS USING STABILIZED DECOMPOSED GRANITE ARE DESCRIBED. INCLUDED IS A TAXI-TRACK AT KAI TAK WHERE DECOMPOSED GRANITE WAS TREATED WITH 12% CEMENT. EXCELLENT COMPRESSIVE STRENGTHS OF LABORATORY AND FIELD SPECIMENS WERE OBTAINED.

Henry, JK Grace, H *Soil Mechanics & Foundation Engineering* June 1948

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 205627

CALCULATION OF ELASTIC DEFORMATIONS OF PAVEMENTS BUILT ON PEAT /IN RUSSIAN/

DATA ARE PRESENTED ON ELASTIC DEFORMATIONS OCCURRING IN ROADS BUILT ON PEAT. OBSERVATIONS WERE CARRIED OUT UNDER VARIOUS WEATHER AND CLIMATIC CONDITIONS. MAXIMA ELASTIC DEFORMATIONS OCCURRED IN THE AUTUMN. THE MAGNITUDE OF THE DEFORMATIONS DEPENDS ON THE THICKNESS OF THE SURFACING AND SUBGRADE AND ON THE PHYSICO-MECHANICAL PROPERTIES OF THE PEAT. MODULI OF ELASTICITY WERE DETERMINED FOR DIFFERENT KINDS OF PEAT; THE ELASTIC MODULUS VARIES VERY LITTLE WITH THE COMPOSITION AND NATURE OF THE PEAT, BUT IS DETERMINED BY ITS DENSITY AND MOISTURE CONTENT. IT WAS SHOWN THAT THE ELASTIC THEORY COULD BE APPLIED TO THE CALCULATION OF ELASTIC DEFORMATIONS OF ROAD STRUCTURES BUILT ON PEAT. /LCPC/RRL/

Segerkrants, VM
Tallin Polytech Inst Proc /Ussr/ 1967

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 205648

PAVEMENT DESIGN CONCEPT FOR TROPICAL COUNTRIES /IN FRENCH/

THE ARTICLE STRESSES THE DIFFERENCES BETWEEN TROPICAL AND TEMPERATE ENVIRONMENTAL FACTORS AND THEIR INFLUENCE ON ROAD CONSTRUCTION AND MAINTENANCE. THE THREE MAIN PHASES OF TROPICAL PAVEMENT DESIGN ARE REVIEWED: (1) FROM 1950 TO 1955, TWO MAIN TECHNIQUES WERE USED: MACADAM AND BITUMEN-STABILIZED SOIL. THE PERFORMANCE OF BOTH MATERIALS PROVED SATISFACTORY; (2) FROM 1955 TO 1964, LOCAL MATERIALS, ESPECIALLY LATERITIC GRAVEL, WERE UTILIZED; (3) THE PRESENT PHASE IS CHARACTERIZED BY AN INCREASE IN TRAFFIC AND THE USE OF MORE COSTLY TECHNIQUES: GRAVEL STABILIZED WITH CEMENT, CRUSHER MATERIAL, AND GRAVEL-BITUMEN. NEW TRENDS ARE DEFINED AND ATTENTION IS DRAWN TO THE NEED FOR FURTHER RESEARCH INTO THE DEVELOPMENT OF NEW TEST METHODS TO SIMULATE REAL TRAFFIC CONDITIONS, THE ADOPTION OF NEW QUALITY CRITERIA FOR SECONDARY ROADS, MORE DETAILED TRAFFIC STUDIES, AND SURVEILLANCE AND MAINTENANCE OF CARRIAGEWAYS. /TRRL/

Liautaud, GA *Ann Inst Tech Batiment Trav Publ /Fr/* No. 281, May 1971, pp 137-62, Figs, Photos

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

2A 205662

A METHOD FOR THE DESIGN OF MULTIPLE SURFACE TREATMENTS BASED ON THE RESULTS OF THREE ROAD SURFACING EXPERIMENTS

A SERIES OF ROAD EXPERIMENTS WERE CARRIED OUT IN DIFFERENT CLIMATIC AREAS ON ROADS CARRYING DIFFER-

ENT AMOUNTS OF TRAFFIC TO COMPARE THE DIFFERENT METHODS OF SURFACE TREATMENT COMMONLY IN USE UNDER PROPERLY CONTROLLED CONDITIONS. ONCE THE RELATIVE PERFORMANCE WAS ESTABLISHED THIS WOULD ENABLE THE MOST ECONOMICAL METHOD TO BE USED IN PRACTICE FOR A PARTICULAR SET OF CIRCUMSTANCES. THREE EXPERIMENTS ARE CONSTRUCTED ON ROADS CARRYING BETWEEN 250 AND 1000 VEHICLES/DAY. THE METHODS INVESTIGATED INCLUDED SINGLE, DOUBLE AND TRIPLE SURFACE TREATMENTS AND SEVERAL VARIATIONS OF THE WELL KNOWN 'CAPE SEAL' METHOD INCLUDING THE USE OF SLURRY SEAL. THE PERFORMANCE OF THE DIFFERENT METHODS TESTED IN THE THREE EXPERIMENTS AFTER PERIODS VARYING BETWEEN 4 1/2 AND 8 YEARS AFTER CONSTRUCTION. THE RESULTS INDICATED THAT THE PERFORMANCE CAN BE RELATED TO THE BINDER-AGGREGATE RATIO AND THE SPREAD OF DATA OBTAINED ENABLED DESIGN CURVES TO BE DRAWN FOR ROADS CARRYING BETWEEN 250 AND 1000 VEHICLES/DAY. IT SEEMS THAT A NUMBER OF THE DOUBLE AND TRIPLE SURFACE-TREATMENT SPECIFICATIONS USED IN THE PAST HAVE NOT INCORPORATED SUFFICIENT BINDER FOR OPTIMUM DURABILITY, AND OTHER SPECIFICATIONS ARE SUSCEPTIBLE TO FATIGUE UP. SOME RELATIVE COSTS OF CONSTRUCTION ARE GIVEN FOR THE DIFFERENT METHODS TESTED IN TWO OF THE EXPERIMENTS. THE MORE EXPENSIVE METHODS HAVE NOT NECESSARILY PERFORMED BETTER THAN CHEAPER METHODS. THIS INDICATES THE IMPORTANCE OF SELECTING THE BEST METHOD FOR GIVEN CONDITIONS IN PRACTICE AND ALSO THAT CAREFUL ATTENTION TO DESIGN IS NECESSARY. /RRL(A)/

Walker, RN
Conf Asphalt Pavements Proc /S Africa/

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 205668

DESIGN CONSIDERATIONS FOR ASPHALT PAVEMENTS
PAVEMENT DESIGN WITHIN A SYSTEMS FRAMEWORK IS CONSIDERED. THE OUTLINES FOR A NUMBER OF SUBSYSTEMS WHICH CAN BE DEVELOPED TO EXAMINE SPECIFIC DISTRESS MODES INCLUDE: FATIGUE IN THE ASPHALT BOUND LAYER (RUPTURE), PERMANENT DEFORMATION IN THE PAVEMENT STRUCTURE (DISTORTION), AND FRACTURE DUE TO STRESSES RESULTING FROM BRAKING AND ACCELERATION (RUPTURE) OR DUE TO THERMAL STRESSES (RUPTURE). RESISTANCE TO RUPTURE CAUSED BY FATIGUE AND BY BRAKING AND ACCELERATING STRESSES AND RESISTANCE TO PERMANENT DEFORMATION ARE EXAMINED IN SOME DETAIL. THE INFLUENCE OF MIXTURE VARIABLES ON THESE LOADING SITUATIONS IS SUMMARIZED, WITH EMPHASIS PLACED ON MIXTURE STIFFNESS, FATIGUE RESISTANCE, FRACTURE CHARACTERISTICS, AND RESISTANCE TO PERMANENT DEFORMATION, ALTHOUGH OTHER MIX CHARACTERISTICS SUCH AS THERMAL PROPERTIES AND DURABILITY CHARACTERISTICS ARE BRIEFLY SUMMARIZED, SINCE THESE DATA ENTER INTO THE SOLUTION OF THE SYSTEMS WHICH HAVE BEEN FORMULATED. ASPHALT MIXTURE DESIGN MUST BE RELATED TO ITS ROLE IN THE OVERALL PAVEMENT STRUCTURE SINCE THE OTHER COMPONENTS OF THE STRUCTURE HAVE A SIGNIFICANT INFLUENCE ON THE RESPONSE OF THE MIXTURE TO THE INPUT VARIABLES SUCH AS LOADING AND ENVIRONMENT. THE EFFECTS OF CONSTRUCTION ARE CONSIDERED, AND IT IS EMPHASIZED THAT CAREFUL ATTENTION MUST BE GIVEN TO PLACEMENT OF THE ASPHALT MIXTURE TO ENSURE THAT IT WILL FULFILL ITS ROLE IN CONTRIBUTING TO PROPER PAVEMENT PERFORMANCE. FINALLY, A BRIEF DESIGN EXAMPLE IS PRESENTED ILLUSTRATING USE OF A WORKING SUBSYSTEM TO CONSIDER THE FATIGUE MODE OF DISTRESS FOR A THICK ASPHALT CONCRETE PAVEMENT SECTION. AVAILABLE THEORY IS USED WHERE POSSIBLE TO ASSIST IN THE ANALYSIS OF MIXTURES AND PAVEMENT STRUCTURES TO BOTH THE EFFECTS OF TRAFFIC LOADING AND ENVIRONMENT. /RRL(A)/

Monismith, CL
Conf Asphalt Pavements Proc /S Africa/

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 205681

DESIGN AND CONSTRUCTION OF AIRCRAFT PAVEMENTS IN UNUSUAL CONDITIONS

THIS PAPER DEALS WITH THE CONSTRUCTION OF AIRFIELD PAVEMENTS OVER DEEP DEPOSITS OF SOFT, COMPRESSIBLE SOILS AND OVER SUBGRADES COMPOSED OF EXPANSIVE SOILS AND SOILS VARYING IN ENGINEERING PROPERTIES AND DISTRIBUTION. SOME OF THE PROBLEMS ENCOUNTERED IN THESE CIRCUMSTANCES ARE DESCRIBED AND ILLUSTRATIVE EXAMPLES OF SOLUTIONS ADOPTED IN THE PAST ARE QUOTED FOR SOME OF THE AIRFIELD PROJECTS WITH WHICH THE AUTHORS HAVE BEEN ASSOCIATED. /TRRL/

Spencer, FW Holt, JK *Inst Civil Engineers Proc, London /UK/ 1971*

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

2A 205731

DESIGN OF PAVEMENTS USING DEFLECTION EQUATIONS FROM AASHO ROAD TEST RESULTS

THE STRUCTURAL PERFORMANCE WAS INVESTIGATED OF SOME SATELLITE PAVEMENTS IN THE PIEDMONT REGION OF VIRGINIA AND THICKNESS EQUIVALENCY VALUES WERE EVALUATED OF MATERIALS USED ON THE BASIS OF AASHO ROAD TEST RESULTS. MODEL EQUATIONS SUGGESTED BY THE AASHO ROAD TEST COMMITTEE FOR DESIGNING PAVEMENTS INVOLVE VARIABLES WHICH COULD NOT BE APPLIED TO VIRGINIA BECAUSE OF DIFFERENCES IN: (1) CONSTRUCTION TECHNIQUES, (2) TYPE OF MATERIALS USED, (3) SUBGRADE PROPERTIES, (4) ENVIRONMENTAL CONDITIONS, (5) TYPE AND DURATION OF TRAFFIC, AND (6) AGE OF PAVEMENT. TWENTY PROJECTS WITH VARYING PAVEMENT STRUCTURES WERE CHOSEN FOR STUDY TO EVALUATE THE THICKNESS EQUIVALENCY VALUES OF THE DIFFERENT MATERIALS IN THE PAVEMENTS' SYSTEMS, AND TO CORRELATE THESE VALUES WITH THE PAVEMENT PERFORMANCE ALONG WITH THE VARIABLES OF SOIL SUPPORT, TRAFFIC, AND AGE. CONCLUSIONS OF THE INVESTIGATION INDICATE THAT: (1) THE STRUCTURAL PERFORMANCE OF THE PAVEMENTS CAN BE EVALUATED FROM REBOUND DEFLECTION OR CURVATURE, OR LONGITUDINAL CROSS-SECTIONAL AREA OF THE DEFLECTED BASIN, OBTAINED FROM THE BENKELMAN BEAM DATA, (2) SUBGRADE SOIL STRENGTH, WHEN DETERMINED BY THE VIRGINIA CBR METHOD CANNOT BE CORRELATED WITH SUBGRADE SOIL SUPPORT VALUES GIVEN BY THE AASHO COMMITTEE, (3) ASSUMING THICKNESS EQUIVALENCY VALUE OF ASPHALTIC CONCRETE AS EQUAL TO 1.0, THICKNESS EQUIVALENCY VALUES COULD BE CONSIDERED FOR DESIGN IN VIRGINIA WITH THE LAYERS PLACED IN THE ORDER DESCRIBED, (4) THE TOLERABLE DEFLECTION OF A PAVEMENT IS A FUNCTION OF ITS RIGIDITY, AND (5) THE METHOD USED IN VIRGINIA IS SUITABLE FOR DESIGN BUT COULD BE MADE MORE FLEXIBLE USING A NOMOGRAPH FOR THICKNESS INDEX DETERMINATION AND A DESIGN BASED ON THICKNESS EQUIVALENCY VALUES.

Vaswani, NK *Highway Research Record, Hwy Res Board 1968*

2A 205748

CONDITION SURVEYS USED IN OKLAHOMA TO EVALUATE FLEXIBLE PAVEMENT DESIGN

THE PROCEDURE IS OUTLINED FOR MAKING FLEXIBLE PAVEMENT CONDITION SURVEYS AND ITS USE IN EVALUATING THE FLEXIBLE PAVEMENT DESIGN OF THE OKLAHOMA HIGHWAY DEPARTMENT. THE FLEXIBLE PAVEMENT DESIGN WAS ADOPTED IN 1947. THE THICKNESS DESIGN USES CALIFORNIA BEARING RATIO CURVES. THE TESTING PROGRAM TO EVALUATE THE PERFORMANCE OF THE PAVEMENT COLLECTED DATA ON THE FOLLOWING CLASSES: (1) CONSTRUCTION SUCH AS TYPICAL PAVEMENT SECTION, TYPE OF CONSTRUCTION,

AND QUALITY TESTS OF MATERIALS MADE DURING CONSTRUCTION, (2) OTHER EXISTING DATA WHICH INCLUDED GEOLOGY, WEATHER, ORIGINAL SOIL SURVEYS, TRAFFIC DATA, AND MAINTENANCE COSTS, (3) FIELD DATA WHICH INCLUDED CONDITIONING SURVEYS OF THE PAVEMENT STRUCTURE, ROUGHOMETER SURVEYS, FIELD CHECKS OF THE ORIGINAL SOIL SURVEYS, AND PEDOLOGICAL SOIL SURVEYS, (4) FIELD TESTS INCLUDING PLATE BEARING TESTS, BENKELMAN BEAM DEFLECTION TESTS, FIELD CALIFORNIA BEARING RATIO TESTS, DENSITY TESTS, MOISTURE TESTS, AND THE TAKING OF SAMPLES FOR LABORATORY TESTING, AND (5) LABORATORY TESTS WHICH INCLUDED ROUTINE LABORATORY TESTING TO DETERMINE WHETHER FIELD SAMPLES CONFORMED TO SPECIFICATIONS FOR THE SUB-BASE, BASE, AND SURFACE COURSES. MAINTENANCE COSTS PER MILE WERE CALCULATED. THE DEPRECIATION PER MILE PER YEAR OF THE PAVEMENT STRUCTURE WAS USED AS A BASIC FACTOR IN THE STUDY TO DETERMINE THE RELATIONSHIP AND EFFECT OF THE FOLLOWING: (1) LOAD SUPPORTING ABILITY OF THE PAVEMENT STRUCTURE AS DETERMINED BY PLATE BEARING TESTS AND BENKELMAN BEAM DEFLECTION TESTS, (2) THICKNESS OF THE 'AS BUILT' PAVEMENT STRUCTURE, (3) TRAFFIC AND WHEEL-LOAD DENSITIES, (4) SOIL AND GEOLOGICAL EXTENTS, (5) CLIMATIC CONDITIONS, (6) QUALITY OF SUBBASE, BASE, AND SURFACE COURSES OF THE PAVEMENT STRUCTURE, (7) THE ORIGINAL CONSTRUCTION COSTS OF THE PAVEMENT STRUCTURE, AND (8) THE MAINTENANCE COST SINCE COMPLETION OF THE PAVEMENT STRUCTURE. A RAPID DEPRECIATION RATE WAS FOUND INDICATING THAT THE PAVEMENT STRUCTURE WAS UNDESIGNED FOR THE POOREST SOIL TYPES AND RESULTED IN THE DEVELOPMENT OF AN INTERIM DESIGN METHOD WHICH EXTENDED THE DESIGN CURVE TO GIVE GREATER THICKNESS OF THE PAVEMENT STRUCTURE FOR THE POOREST SOILS. THE RELATIONSHIP BETWEEN THE SUBGRADE INDEX NUMBERS AND THE CALIFORNIA BEARING RATIOS OF THE SOILS WAS DETERMINED, AND THE APPROPRIATE PAVEMENT THICKNESS WAS DETERMINED FROM STANDARD CBR CURVES FOR SUBGRADE INDEX NUMBERS.

Ferguson, RP *Highway Research Board Bulletin* 1961

**2A 205760
BASIC PRINCIPLES OF FLEXIBLE PAVEMENT DESIGN AND CONSTRUCTION IN THE USSR**

CLIMATIC FACTORS IN THE USSR ARE DISCUSSED IN REGARD TO ECONOMIC DEVELOPMENT OF FLEXIBLE PAVEMENTS. THE METHOD USED FOR DETERMINING THE THICKNESS OF FLEXIBLE ROAD PAVEMENTS IS DESCRIBED. THE METHOD IS BASED ON THE FOLLOWING THESIS: (1) THE STRESS CONDITIONS IN THE ROAD STRUCTURE AT THE BEGINNING OF FAILURE ARE CHARACTERIZED BY A DEFINITE ULTIMATE VALUE OF ACCUMULATED VERTICAL DISPLACEMENT, AND DEFLECTION OF THE PAVEMENT, (2) THE MODULUS OF DEFORMATION OF THE STRUCTURE DEPENDING UPON THE RATIO BETWEEN THE UNIT LOAD ACTING ON THE SURFACE OF THE STRUCTURE AND THE TOTAL RELATIVE DEFLECTION CAUSED BY IT, IS THE CRITERION FOR DETERMINING THE RESISTANCE TO DEFORMATION OF FLEXIBLE PAVEMENTS, AND (3) THE ROAD PAVEMENT SHOULD BE DESIGNED IN SUCH A MANNER THAT THE ACTUAL DEFLECTION OF THE DESIGN STRUCTURE UNDER THE ACTION OF DESIGN MODE DOES NOT EXCEED THE ALLOWABLE DEFLECTION TAKING INTO ACCOUNT THE NATURE AND INTENSITY OF THE ROAD TRAFFIC. THE DESIGN METHOD FOR FLEXIBLE PAVEMENTS IN THE USSR PERMITS: (1) THE DESIGN OF NEW ROAD DEVELOPMENT WHICH REQUIRED OPERATING PROPERTIES FOR VARIOUS CLIMATIC CONDITIONS WITH AVAILABLE DATA ON TRAFFIC NATURE AND DENSITY AND ON THE QUALITY OF MATERIAL TO BE USED, (2) VARYING DESIGNS OF PAVEMENT OF EQUAL STRENGTH USING VARIOUS MATERIAL IN SEPARATE LAYERS AND CREATING THE MOST EXPEDIENT AND ECONOMICAL STRUCTURES, AND (3) ESTIMATES OF THE STRENGTH OF EXISTING PAVEMENTS ON EXISTING ROADS

AND THE REQUIREMENTS FOR THEIR IMPROVEMENT OR RESTRICTION OF TRAFFIC AS REGARDS NATURE AND INTENSITY IN THE RAINY PERIOD OF THE YEAR. METHODS FOR OBTAINING THE NUMERICAL VALUES OF DEFORMABILITY INDICES FOR PAVEMENTS AND SUBGRADES ARE PRESENTED. THE MODULUS OF DEFORMATION OF THE SUBGRADE IS RELATED TO THE DESIGNED SOIL CONDITION. THE STRUCTURAL METHODS USED TO LIMIT THE SURFACE AND GROUND WATER ARE PRESENTED. THE PRINCIPAL SOILS STABILIZED IN THE USSR ARE CLAYEY AND SILTY SOILS. CHEMICALLY STABILIZED SOILS ARE CONSIDERED AS HIGH QUALITY MATERIALS FOR ROAD FOUNDATIONS IN PLACES OF POOR RESOURCES. STABILIZATION METHODS ARE DESCRIBED.

Bezruk, VM *Highway Research Board Special Reports* 1960

**2A 205767
PRESTRESSED CONCRETE PAVEMENTS**

DESIGN INVESTIGATIONS AND LIMITED TESTING OF MODEL AND PROTOTYPE SLABS INDICATE THAT PRESTRESSED PAVEMENTS PERMIT A MORE EFFICIENT USE OF CONSTRUCTION MATERIALS IN TERMS OF REQUIRED PAVEMENT THICKNESS. PRESTRESSED PAVEMENTS CAN BE DESIGNED WITH FEWER JOINTS AND WITH LESS PROBABILITY OF CRACKING THAN CONVENTIONAL RIGID PAVEMENTS, THEREBY PROMISING EXTENDED PAVEMENT LIFE AND REDUCED MAINTENANCE REQUIREMENTS. INFORMATION RELATIVE TO THE DESIGN AND CONSTRUCTION OF PRESTRESSED CONCRETE PAVEMENTS IS PRESENTED. RECOMMENDATIONS ARE DEVELOPED ON PLANNING, DESIGN, AND AREAS OF ENGINEERING INVESTIGATION AND RESEARCH. MINIMUM TESTS ARE RECOMMENDED FOR EXPERIMENTAL HIGHWAY PAVEMENTS. DESIGN VARIABLES ARE DISCUSSED WITH FACTORS AFFECTING DESIGN.

Highway Research Board Special Reports 1963

**2A 205772
OPTIMAL DESIGN OF FLEXIBLE PAVEMENT SECTIONS**

A SYSTEMS ANALYSIS WAS CONDUCTED TO DEVELOP A RATIONAL METHOD FOR THE OPTIMAL DESIGN OF FLEXIBLE PAVEMENT SECTIONS. THE OPTIMAL COMBINATION OF FLEXIBLE PAVEMENT COMPONENTS MUST MINIMIZE THE TOTAL IN-PLACE COST OF THE PAVEMENT SYSTEM. A DESIGN MODEL WAS CONSTRUCTED CONSISTING OF AN OBJECTIVE FUNCTION AND VARIOUS CONSTRAINT EQUATIONS. THE TOTAL PAVEMENT SYSTEM IS DESCRIBED BY THE VARIOUS DESIGN PARAMETERS WHICH REPRESENT TRAFFIC CONDITIONS, SOIL SUPPORT VALUES, PAVEMENT MATERIAL CHARACTERISTICS, ENVIRONMENTAL EFFECTS, AND PAVEMENT PERFORMANCE REQUIREMENTS. UNIT COSTS OF PAVEMENT COMPONENTS AND ALTERNATE CROSS-SECTION DESIGNS ARE CONSIDERED IN THE SELECTION OF THE OPTIMUM FLEXIBLE PAVEMENT SECTION. THE TOTAL COST OF THE PAVEMENT SYSTEM IS QUANTITATIVELY DESCRIBED BY THE OBJECTIVE FUNCTION, AND THE MINIMUM-COST SOLUTION IS OBTAINED FOR EACH COMBINATION OF MATERIAL COSTS AND DESIGN CONDITIONS. THE MATHEMATICAL DESIGN MODEL WAS SOLVED BY A MODIFIED LINEAR PROGRAMMING TECHNIQUE. THE DESIGN PROCEDURE SPECIFIES A MINIMUM PAVEMENT THICKNESS TO ACCOUNT FOR VARIOUS INFLUENCING ENVIRONMENTAL CONDITIONS. IN ADDITION TO THE TRAFFIC LOADING, SOIL SUPPORT, PAVEMENT PERFORMANCE, AND ENVIRONMENT CONSTRAINTS, PRACTICAL LIMITATIONS ON LAYER THICKNESSES ARE SPECIFIED IN CONCURRENCE WITH PRESENT HIGHWAY CONSTRUCTION PRACTICES. THE UNIT COSTS OF THE PAVEMENT COMPONENTS ARE SPECIFIED TO PERMIT THE DESIGN OF AN ACCEPTABLE STRUCTURE FOR THE LEAST COST. THIS COST-EFFECTIVENESS APPROACH SEEMS TO PROVIDE BOTH AN OPTIMAL AND A PRACTICAL SOLUTION TO THE PROBLEM OF FLEXIBLE PAVEMENT DESIGN.

Hejal, SS Yoder, SR Oppenlander, JC
Purdue & Ind State Hwy Comm Jhrp Sept. 1969

2A 205782

FLEXIBLE PAVEMENTS

FROM THE REPORTS OF 25 COUNTRIES DEALING WITH FLEXIBLE PAVEMENTS, DR. E. BALAGUER OF SPAIN PREPARED A LIST OF CONCLUSIONS AND RECOMMENDATIONS AND PRESENTED THESE TO THE MEETING UNDER THE FOLLOWING SUBGROUPS: (1) SUBBASES AND THEIR MATERIALS; (2) BASES AND THEIR MATERIALS; (3) COMPACTION OF LAYERS AND COMPARISON OF METHODS; (4) CHEMICAL STABILIZATION; (4) SURFACING COURSES AND THE GRADING OF AGGREGATES FOR SURFACING; (5) PARAFIN-BASED BITUMENS; (6) DEFORMATION OF THE SURFACING PROFILES UNDER TRAFFIC ACTION; (7) MANUFACTURE, SPREADING AND COMPACTION OF BITUMEN COATED MATERIALS (INCLUDING PROBLEMS OF DUST IN HOT-MIX MANUFACTURING PLANTS); (8) LIGHT COLORED WEARING COURSES; (9) THIN WEARING COURSES; (10) EFFECTS OF HEAVY DUTY EQUIPMENT USE ON DESIGN; (11) SURFACE DRESSINGS USING ALTERNATIVES TO BITUMINOUS BINDERS; AND (12) ACTION OF SALT ON SURFACES. THE LIST OF SPEAKERS INCLUDED: (1) M. ARQUIE OF FRANCE, WHO OUTLINED THE MAIN TRENDS IN FLEXIBLE PAVEMENT CONSTRUCTION IN HIS COUNTRY; (2) MR. GAJPOWSKI OF POLAND WHO DISCUSSED BOTH CHEMICALLY STABILIZED BASE COURSES AND USE OF PARAFFIN OIL BITUMENS; (3) MR. MIKHAILOV OF USSR WHO DESCRIBED HIS COUNTRY'S RESEARCH PROGRAMS ON THE PROCESSING OF BITUMENS AND PRODUCTION OF BITUMEN STRUCTURES; (4) MR. TAKAHASHI OF JAPAN, WHO DISCUSSED RECENT DEVELOPMENTS IN ROAD TECHNOLOGY IN HIS COUNTRY; (5) MR. FERREIRA OF PORTUGAL WHO DESCRIBED EXPERIMENTS WITH SOIL CEMENT BASES; (6) MR. FENLO OF SPAIN WHO EMPHASIZED THE NEED FOR STANDARDIZATION OF TERMINOLOGY FOR COATED MATERIALS USED FOR FLEXIBLE PAVEMENTS; (7) MR. BENINI OF ITALY WHO DISCUSSED RESULTS OF PAVEMENT INVESTIGATIONS SUBSEQUENT TO THE SUBMISSION OF HIS COUNTRY'S REPORT; (8) MR. NICHOLS OF GREAT BRITAIN WHO SPOKE ON BINDER MATERIALS AND MAINTENANCE OF SKIDDING RESISTANCE; AND (8) MR. LAW OF GREAT BRITAIN WHO DISCUSSED SUBBASE STABILIZATION, COMPACTION AND SURFACE TEXTURE OF WEARING COURSES, AND AUTOMATION OF MIXING PLANTS. THE SPEAKERS COMMENTS WERE SUMMARIZED BY DR. BALAGUER AT THE CLOSE OF THE SESSION.

Perm Intl Assoc Road Congresses Proc 1967

2A 205807

SOME PRINCIPLES INVOLVED IN BITUMINOUS MACADAM CONSTRUCTION

FUNDAMENTAL PRECAUTIONS FOR SUCCESSFUL BITUMINOUS MACADAM PAVEMENT DESIGN AND CONSTRUCTION ARE DISCUSSED IN THE LIGHT OF FIELD OBSERVATIONS. OF PRIME IMPORTANCE IS THE PREPARATION OF THE SUBBASE UPON WHICH THE BASE COURSE OF CRUSHED STONE IS TO BE PLACED. ANOTHER ESSENTIAL INGREDIENT IN CONSTRUCTION IS THE PLACING OF SUFFICIENT SHOULDER ALONG THE SIDE LINES TO HOLD THE CRUSHED STONE COURSES. THE PENETRATION COURSE OF STONE SHOULD BE UNIFORM IN DEPTH TO ENSURE THE BEST RESULTS. THE BASE COURSE OF CRUSHED STONE SHOULD BE FILLED WITH SAND OR CRUSHER DUST. STREAKS IN THE PENETRATION COURSE OF STONE SHOULD BE PENETRATED WITH A HAND HOSE AND NOT LEFT FOR THE SEAL COAT TO COVER UP. IN ADDITION TO SKILLFUL ROLLING REQUIRED IN THE CONSTRUCTION OF A GOOD BITUMINOUS MACADAM, IT IS ESSENTIAL THAT THE PAVEMENT SECURE SUFFICIENT ROLLING TO THOROUGHLY COMPACT THE STONE. CONSTANT CARE SHOULD BE TAKEN DURING THE WHOLE CONSTRUCTION PROCESS AND FAULTS CORRECTED AS THEY OCCUR.

Henderson, GH Highway Research Board Proceedings 1927

156

2A 205836

A GENERALIZED INVESTIGATION OF SELECTED HIGHWAY DESIGN AND CONSTRUCTION FACTORS BY REGIONAL GEOMORPHIC UNITS WITHIN THE CONTINENTAL UNITED STATES

AN INVESTIGATION WAS MADE OF THE OCCURRENCE AND DISTRIBUTION OF SELECTED HIGHWAY FACTORS WITHIN REGIONAL GEOMORPHIC UNITS COMPRISING THE ADJACENT 48 STATES. THE REGIONAL CLASSIFICATION SYSTEM USED AS A BASIS OF EXAMINATION WAS THAT PROPOSED BY WOODS-LOVELL. THIS SYSTEM WAS SLIGHTLY MODIFIED TO PRODUCE 97 SECTIONS FOR INVESTIGATION. THE HIGHWAY FACTORS ANALYZED BY SECTION WERE: AVAILABILITY OF QUALITY AGGREGATE RESOURCES, SOIL ORIGIN AND TEXTURE, HIGH VOLUME CHANGE SOILS, POTENTIALLY POOR SUBGRADE SUPPORT CONDITIONS (CLAYEY AND ORGANIC TYPE) AND FROST SUSCEPTIBLE SOILS. POTENTIAL AGGREGATE MAPS OF THE UNITED STATES WERE COMPILED AND USED ALONG WITH VARIOUS OTHER SOURCES OF INFORMATION, INCLUDING A STATE HIGHWAY AGGREGATE QUESTIONNAIRE, TO OBTAIN A QUALITATIVE ESTIMATE OF THE POTENTIAL AGGREGATE AVAILABILITY RATING FOR EACH SECTION. FOR FACTORS OF DESIGN RELATIVE TO SOIL TEXTURE, A GENERALIZED SOILS MAP OF THE UNITED STATES WAS DEVELOPED. A SUMMARY TABLE OF THE SALIENT COMPOSITE HIGHWAY FACTORS INVESTIGATED WAS COMPILED FOR EACH SECTION, AND REPRESENTED A BRIEF AND CONCISE SUMMARY OF THE MAJOR FINDINGS. BECAUSE OF THE MULTIPLICITY OF FACTORS USED TO DEFINE AND BOUND PHYSIOGRAPHIC SECTIONS, IT IS NOT POSSIBLE TO MAKE A BLANKET CONCLUSION REGARDING THE VALIDITY OF UTILIZING THESE SECTIONS AS FILING SYSTEMS FOR HIGHWAY FACTORS. THE MAJORITY OF SECTIONS EXAMINED SHOWED A SIGNIFICANT PRESENCE OF SMALLER, VARIANT UNITS WITHIN THEM. BASED UPON THIS CONSIDERATION, PLUS THE OVERALL IMPORTANCE OF THE PARENT MATERIAL-ORIGIN CHARACTERISTICS TO THE HIGHWAY ENGINEER, A SUGGESTED HIGHWAY ENGINEERING-PHYSIOGRAPHIC UNIT MAP OF THE CONTINENTAL UNITED STATES IS PRESENTED. /AUTHOR/

Witczak, MW Highway Research Board Nchrp Summary

2A 205851

WYOMING THICKNESS DESIGN FOR FLEXIBLE PAVEMENT REVISIONS TO THE WYOMING PAVEMENT DESIGN PROCEDURES ARE BASED ON THE AASHO ROAD TEST AND RECOMMENDATIONS MADE ARE BASED ON THE AASHO INTERIM DESIGN GUIDE. THE METHODS DEVELOPED DEPEND ON SUCH VARIABLES AS THE SUB-GRADE, TRAFFIC CONSTRUCTION MATERIALS, AND REGIONAL FACTORS. ACCORDING TO THE AUTHOR, THESE METHODS INDICATE A RELATIONSHIP OF TRAFFIC (AXLE LOADS) TO THE PERFORMANCE OF THE PAVEMENT (SERVICEABILITY). IN WYOMING DESIGN CONSIDERATIONS ALSO INCLUDE PROTECTION AGAINST EXPANSIVE SOILS, FROST PROTECTION, AND MOISTURE DENSITY CONTROL. CONSTRUCTION CONTROL OF SPECIFICATIONS AND CONDITIONS ASSUMED IN THE DESIGN PHASE ARE IMPORTANT IN THE FINISHED PRODUCT.

Nolan, PR

Wyoming State Highway Department Nov. 1970

2A 205866

A PROCEDURE FOR EVALUATING PAVEMENTS WITH NONUNIFORM PAVING MATERIALS

A PROCEDURE WAS DEVELOPED TO EVALUATE LAYERED SYSTEMS WITH NONUNIFORM MATERIAL PROPERTIES. THE PROCEDURE CONSISTS OF DEFINING THE LAYERED SYSTEM BY A PHYSICAL MODEL CONSISTING OF MASS POINTS TIED TOGETHER BY SPRINGS AND BARS. THE VARIABILITY OF THE MATERIAL IS SIMULATED BY ASSIGNING DIFFERENT CHARACTERISTICS OF THE MATERIAL PROPERTIES TO SPRINGS CONNECTING THE MASS POINTS. ASSIGNMENT OF VALUES

REPRESENTING THE MATERIAL PROPERTIES IS DONE ON A RANDOM BASIS. THE RANDOM VALUES ARE GENERATED IN A MANNER THAT PRODUCES A MODEL WITH MEAN CHARACTERISTICS CORRESPONDING TO THE MEAN PROPERTIES OF THE MATERIALS IN THE VARIOUS LAYERS OF THE PAVEMENT, AND WITH A COEFFICIENT OF VARIATION OF THE CORRESPONDING PAVING MATERIAL. RESULTS SHOW THAT THE RESPONSE OF THE LAYERED SYSTEM IS INFLUENCED BY THE STATISTICAL CHARACTERISTICS OF THE MATERIALS. THE STATISTICAL NATURE OF THE RESPONSE IS INFLUENCED BY BOTH THE VARIABILITY OF THE MATERIAL AND THE NATURE OF THE VARIABILITY. A LARGE AREA WITH SLIGHTLY LESS THAN AVERAGE STIFFNESS HAS A GREATER INFLUENCE ON THE RESPONSE OF THE SYSTEM THAN A LARGE DIFFERENCE IN STIFFNESS OVER A SMALL AREA. THUS, DETAILED ANALYSES ARE NECESSARY TO OBTAIN A COMPREHENSIVE UNDERSTANDING OF THE BEHAVIOR OF THE SYSTEM. MUCH WORK STILL NEEDS TO BE DONE TO OBTAIN A COMPLETE PICTURE OF THE STATISTICAL NATURE OF PAVEMENT RESPONSE. PRELIMINARY RESULTS STRONGLY INDICATE A NEED FOR THE TYPE OF ANALYSIS PRESENTED IN THE PAPER AS A GUIDE FOR ESTABLISHING REALISTIC QUALITY CONTROL CRITERIA FOR PAVING MATERIALS. WITH RESULTS FROM SUCH A PROCEDURE IT IS POSSIBLE TO ESTABLISH A COST BENEFIT FROM HIGHER QUALITY CONTROL CRITERIA. /AUTHOR/

Levey, JR Barenberg, EJ *Highway Research Record, Hwy Res Board* 1970

2A 205952

EXPERIMENTAL FLEXIBLE OVERLAYS ON CEMENT CONCRETE ON NATIONAL HIGHWAY NO. 7 NEAR HYDERABAD

THE DETAILS OF CONSTRUCTION OF EXPERIMENTAL FLEXIBLE OVERLAYS ON A THIN CEMENT CONCRETE SLAB IN VARYING DEGREES OF DISTRESS, TOGETHER WITH THEIR PERFORMANCES OBSERVED OVER A SEVEN YEAR PERIOD, ARE DEALT WITH. OUT OF TEN DIFFERENT SPECIFICATIONS TRIED ON A TEST TRACK, IT WAS FOUND THAT A 4 IN. THICK ASPHALTIC CONCRETE OR A 6 IN. WATER BOUND MACADAM LAYER SURFACED WITH EITHER A 1 1/2 IN. ASPHALTIC CONCRETE OR A 3/4 IN. PREMIX WITH SEAL GAVE SATISFACTORY PERFORMANCE; THE LATTER BEING MORE ECONOMIC. /AUTHOR/

Swaminathan, CG Nair, KP
Central Road Research Inst of India 1970

2A 206047

RELATIONSHIPS BETWEEN PHYSIOGRAPHIC UNITS AND HIGHWAY DESIGN FACTORS

THIS REPORT IDENTIFIES THE SEVERITY AND/OR FREQUENCY OF OCCURRENCE OF AGGREGATE AVAILABILITY, SUBGRADE SUPPORT, HIGH VOLUME CHANGE SOILS, AND FROST-SUSCEPTIBLE SOILS WITHIN 97 PHYSIOGRAPHIC SECTIONS OF THE CONTIGUOUS 48 STATES; AND QUALITATIVELY ASSESS THE POTENTIAL FOR THE INFLUENCE OF THESE FACTORS ON HIGHWAY DESIGN AND CONSTRUCTION. THE FINDINGS ARE FOUNDED ON THE PREMISE THAT PHYSIOGRAPHIC UNITS CAN FORM AN ORDERLY FILING SYSTEM FOR ACCUMULATED ENGINEERING EXPERIENCE WHICH, IN THE HIGHWAY DESIGN FIELD, CONSTITUTES ENGINEERING JUDGMENT. A LARGE AMOUNT OF INFORMATION ON THE DISTRIBUTION OF AGGREGATES AND SOILS IN THE CONTIGUOUS U. S. HAS BEEN COMPILED AND PRESENTED ON A SERIES OF MAPS. HIGHWAY ENGINEERING STUDENTS AND YOUNG ENGINEERS IN THE PROCESS OF ACCUMULATING EXPERIENCE AND ACQUIRING ENGINEERING JUDGMENT WILL UNDOUBTEDLY BENEFIT FROM A STUDY OF THE INFORMATION CONTAINED IN THE REPORT. IT SHOULD ALSO BE PARTICULARLY VALUABLE TO SUCH ORGANIZATIONS AS CONSULTING ENGINEERING FIRMS AND CONTRACTORS THAT SERVE LARGE GEOGRAPHICAL AREAS, AND THUS MAY NOT HAVE ACTUAL EXPERIENCE IN MANY LOCAL AREAS. /HRB/

Witczak, MW *Highway Research Board Nchrp Reports* No. 132, 1972, 161 pp, 23 Fig, 20 Tab, 393 Ref

2A 206091

SYMPOSIUM-TECHNOLOGY OF THICK LIFT CONSTRUCTION WITH DISCUSSION

THIS SYMPOSIUM ON THICK LIFT CONSTRUCTION IS DIVIDED INTO FOUR SECTIONS. THE FIRST SECTION--STRUCTURAL DESIGN CONSIDERATIONS--ILLUSTRATES EXISTING AND POTENTIAL PAVEMENT DESIGN (THICKNESS SELECTION) PROCEDURES FOR THICK LIFT ASPHALT CONCRETE SECTIONS RESTING DIRECTLY ON PREPARED SUBGRADES. IN ADDITION, A METHOD USING RECENT RESEARCH DEVELOPMENTS INTENDED TO BROADEN THE DESIGN FRAMEWORK FOR SUCH PAVEMENTS AND BASED ON CONCEPTS EMBODIED IN THE SHELL PROCEDURE IS ALSO BRIEFLY ILLUSTRATED. THE SECOND SECTION--MIX DESIGN CONSIDERATIONS--POINTS OUT THAT CONVENTIONAL MIX DESIGN PROCEDURES ARE GENERALLY SUITABLE FOR DESIGNING ASPHALT PAVING MIXTURES FOR THICK LIFT CONSTRUCTION. IT ALSO IS POINTED OUT THAT INFORMATION IS AVAILABLE ON HOW VARIOUS MIX DESIGN VARIABLES AFFECT THE BASIC MATERIAL PROPERTIES OF ASPHALT PAVING MIXTURES SUCH AS ELASTIC, FATIGUE, AND FRACTURE STRENGTH PROPERTIES. SECTION THREE--LABORATORY CONSIDERATIONS--DEALS PRIMARILY WITH THOSE METHODS UTILIZED TO OBTAIN THE MATERIAL PARAMETERS USED IN THE DESIGN PROCEDURES DISCUSSED IN THE FIRST SECTION. SECTION FOUR--CONSTRUCTION METHODS--PRESENTS A CONTEMPORARY VIEW OF CONSTRUCTION METHODS AND PROCEDURES. A DISCUSSION IS INCLUDED WHICH DEALS WITH VARIOUS QUESTIONS ARISING FROM THIS SYMPOSIUM.

Monismith, CL Mclean, DB Kallas, BF Terrel, RL Marker, V Awad, IS *Assoc Asphalt Paving Technol Proc Proceedings* Vol. 41 Feb. 1972, pp 257-382, 68 Fig, 17 Tab, 111 Ref

2A 206298

SOME RECENT FINDING IN FLEXIBLE PAVEMENT RESEARCH

THE AVERAGE LEVEL OF PAVEMENT PERFORMANCE DETERMINED FROM A TWO-YEAR CONTROLLED TRAFFIC TEST /AASHO ROAD TEST/ WAS CORRELATED WITH PERFORMANCE OF TEXAS PAVEMENTS UNDER NORMAL MIXED TRAFFIC, AND THE EFFECT OF WEATHER AND THE REGIONAL EFFECT THROUGHOUT THE STATE. APPROXIMATE VALUES WERE OBTAINED OF COEFFICIENTS OF TEXAS MATERIALS FOR FLEXIBLE PAVEMENTS FOR COMPARISONS WITH AASHO ROAD TEST LAYER COEFFICIENTS. THE ASSUMPTION WAS MADE THAT LOAD-INDUCED DEFLECTIONS OF PAVEMENTS SURFACE ARE AN INDEX TO THE POTENTIAL RATE OF PAVEMENT DETERIORATION. THE RESULTS REPORTED INCLUDED: /1/ DEVELOPMENT OF AN EMPIRICAL EQUATION FOR ESTIMATING DEFLECTIONS FROM THICKNESS AND LABORATORY-DETERMINED STRENGTH OF THE PAVEMENT STRUCTURE MATERIALS, AND /2/ USE OF THE EQUATION TOGETHER WITH DEFLECTIONS OBSERVED ON 323 TEST SECTIONS, TO EVALUATE THE REGIONAL EFFECT. WITH THE SIGNIFICANT REGIONAL EFFECT EVALUATED, THE NET RESULT IS AN EQUATION FOR DEFLECTIONS THAT CONTAINS: /1/ A FIELD COMPRESSION COEFFICIENT FOR EACH LAYER, DEPENDENT ON LABORATORY STRENGTH AND REGIONAL EFFECT, AND /2/ A DEPTH COEFFICIENT FOR EACH LAYER /INCLUDING THE FOUNDATION LAYER/ DEPENDENT UPON THE THICKNESS OF THE LAYER AND ITS POSITION IN THE STRUCTURE.

Scrivner, FH Moore, WM
Texas Transportation Institute Feb. 1967

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4621332 67)PB 176 060, 3C26021626, 4C26020883

2A 206309

INFLUENCE OF DESIGN, CONSTRUCTION AND TRAFFIC ON COMPACTION OF HOT-MIX ASPHALTIC CONCRETE
THE REPORT INDICATES SOME RELATIONSHIPS BETWEEN THE COMPACTION OF HOT-MIX ASPHALTIC CONCRETE AS INFLUENCED BY CONSTRUCTION AND TRAFFIC. THE EFFECTS OF MIX DESIGN ARE NOT COVERED. THE CONCLUSIONS PRESENTED ARE BASED FOR THE MOST PART ON 4 MONTHS OF DATA. THE SIGNIFICANT FINDINGS ARE: (1) PAVEMENT DENSITY WAS FOUND TO INCREASE WITH TIME WHEN THE TEST SECTION WAS UNDER TRAFFIC, (2) LITTLE CORRELATION EXISTS BETWEEN LABORATORY DETERMINED DENSITY AND THE IN-PLACE DENSITY IMMEDIATELY AFTER CONSTRUCTION, (3) MOST OF THE PAVEMENTS WERE NOT COMPACTED TO 95% OF LABORATORY DENSITY AT THE TIME OF CONSTRUCTION, AND (4) NO APPRECIABLE DEGRADATION OF AGGREGATE TAKES PLACE DUE TO COMPACTION OPERATIONS OR TRAFFIC. /BPR/

Harper, WJ Gallaway, BM
Texas Transportation Institute, Texas State Department of Highways & Public Transp, Bureau of Public Roads /US/ 1967

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4351072 67)2R31012960, 1C26021037

2A 206341

A STUDY OF THE RELATIONSHIP BETWEEN AIR TEMPERATURES AND DEPTH OF FROST PENETRATION AS RELATED TO PAVEMENT PERFORMANCE OF WEST VIRGINIA'S HIGHWAYS
RELATIONSHIPS WERE STUDIED BETWEEN AIR TEMPERATURES AND THE DEPTH OF FROST PENETRATION IN WEST VIRGINIA TO EVALUATE THE EFFECTS OF FROST ACTION ON HIGHWAY PAVEMENTS, AND TO ESTABLISH THE NEED FOR A DESIGN PROCEDURE TO REDUCE THE DETRIMENTAL EFFECTS OF FROST PENETRATION. THE RESEARCH WAS CONDUCTED IN THREE PHASES: (1) FROST PENETRATION STUDIES, (2) PAVEMENT PERFORMANCE STUDIES, AND (3) EVALUATION OF EXISTING DESIGN METHODS AND THE DEVELOPMENT OF NEW DESIGN CRITERIA. THE FROST PENETRATION STUDIES CONSISTED OF: (1) THE COLLECTION OF AIR, PAVEMENT AND SOIL TEMPERATURE DATA FROM THIRTEEN FIELD THERMOCOUPLE INSTALLATIONS LOCATED THROUGHOUT THE STATE, (2) THE ANALYSIS OF CLIMATE FACTORS, (3) THE ANALYSIS OF THE THERMAL PROPERTIES OF SOILS AND HIGHWAY MATERIALS, AND (4) THE ANALYSIS OF FROST PENETRATION BY COMPARISON OF THE FROST DEPTHS MEASURED AT THE THERMOCOUPLE INSTALLATION SITES WITH THOSE COMPUTED BY FROST DEPTH PREDICTION FORMULAS. THE PAVEMENT PERFORMANCE STUDIES CONSISTED OF AN EVALUATION OF THE ADEQUACY OF THE EXISTING PAVEMENTS AT THE THERMOCOUPLE INSTALLATION SITES USING A COMPARATIVE DESIGN TECHNIQUE. IT WAS FOUND THAT A REASONABLY RELIABLE ESTIMATE OF THE DEPTH OF FROST PENETRATION BENEATH HIGHWAY PAVEMENTS IN WEST VIRGINIA MAY BE OBTAINED BY THE APPLICATION OF THE EXACT MODIFIED BERGGREN FORMULA. A METHOD WAS DEVELOPED BY WHICH SATISFACTORY ESTIMATES OF AIR AND PAVEMENT SURFACE FREEZING INDICES MAY BE OBTAINED FOR ANY ELEVATION AND LATITUDE IN WEST VIRGINIA IN TERMS OF THE STATISTICAL PROBABILITY OF THEIR OCCURRENCE. METHODS WERE ALSO DEVELOPED FOR THE ESTIMATION OF THE AVERAGE SOIL TEMPERATURE AT THE START OF PAVEMENT SURFACE FREEZING AND FOR SPECIAL UTILIZATION OF EXISTING PROCEDURES FOR ESTIMATING THE THERMAL PROPERTIES OF HIGHWAY MATERIALS. IT WAS FOUND THAT FROST ACTION WAS AT LEAST A CONTRIBUTING FACTOR TO THE POOR PAVEMENT PERFORMANCE OBSERVED AT SIX OF THE THIRTEEN SITES INVESTIGATED. IT WAS ALSO FOUND THAT, WHILE THE CURRENT WEST VIRGINIA PROCEDURE FOR THE DESIGN OF PAVEMENTS TO RESIST THE DETRIMENTAL EFFECTS OF FROST ACTION WOULD OBIVIATE THIS DIFFICULTY, IT TENDS TO BE

OVERLY CONSERVATIVE. A NEW METHOD WAS DEVELOPED FOR THE DESIGN OF FLEXIBLE PAVEMENTS IN WEST VIRGINIA TO RESIST THE EFFECTS OF FROST ACTION. IT WAS FOUND THAT NO SPECIAL MEASURES ARE NECESSARY FOR THE DESIGN OF RIGID PAVEMENTS FOR FROST CONDITIONS IN WEST VIRGINIA. /BPR/

Moulton, LK Dubbe, EC
West Virginia University, West Virginia State Road Commission, Bureau of Public Roads /US/

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4611082 68)PB 182 349, 1C26021435

2A 206422

EVALUATION OF PAVEMENT DESIGN IN VIRGINIA BASED ON LAYER DEFLECTIONS, SUBGRADE AND ITS MOISTURE CONTENT

THE OPTIMUM STRUCTURAL STRENGTH CONTRIBUTED BY A MATERIAL TO THE OVERALL STRENGTH OF THE PAVEMENT WAS STUDIED FOR CASES APPLICABLE TO VIRGINIA. THE VARIABLES WERE (1) THE MODULUS OF ELASTICITY OR THE THICKNESS EQUIVALENCY OF THE MATERIAL, (2) THE THICKNESS OF THE MATERIAL IN THE LAYER, (3) THE LOCATION OF THE MATERIAL WITH RESPECT TO OTHER LAYERS CONTAINING STRONGER OR WEAKER MATERIALS AND IN VARYING THICKNESSES, AND (4) THE EFFECT OF THE TOTAL PAVEMENT THICKNESS AND THE DEPTH OF THE MATERIAL FROM THE TOP OF THE PAVEMENT. THE INVESTIGATION CONSISTED: (1) A STUDY OF THE THICKNESS EQUIVALENCIES OF THE MATERIALS ON INTERSTATE, PRIMARY, SECONDARY AND SUBDIVISION ROADS IN VIRGINIA. AND (2) A MODEL STUDY. THE EVALUATION OF THE HIGHWAY SYSTEM WAS QUANTITATIVE, WHILE THAT OF THE MODEL STUDY WAS QUALITATIVE ONLY. THIS INVESTIGATION SHOWED THAT THE STRUCTURAL STRENGTH OF A PAVEMENT IS DECREASED WHEN A WEAKER LAYER IS PLACED OVER A STRONGER LAYER OR WHEN A WEAKER LAYER IS SANDWICHED BETWEEN TWO STRONG LAYERS. THE INVESTIGATION ALSO SHOWED THAT WHEN THE BOTTOM OF THE TOP LAYER DOES NOT BEND, THE STRESS DISTRIBUTION IS BULB TYPE; AND WHEN THE BOTTOM BENDS, THE STRESS DISTRIBUTION IS FAN TYPE. EACH CASE WOULD, THEREFORE, NEED A DIFFERENT MATHEMATICAL TREATMENT FOR DESIGN. /AUTHOR/

Vaswani, NK
Virginia Department Highways, Federal Highway Administration /US/

ACKNOWLEDGMENT: Federal Highway Administration (4830062 70)NTIS PB 194334, 1C26022256

2A 206492

FLEXIBLE PAVEMENT DENSITY: THREE STUDIES

THE FIRST STUDY REPORTED A CHANGE IN THE DENSITY AND ITS VARIABILITY IN ALL PAVEMENT COURSES DURING SUCCESSIVE PHASES OF CONSTRUCTION AND AFTER A PERIOD UNDER TRAFFIC. THE SECOND STUDY DETERMINED THE INFLUENCE OF VARIOUS NUMBERS OF STEEL-WHEEL ROLLER PASSES ON PAVEMENT DENSITY. THE PAVEMENT WAS RESAMPLED AFTER 3 YEARS TO DETERMINE THE CHANGE IN DENSITY RESULTING FROM A LIMITED AMOUNT OF TRAFFIC. IN THE THIRD STUDY, INITIAL PAVEMENT PROPERTIES (PERCENT OF AIR VOIDS AND ASPHALT CONTENT) WERE INVESTIGATED TO DETERMINE THEIR EFFECTS ON PERFORMANCE. ONE PARTICULAR PAVEMENT, CONSTRUCTED IN LATE-SEASON COOL WEATHER, WAS STUDIED TO FIND THE CAUSE OF ITS PREMATURE FAILURE. /AUTHOR/

New York State Dept Transportation July 1972, 57 pp

ACKNOWLEDGMENT: New York State Dept Transportation, Federal Highway Administration

2A 206518

RECENT EXPERIMENTAL PCC PAVEMENTS IN CALIFORNIA
THE CONSTRUCTION OF EXPERIMENTAL PCC PAVEMENT SECTIONS IS DESCRIBED. THE PREDOMINANT EXPERIMEN-

TAL FEATURE WAS CONTINUOUSLY REINFORCED CONCRETE PAVEMENT WITH THREE DIFFERENT TYPES OF REINFORCEMENT. ALSO INCLUDED WERE UNREINFORCED SECTIONS WITH (1) WEAKENED PLANE JOINTS AT ABOUT ONE-HALF THE NORMAL INTERVALS, (2) HIGHER CEMENT CONTENT, (3) OVER DESIGNED THICKNESS, AND (4) USE OF A LEAN CONCRETE (4-SACK) BASE. DESIGN AND CONSTRUCTION DETAILS ARE PRESENTED ALONG WITH A COMPARISON OF THE CONSTRUCTION COSTS OF THE VARIOUS SECTIONS. EARLY PERFORMANCE CHARACTERISTICS ARE ALSO DISCUSSED. THE PAVEMENTS WILL BE MONITORED PERIODICALLY TO DETERMINE RELATIVE PERFORMANCE.

Spellman, DL Woodstrom, JH Neal, BF Mason, PE
California Department Transportation June 1973, 56 pp

ACKNOWLEDGMENT: Federal Highway Administration, California Department Transportation FHWA S0133, NITS PB 223 932/AS, 1C26023321

2A 206543

FIRST PROGRESS REPORT ON CONCRETE EXPERIMENTAL TEST SECTIONS IN BRAZOS COUNTY, TEXAS
SURFACE CHARACTERISTICS OF PORTLAND CEMENT CONCRETE PAVEMENT HAVE RECEIVED MUCH ATTENTION IN RECENT YEARS ESPECIALLY AS THEY RELATE TO SKID RESISTANCE. SEVEN EXPERIMENTAL TEST SECTIONS WERE CONSTRUCTED IN ORDER TO QUANTIFY THE RELATIVE EFFECTS OF THE SURFACE TEXTURES. PRELIMINARY CONCLUSIONS REACHED, AFTER THE FIRST YEAR'S OBSERVATION, WERE: 1. THE OVERALL CONTROL OF CONCRETE QUALITY AND UNIFORMITY DURING CONSTRUCTION WAS GOOD TO EXCELLENT, AND THERE WERE NO APPRECIABLE DIFFERENCES IN ANY OF THE CONCRETE PROPERTIES AS A FUNCTION OF SURFACE FINISH. 2. DURING THE FIRST YEAR IN SERVICE, SKID VALUES FOR ALL EXPERIMENTAL TEXTURES WERE HIGHER THAN THE BURLAP DRAG TEXTURE NOW GENERALLY USED BY THE TEXAS HIGHWAY DEPARTMENT (THD). 3. THE CHANGE IN THD SKID TRAILER VALUES AT 40 MPH WITH TIME AS THE PAVEMENT IS SUBJECTED TO WEAR IS INCONSISTENT AND CANNOT BE EXPLAINED AT THIS TIME. 4. UNDER SIMULATED RAINFALL THE SKID RESISTANCE VALUES FOR DEEP-TEXTURED PAVEMENTS ARE MARKEDLY DIFFERENT FROM VALUES USING THD TRAILER WATER. 5. UNDER "LIGHT" RAINFALL, ALL OF THE EXPERIMENTAL TEXTURES EXHIBITED HIGHER SKID RESISTANCES THAN THE BURLAP DRAG TEXTURE. UNDER "HEAVY" RAINFALL, SOME OF THE BENEFICIAL SKID RESISTANCE EFFECTS OF THE DEEPER EXPERIMENTAL TEXTURES WERE MASKED, WHILE THE TRANSVERSE TINES EXHIBITED THE BEST OVERALL SKID RESISTANCE. 6. IN GENERAL, THE GREATER THE TEXTURE DEPTH OF A CONCRETE SURFACE, THE GREATER THE ASSOCIATED SKID NUMBER AS MEASURED USING THD TRAILER WATER. HOWEVER, THIS TREND WAS NOT AS CLEAR WHEN SIMULATED RAINFALL WAS USED. 7. WITH AN INCREASE IN TEXTURE DEPTH, THERE IS AN ASSOCIATED INCREASE IN SOUND, AS MEASURED BY SOUND PRESSURE LEVEL. /FHWA/

Davis, JL Ledbetter, WB Meyer, AH
Texas Transportation Institute Intrm Rpt Aug. 1973, 73 pp

ACKNOWLEDGMENT: Federal Highway Administration, Texas Highway Department FHWA M-0119, NTIS PB 231 000/AS, 1C26023629

2A 206544

THE REHABILITATED AASHO TEST ROAD PART I--MATERIALS AND CONSTRUCTION
THE WORKING COMMITTEE FOR THE AASHO ROAD TEST PROJECT RECOMMENDED EXTENDING THE STUDY OF THE AASHO ROAD TEST UNDER MIXED TRAFFIC AT THE SITE NEAR OTTAWA, ILLINOIS. AT THE CLOSE OF CONTROLLED TESTING, NEW RIGID AND FLEXIBLE TEST SECTIONS WERE ADDED AS LINKS BETWEEN THE TEST TANGENTS OF THE FOUR MAJOR LOOPS AND AS REPLACEMENT TEST SECTIONS FOR THOSE WHICH EITHER HAD FAILED OR WERE INADE-

QUATE BY INTERSTATE STANDARDS. NEW SUBBASE MATERIALS INTRODUCED UNDER RIGID PAVEMENT WERE CRUSHED STONE, GRAVEL, BITUMINOUS-AGGREGATE MIXTURE AND CEMENT-AGGREGATE MIXTURE, BUT THE ONLY NEW SUBBASE MATERIAL USED UNDER THE FLEXIBLE PAVEMENT WAS GRAVEL. EXCEPT FOR PORTLAND CEMENT CONCRETE, BASE MATERIALS SUCH AS SALVAGED CRUSHED STONE-SPECIAL, CRUSHED STONE, BITUMINOUS-AND CEMENT-AGGREGATE MIXTURES WERE SIMILAR TO THOSE USED IN THE ORIGINAL AASHO TEST ROAD. AS A SIDE STUDY, THE BITUMINOUS SURFACE WAS ALTERED IN SEVERAL TEST SECTIONS EITHER BY ADDING ASBESTOS TO OR BY SUBSTITUTING HYDRATED LIME AND KAOLIN CLAY FOR LIMESTONE DUST MINERAL FILLER. THE NEW EXPERIMENTAL HIGHWAY, WHICH WAS OPENED TO TRAFFIC IN NOVEMBER 1962 AS A PART OF INTERSTATE 80, HAS 85 RIGID AND 43 FLEXIBLE TEST SECTIONS. /FHWA/

Little, RJ Mckenzie, LJ Dierstein, PG
Illinois Dept of Transportation Interim July 1973, 84 pp

ACKNOWLEDGMENT: Illinois Dept of Transportation, Federal Highway Administration FHWA S0214, NTIS PB 230 847/AS, 1C26023636

2A 206552

RESULTS OF OKLAHOMA FLEXIBLE PAVING RESEARCH PROJECT

FROM 1955 TO 1962 THE OKLAHOMA HIGHWAY DEPARTMENT STUDIED PLATE-BEARING AND BENKELMAN BEAM TESTS ON EXISTING ROADS AND THE EFFECTS OF SOILS, CLIMATE, TRAFFIC AND OTHER FACTORS. A PAVEMENT DESIGN METHOD WAS DEVELOPED AND A SOILS MANUAL WAS PUBLISHED. RECENTLY CONSTRUCTED PROJECTS GIVING UNSATISFACTORY SERVICE WERE INVESTIGATED AND STUDIES WERE MADE TO DETERMINE THE CAUSES OF POOR PAVEMENT PERFORMANCE. THESE WERE UNDERDESIGN FOR THE LOAD ASSUMED, DEFECTIVE MATERIALS IN THE BASE, OVERLOADED, POOR SUBBASE MATERIAL, SHRINKAGE OF SUBGRADE SOIL AND WATER ENTERING THROUGH THE SURFACE. /RRL/

Helmer, R A *Highway Research Record, Hwy Res Board* 1965

2A 206669

AN APPARATUS FOR MEASURING THE DYNAMIC STIFFNESS OF ROADS AND SOILS

THE ARTICLE DESCRIBES A SMALL AND PORTABLE APPARATUS DESIGNED TO MEASURE THE DYNAMIC STIFFNESS OF ROADS AND SOILS UNDER SINUSOIDAL LOADING, AT FREQUENCIES BETWEEN 5 AND 1000 HZ. AN ELECTROMAGNETIC VIBRATOR APPLIES FORCES OF UP TO APPROXIMATELY 14 LB /ABOUT ITS DEAD WEIGHT OF 45 LB/ TO THE ROAD SURFACE, THE FORCE ITSELF AND THE RESULTING DISPLACEMENT OF THE ROAD SURFACE BEING MEASURED BY MEANS OF ELECTRICAL TRANSDUCERS FEEDING A PHASE-SENSITIVE VOLT-METER. VALUES OF THE ELASTIC STIFFNESS OF THE CONSTRUCTION AND VALUES OF THE DAMPING ARE OBTAINED. CHECK TESTS OF THE BEHAVIOR OF THE APPARATUS ARE DESCRIBED. AND SOME TYPICAL RESULTS ON VARIOUS TYPES OF ROAD PAVEMENT ARE GIVEN. /AUTHOR/

Thrower, EN *Journal Scientific Instruments /UK/* July 1967

2A 206692

PAVEMENT STRUCTURE-POLAND

THERE HAS BEEN INTEREST IN POLAND FOR QUITE A TIME ON THE CAUSE OF CRACKING OF BASE LAYERS STABILIZED WITH CEMENT. ON THE BASIS OF TESTS AND OBSERVATIONS IT HAS BEEN NOTED THAT: /1/ THE CRACKING OF LAYERS IS MOST OFTEN CAUSED BY THE LACK OF UNIFORMITY OF THE COMPACTION OF THE SOIL UNDER HIGHWAY TRAFFIC. IT IS A KNOWN FACT, THAT VEHICLES NORMALLY TRAVEL ON THE SAME PATHS, WHICH IS DOUBTLESS THE PRINCIPAL CAUSE OF THIS TYPE OF CRACKING. IT IS NOTED THAT THE IRREGULAR PATTERN OF CRACKS OFTEN APPEARS IN THE

PLACES WHICH ARE EXPOSED TO THE NUMEROUS JOURNEYS PERPENDICULAR TO THE AXIS OF THE HIGHWAY, /2/ TO ANTICIPATE FORMATION OF CRACKING IN BASE LAYERS IN SOIL CEMENT, IT IS THEREFORE ESSENTIAL TO PAY SPECIAL ATTENTION TO THE COMPACTION OF SOIL CEMENT DURING THE CONSTRUCTION OF THE HIGHWAY AND ALSO THE SUBGRADE SOIL ITSELF. IT IS ALSO NECESSARY, THAT THE MIXING WITH CEMENT IS IN SUFFICIENT DEPTH, AND /3/ CRACKING DOES NOT BRING ABOUT VERY SERIOUS DAMAGE, BUT IT REQUIRES SUPPLEMENTARY PRESERVATION WORKS SUCH AS THE CLOSING OF THESE CRACKS WITH SEALANT MATERIALS.

Skalmonski, W *Perm Intl Assoc Road Congresses Proc* 1967

2A 206734

FIELD MEASUREMENT OF DYNAMIC ELASTIC MODULI OF MATERIALS IN FLEXIBLE PAVEMENT STRUCTURES

A SERIES OF WAVE PROPAGATION (VELOCITY) MEASUREMENTS WERE MADE ON TWO FIELD PROJECTS IN THE UNITED STATES USING THE SMALL, HIGH FREQUENCY VIBRATION EQUIPMENT. THE USE OF THE HIGH FREQUENCY VIBRATION EQUIPMENT FOR TESTING PAVEMENT SECTIONS (BOTH EXPERIMENTAL AND REGULAR) HAS DEMONSTRATED THE ABILITY TO OBTAIN SIGNIFICANT WAVE PROPAGATION DATA WHICH CAN BE RELATED TO MATERIAL PROPERTIES SUCH AS THE MODULUS OF ELASTICITY. DYNAMIC TESTS ON THE PERFORMANCE OF A SERIES OF ASPHALT-TREATED SAND ASPHALT BASES SHOWED THE ANALYSIS OF VELOCITY DATA FROM PAVEMENTS CONTAINING RELATIVELY THICK LAYERS OF ASPHALT-BOUND MATERIAL REQUIRED THE USE OF ANALYTICAL METHODS WHICH DIFFER SOMEWHAT FROM THOSE EMPLOYED IN THE PAST. TESTS ON A LARGE VARIETY OF PAVEMENT TYPES CONFIRM THAT THE INDIVIDUAL TYPE OF PAVEMENT INVOLVED GOVERNS THE PATTERN OF VELOCITY RESPONSE WHICH IS OBTAINED FROM THE TESTS AND THAT EACH INDIVIDUAL TYPE MUST BE JUDGED FROM A KNOWLEDGE OF THE PARTICULAR COMPONENTS REPRESENTED.

Metcalf, CT *Intl Conf Struct Design Asphalt Pvmnts* Aug. 1967

2A 206770

A STUDY OF VIBRATION PHENOMENA IN ASPHALTIC ROAD CONSTRUCTION

IT IS HYPOTHESIZED THAT THE FLEXURAL STRESSES SET UP BY MOVING TRAFFIC ULTIMATELY EXCEED THE STRENGTH OF THE MATERIALS, LEADING TO CRACK FORMATION. FLEXURAL STRENGTH AFTER REPEATED LOADINGS AND FATIGUE PHENOMENA ARE INVESTIGATED. A VIBRATION GENERATOR IS DESCRIBED WHICH PRODUCES A WIDE VARIATION OF BOTH FREQUENCY AND AMPLITUDE OF FORCE APPLIED TO THE PAVEMENT STRUCTURE. METHODS OF DETERMINING PAVEMENT DEFLECTION AS A FUNCTION OF THE FORCE ACTING ON THE PAVEMENT AND MEASURING STRAINS IN THE PAVEMENT AND THE RATE OF PROPAGATION OF WAVES PRODUCED BY THE VIBRATION GENERATOR ARE PRESENTED. EXPERIMENTAL RESULTS INCLUDE SHEAR MODULUS OF PAVEMENT COMPONENT LAYERS, PAVEMENT DEFLECTION WITH AND WITHOUT ASPHALT SURFACE, PAVEMENT STIFFNESS, EFFECT OF THICKNESS OF BITUMINOUS BOUND LAYER, STRAIN MEASUREMENT UNDER THE VIBRATION MACHINE AND UNDER MOVING TRAFFIC. IT IS CONCLUDED THAT CRACKING OF ASPHALTIC ROAD CARPETS IS MAINLY DUE TO BENDING STRESSES EXCEEDING THE STRENGTH OF THE MATERIAL. STIFFNESS OF COMPLETED CONSTRUCTION CAN BE DESCRIBED BY A SINGLE VALUE, THE DYNAMIC LOAD PER UNIT OF DEFLECTION. IT IS POSSIBLE TO MEASURE THE DYNAMIC SHEAR MODULUS OF SUB-SOIL AND SUB-BASE IN SITES. A BITUMINOUS BOUND BASE HAS A VERY BENEFICIAL EFFECT ON THE STRAINS IN THE CARPET.

Nijboer, LW Van, DER POEL C *Assoc Asphalt Paving Technol Proc* 1953

2A 206771

PAVEMENT BLOWUPS CORRELATED WITH SOURCE OF COARSE AGGREGATE

RESULTS ARE GIVEN OF A STUDY OF THE PERFORMANCE OF 3300 MILES OF RIGID PAVEMENT CONSTRUCTED IN INDIANA FROM 1921- 1943. THE DATA WERE OBTAINED FROM FIELD PERFORMANCE SURVEYS MADE OVER A PERIOD OF TWO YEARS, TOGETHER WITH RECORDS OF CONSTRUCTION AND MATERIALS OBTAINED FROM THE CONSTRUCTION AND TESTING DEPARTMENTS OF THE STATE HIGHWAY COMMISSION OF INDIANA, AND FROM BLOWUP REPORTS OBTAINED FROM THE MAINTENANCE DEPARTMENT. IN ANALYZING THE DATA, IT WAS FOUND THAT THERE WERE 2404 BLOWUPS IN THE 2623 MILES WITHOUT EXPANSION JOINTS AND THAT 851 MILES CONTAINED NO BLOWUPS, WHILE 1715 MILES (65%) CONSTRUCTED FROM 82 COARSE AGGREGATE SOURCES CONTAINED ONLY 203 BLOWUPS. IN CONTRAST, 1188 BLOWUPS WERE FOUND IN 284 MILES OF PAVEMENTS CONSTRUCTED WITH MATERIAL FROM ONLY FIVE DIFFERENT SOURCES. FURTHERMORE, 97.1 MILES OF PAVEMENT CONSTRUCTED WITH MATERIAL FROM ONE OF THESE SOURCES CONTAINED 707 BLOWUPS (29.6% OF THE TOTAL BLOWUPS IN THE STATE). THESE DATA WERE CONSIDERED IMPORTANT, SINCE IT WAS OBSERVED GENERALLY THAT MAP CRACKING, SERIOUS DISINTEGRATION, AND A RELATIVELY SHORT PAVEMENT LIFE ACCOMPANIED THE BLOWUP FAILURES. IT WAS CONCLUDED, ON THE BASIS OF A STATISTICAL ANALYSIS OF THESE BLOWUP DATA THAT: /1/ AN OUTSTANDING CORRELATION EXISTED BETWEEN CERTAIN COARSE AGGREGATES USED IN THE CONCRETE MIX AND THE BLOWUP PERFORMANCE OF THE PAVEMENTS, /2/ NO CORRELATION EXISTED BETWEEN THE CEMENT, FINE AGGREGATE, TRAFFIC, OR SUBGRADE SOILS USED AND BLOWUP PERFORMANCE, AND /3/ EXTENSIVE LABORATORY RESEARCH IS INDICATED AS NECESSARY TO DETERMINE THE BASIC REASON FOR THE VARIATION IN PERFORMANCE BETWEEN AGGREGATE SOURCES AND TO DEVELOP NEW AND BETTER METHODS OF TESTS BY WHICH THOSE AGGREGATES WHICH PRODUCE CONCRETE OF AN UNSATISFACTORY QUALITY CAN BE IDENTIFIED BEFORE THEY ARE INCORPORATED IN THE CONCRETE PAVEMENT. /AUTHOR/

Woods, KB Sweet, HS Shelburne, TE *Highway Research Board Proceedings* 1945

2A 206772

FINAL REPORT ON DURABILITY PROJECT, MICHIGAN TEST ROAD

BUILT IN CONJUNCTION WITH THE DESIGN PROJECT IN 1940, THE DURABILITY PROJECT OF THE MICHIGAN TEST ROAD WAS DESIGNED TO STUDY THE EFFECT OF VARIOUS FACTORS ON THE DURABILITY OF CONCRETE IN SERVICE. THE STUDY INCLUDED BOTH MATERIALS AND OPERATIONS, PRINCIPALLY THE FOLLOWING FACTORS: /1/ PROPORTIONING AND GRADING OF AGGREGATES, /2/ VARIOUS TYPES OF ADDITIVES, INCLUDING PLASTICIZERS AND AIR-ENTRAINING AGENTS, /3/ BLENDS OF PORTLAND WITH NATURAL CEMENT PRODUCED WITH AND WITHOUT A GRINDING AID, /4/ LIMESTONE AGGREGATES IN VARIOUS COMBINATIONS AND GRADINGS AND /5/ FINISHING AND CURING. SUPPLEMENTARY LABORATORY STUDIES PRECEDED AND ACCOMPANIED CONSTRUCTION AND EVALUATION OF THE PAVEMENT. SEVERAL INCIDENTAL STUDIES WERE ALSO CARRIED OUT IN CONNECTION WITH THE CONSTRUCTION OF THE PROJECT, AND ACCELERATED SCALING TESTS WERE PERFORMED ON THE TEST AREAS DURING THE FIRST TWO WINTERS AFTER CONSTRUCTION.

Rhodes, CC Finney, EA *Highway Research Board Proceedings* 1960

2A 206898

A COMBINED APPROACH TO THE OPTIMISATION OF TIRE AND PAVEMENT INTERACTION

THE DEVELOPMENT OF PAVEMENT SURFACING TECHNOLOGY WITH REGARD TO SKID RESISTANCE, AND ADVANCES IN

THE UNDERSTANDING OF TIRE-PAVEMENT INTERACTION ARE REVIEWED. THE INFLUENCE OF THESE ADVANCES ON THE CONSTRUCTION OF PAVEMENT SURFACES AND DESIGN OF TIRES IN GREAT BRITAIN IS DISCUSSED. DETAILS ARE GIVEN OF A VARIABLE SPEED INTERNAL DRUM MACHINE DESIGNED TO CONTROL SOME OF THE VARIABLES PRESENT IN ROAD HOLDING MEASUREMENTS AND TO DEVELOP AND TEST SURFACINGS AND TREAD COMPOUNDS UNDER LABORATORY CONDITIONS. THE POLISHING ACTION OF THE TRAFFIC AND ROUGHENING EFFECT OF CLIMATIC CHANGES ARE STUDIED BY MEANS OF ELECTRON MICROSCOPY AND RELATED TO SKID RESISTANCE MEASUREMENTS. THE VARIOUS TYPES OF TREAD COMPOUND ABRASION TERMED "REVERSION" DISCUSSES THE CONDITIONS ABRASION ARE REVIEWED AND THE PARAMETERS INFLUENCING GOVERNING ITS FORMATION. THE CONCEPT OF THE THREE ZONE CONTACT PATH IS DISCUSSED WITH REGARD TO RECENT DEVELOPMENTS IN TIRE CONSTRUCTION, TREAD PATTERNS AND PAVEMENT SURFACES. SPECIAL REFERENCE IS MADE TO THE DEVELOPMENT OF PAVEMENTS USING ARTIFICIAL AGGREGATES AND NATURAL AGGREGATES OF THE GRITSTONE GROUP. /RRL/

Holmes, T Lees, G Williams, AR
Birmingham University /UK/

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 207031

THE WASHO ROAD TEST, PART 2: TEST DATA, ANALYSES, FINDINGS

CONTENTS: PRIMARY OBJECTIVE, PRINCIPAL TEST CONSIDERATION, AND SYNOPSIS OF FINDINGS OPERATION OF TEST TRAFFIC TEST VEHICLE DATA AND SUMMARY OF OPERATIONS VEHICLE OPERATING SPEED TRANSVERSE POSITION OF TEST VEHICLES TIRE CONTACT ANALYSIS PERFORMANCE OF TEST PAVEMENTS PRESENTATION OF DATA CRITICAL PERIODS ANALYSES OF PERFORMANCE DATA PAVEMENT DEFLECTION TRANSVERSE SURFACE, SUBBASE, AND SUBGRADE PROFILES SUBSURFACE CONDITIONS SPECIAL TEST SECTIONS SPECIAL OBSERVATIONS AND MEASUREMENTS CLIMATE AND METEOROLOGICAL DATA FIELD CBR STUDIES SPECIAL DEFLECTION STUDIES SPEED VERSUS DEFLECTION TEMPERATURE VERSUS DEFLECTION LOAD VERSUS DEFLECTION CBR VERSUS DEFLECTION MOISTURE CONTENT VERSUS DEFLECTION DEFLECTION PATTERNS AND RATIO OF D TO A BENKELMAN BEAM VERSUS ELECTRONIC DEFLECTIONS DEFLECTIONS AT TOP OF BASEMENT SOIL TRANSVERSE MOVEMENT OF GRANULAR MATERIAL LOAD SHIFT FLEXURAL STRENGTH OF ASPHALTIC CONCRETE ROAD ROUGHNESS MEASUREMENTS PROFILOGRAPH STUDIES ARTIFICIAL RAIN EXPERIMENT PERMEABILITY OF ASPHALTIC CONCRETE DYNAMIC TESTS SPECIAL STUDIES OF PAVEMENT MATERIAL CORPS OF ENGINEERS BASEMENT SOIL FROST STUDIES SPECIAL STUDIES OF WASHO PAVEMENT MATERIALS UNIVERSITY OF CALIFORNIA RESEARCH ON SOIL FROM WASHO ROAD TEST ASPHALTIC CONCRETE TESTS BUREAU OF PUBLIC ROADS STUDIES MAINTENANCE OF TEST PAVEMENT

Highway Research Board Special Reports 1955

2A 207037

THE AASHO ROAD TEST: REPORT 7-SUMMARY REPORT

A SUMMARY IS PRESENTED OF THE AASHO ROAD TEST ON THE STUDY OF THE PERFORMANCE OF PAVEMENT AND BRIDGE STRUCTURES OF KNOWN CHARACTERISTICS UNDER MOVING LOADS OF KNOWN MAGNITUDE AND FREQUENCY. THE AASHO ROAD TEST WAS CONDUCTED NEAR OTTAWA, ILLINOIS, OVER A 2-YEAR PERIOD TO PROVIDE RESEARCH DATA USEFUL IN THE DESIGN OF EFFICIENT HIGHWAYS OF ECONOMICAL COST FOR HIGHWAY ENGINEERS. THE ROAD TEST WAS COMPOSED OF THE FOLLOWING MAJOR EXPERIMENTS: RELATING TO FLEXIBLE PAVEMENT WITH ASPHALT CONCRETE SURFACING, RIGID PAVEMENT WITH CONCRETE SURFACING, SHORT-SPAN BRIDGES WITH STEEL BEAMS AND

SHORT-SPAN BRIDGES WITH CONCRETE BEAMS. ONE OF THE BASIC CONCEPTS OF THE EXPERIMENT WAS TO STUDY AND EVALUATE THE PERFORMANCE OF PAVEMENTS AND BRIDGES THROUGH FAILURE. CONSTRUCTION OF THE TEST PAVEMENTS WAS VERY CAREFULLY CONTROLLED. PAVEMENT RESEARCH WAS CONDUCTED TO ESTABLISH RELATIONSHIPS SHOWING HOW PERFORMANCE OF PAVEMENTS IS INFLUENCED BY STRUCTURAL DESIGN, REPRESENTED BY COMPONENT THICKNESSES OF THE PAVEMENT STRUCTURE, AND LOADING, REPRESENTED BY THE MAGNITUDE AND FREQUENCY OF AXLE LOADS, FOR BOTH RIGID AND FLEXIBLE PAVEMENTS OF CONVENTIONAL DESIGN. TEST RESULTS ARE PRESENTED IN THE FORM OF EQUATIONS AND GRAPHS SHOWING THE RELATIONSHIPS SOUGHT. AN IMPORTANT BY-PRODUCT OF THE AASHO ROAD TEST WAS THE DEVELOPMENT OF A NEW CONCEPT FOR THE EVALUATION OF PAVEMENT PERFORMANCE. OTHER IMPORTANT FINDINGS FROM THE PAVEMENT PERFORMANCE STUDY INCLUDE INFORMATION ON THE EQUIVALENCIES OF SINGLE AND TANDEM AXLE ARRANGEMENTS. FLEXIBLE PAVEMENTS LOST SERVICEABILITY THROUGH THE DEVELOPMENT OF RUTS AND ROUGHNESS IN THE WHEEL PATHS AND BY CRACKING IN THE ASPHALTIC CONCRETE SURFACING, EVENTUALLY REQUIRING PATCHING OF THE SURFACE. FOR THE ROAD TEST CONDITIONS, THE TESTS SHOWED THAT IN THE DESIGN OF FLEXIBLE PAVEMENT 1 INCH OF ASPHALT CONCRETE WAS EQUIVALENT TO 3 INCHES OF CRUSHED LIMESTONE BASE, OR 4 INCHES OF SAND-GRAVEL SUBBASE IN THEIR LOAD-CARRYING ABILITIES. FLEXIBLE PAVEMENT BASES TREATED WITH BITUMINOUS MATERIAL OR CEMENT WERE FAR SUPERIOR TO UNTREATED CRUSHED LIMESTONE OR GRAVEL BASES IN RESISTING LOSS OF SERVICEABILITY UNDER LOAD. RIGID PAVEMENTS LOST SERVICEABILITY BY THE DEVELOPMENT OF ROUGHNESS ALONG THE WHEEL PATHS, BY SLAB CRACKING OR BY THE NECESSITY OF PATCHING THE PAVEMENT SURFACE DUE TO SEVERE CRACKING AND ROUGHNESS. IN THE RIGID PAVEMENT EXPERIMENT, THE USE OF SAND-GRAVEL SUBBASE INCREASED THE LIFE OF THE PAVEMENT APPRECIABLY WHEN PAVEMENTS WITH SUBBASE WERE COMPARED TO PAVEMENTS WITH NO SUBBASE. THE COMBINED DEFECTS OF TRAFFIC AND WEATHERING ON PAVEMENT SURFACE SKID RESISTANCE WERE STUDIED. AN IMPORTANT PART OF THE AASHO ROAD TEST WAS A STUDY OF THE SHORT-SPAN HIGHWAY BRIDGES. REPEATED APPLICATIONS OF OVERSTRESS WERE MADE TO THESE STRUCTURES TO DETERMINE FATIGUE LIFE AND THE MANNER IN WHICH DISTRESSES CAUSED BY REPEATED STRESSES. THE DYNAMIC EFFECTS OF MOVING VEHICLES WERE DETERMINED ON THESE STRUCTURES AND THESE DYNAMIC EFFECTS CORRELATED WITH THOSE PREDICTED BY THEORETICAL COMPUTATIONS. THE OBSERVED DISTRESS CAUSED BY REPEATED APPLICATIONS OF A STRESS INDICATED THAT THE LIFE OF HIGHWAY BRIDGES CAN BE PREDICTED WITH REASONABLE ACCURACY ON THE BASIS OF SIMPLE LABORATORY TESTS, IF THE HISTORY OF STRESSES IN THE BRIDGE IS KNOWN.

Highway Research Board Special Reports 1962

2A 207202

CALIFORNIA PAVEMENT FAULTING STUDY

DETAILS OF AN INVESTIGATION OF FAULTED CONCRETE PAVEMENTS CONSTRUCTED ON CEMENT TREATED BASES ARE PRESENTED. VARIOUS TESTS AND MEASUREMENTS WERE MADE ON THE PAVEMENTS AND CONSTRUCTION MATERIALS INCLUDING STRAINS, DEFLECTIONS, LOAD TRANSFER EFFECTIVENESS ACROSS THE UNDOWELED JOINTS, JOINT OPENINGS AND MOVEMENTS DUE TO TEMPERATURE CHANGES, SLAB CURL, COMPRESSIVE STRENGTH, AND PETROGRAPHIC AND CHEMICAL TESTS. AT SOME SITES, MOVEMENT OF WATER AT THE SLAB BASE INTERFACE WAS DETERMINED BY THE USE OF COLORED TRACER SANDS PLACED UNDER THE SLABS SEVERAL WEEKS PRIOR TO SLAB REMOVAL OR CORING. PORTIONS OF PAVEMENT SLABS WERE

REMOVED AT FOURTEEN SITES IN THREE DIFFERENT GEOGRAPHICAL REGIONS--VALLEY, COASTAL, AND MOUNTAIN. THE SECTIONS, REMOVED FROM THE OUTER EDGE OF PAVEMENT, WERE THREE FEET WIDE AND EXTENDED APPROXIMATELY THREE FEET ON EITHER SIDE OF THE JOINT. TEN OF THE JOINTS THUS OPENED WERE FAULTED IN AMOUNTS VARYING FROM 0.10-INCH TO 0.30-INCH. AT EACH FAULTED JOINT, A BUILDUP OF GRANULAR MATERIAL WAS FOUND UNDER THE APPROACH SLAB, AND IN SOME INSTANCES, UNDER THE LEAVE SLAB AS WELL. THE BUILDUP DIFFERENTIAL WAS APPROXIMATELY EQUAL TO THE AMOUNT OF FAULTING MEASURED. THERE WAS NO EVIDENT SETTLEMENT OF FAULTING OF THE CEMENT TREATED BASE COURSE. THE MAJOR SOURCE OF THE BUILDUP MATERIAL WAS DEFINITELY IDENTIFIED AS BEING MATERIAL ERODED FROM THE CEMENT TREATED BASE IN ONE INSTANCE, AND THE UNTREATED AGGREGATE BASE FROM THE SHOULDER IN ANOTHER INSTANCE. IT IS CONCLUDED THAT THE FAULTED CONDITION OF THE JOINTS WAS CREATED BY A BUILDUP OF MATERIAL UNDER THE PAVING SLABS AT THE JOINTS. THE BUILDUP WAS CAUSED BY VIOLENT WATER ACTION ON AVAILABLE LOOSE OR ERODABLE MATERIALS WHICH WERE PRESENT BENEATH OR ADJACENT TO THE SLABS. TO PREVENT OR REDUCE FAULTING, MORE EROSION RESISTANT MATERIALS ARE NEEDED AT THE SURFACE OF THE BASE COURSE AND IN THE SHOULDERS. IN ADDITION, CONSIDERATION SHOULD BE GIVEN TO PREVENTING THE INTRUSION OF WATER, OR PROVIDING POSITIVE DRAINAGE. /AUTHOR/

Spellman, DL Stoker, JR Neal, BF
California Division Highways Jan. 1970

2A 207592

PAVEMENT CHARACTERISTIC STUDIES OF N.H. 3 AND N.H. 4
THIS STUDY WAS TAKEN UP IN MAHARASHTRA STATE ON THE INVITATION OF THE CHIEF ENGINEER, BUILDINGS AND COMMUNICATIONS, DEPARTMENT OF THE GOVERNMENT OF MAHARASHTRA, IN CONNECTION WITH THE I.D.A. WORKS FOR IMPROVING THE ROADS OF NATIONAL HIGHWAYS TO INTERNATIONAL STANDARDS. RIDING QUALITY OF EXISTING PAVEMENT WAS ONE OF THE FACTORS FOR DECIDING THE STRETCH OF ROAD TO BE IMPROVED. ROAD TESTS WITH THE BUMP INTEGRATOR WERE CONDUCTED ON THE N.H. 4 KOLHAPUR-POONA SECTION (KM-592/5-836/0) AND THE N.H. 3 BOMBAY-AGRA ROAD (KM 265/0-543/0). THE MEAN VALUE OF THE ROUGHNESS INDEX FOR THE 403 KMS TESTED IS 303.8 INCHES/MILE AND THE STANDARD DEVIATION IS 50 INCHES/MILE. ALLOWING THE TOLERANCE LIMIT 50 INCHES/MILE, IT WAS CONSIDERED THAT 250 INCHES/MILE AND BELOW WAS GOOD SECTION. THE STANDARD ADOPTED IN DIFFERENT COUNTRIES VARY ACCORDING TO THE DIFFERENT METHODS OF ROAD CONSTRUCTION, VOLUME OF TRAFFIC, AND THE WAY OF MAINTENANCE TO THE VARYING CLIMATIC CONDITIONS. 160 INCHES/MILE AND BELOW IS CONSIDERED TO BE A GOOD SURFACE IN THE UNITED KINGDOM; IN THE UNITED STATES (1) IN THE STATE OF VIRGINIA 100 TO 150 INCHES/MILE, (2) IN THE STATE OF CALIFORNIA 100 TO 200 INCHES/MILE, AND (3) IN THE STATE OF MINNESOTA 75 INCHES/MILE AND BELOW. THE HIGHWAY RESEARCH BOARD COMMITTEE HAS RECOMMENDED 100 TO 150 INCHES/MILE AS GOOD SURFACE. THE CENTRAL ROAD RESEARCH INSTITUTE, NEW DELHI, HAS EVOLVED A STANDARD OF 160 INCHES/MILE AND BELOW AS GOOD SURFACE AS PER THE TESTS CONDUCTED IN SOME OF THE ROADS IN INDIA. IN TAMIL NADU, IT HAS BEEN ASSESSED THAT 230 INCHES/MILE AND BELOW, ROUGHNESS INDEX IS GOOD ROAD SECTION, AND IMPROVEMENTS ARE BEING MADE TO THE ROAD SECTIONS WHERE THE VALUES ARE HIGHER. AS PER THE TESTS CONDUCTED IN MAHARASHTRA STATE, RECOMMENDATIONS ARE GIVEN FOR IMPROVING THE ROAD SECTIONS WITH A HIGHER INDEX VALUE THAN 250 INCHES/MILE. 46 KMS IN N.H. 3 WITH 3-INCH BITUMINOUS MACADAM AND 1.25-INCH THICK ASPHALTIC CONCRETE PAVEMENT HAS

GIVEN AN INDEX VALUE VARYING FROM 126 INCHES/MILE TO 220 INCHES/MILE. THUS THE STUDY INDICATES THAT BETTER RIDING QUALITY CAN BE ACHIEVED BY MECHANIZED METHODS OF ROAD CONSTRUCTION AND WITH A SUPERIOR TYPE OF SURFACE LIKE ASPHALTIC CONCRETE. /AUTHOR/

Highways Res Station, Madras /India/ No. 35, 1971, 41 pp, Tabs

2A 207616

PENN STATE'S CONTINUING PAVEMENT TEST IS YIELDING VALUABLE RESEARCH RESULTS

A ONE-MILE, ONE-LANE, OVAL-SHAPED TRACK BUILT BY THE UNIVERSITY IN 1971, IS NOW BEING TESTED TO DETERMINE THE BEST BASE-COURSE MATERIAL FOR STANDARD PENNSYLVANIA HIGHWAY PAVEMENT DESIGN. THERE ARE 17 DIFFERENT BASE-COURSE SECTIONS, WITH EACH CONTAINING A MATERIAL TYPE OR MATERIAL THICKNESS VARIABLE. THE PAVEMENT SURFACE IS A UNIFORM ID-2A WEARING COURSE. THE TRAFFIC ON THE TRACK IS PROVIDED BY A CONVENTIONAL TRUCK TRACTOR WITH A SEMI-AND A FULL-TRAILER WHICH OPERATES 18 HOURS A DAY, FOR SEVEN DAYS A WEEK. RECORDING EQUIPMENT ALONG THE TRACK MEASURES SOIL PRESSURE AND STRESS ON THE SOIL AND PAVEMENT. A SKID TEST AREA IS PROVIDED ON THE INSIDE SHOULDER OF THE CUT TANGENT, AND A 120-FT, 2-SPAN, STANDARD HIGHWAY BRIDGE IS ALSO INCLUDED. TO COMPARE THE DIFFERENT DECK CONSTRUCTIONS, THE BRIDGE WAS INSTRUMENTED WITH, STRAIN GAUGES AND DEFLECTOMETERS. THE DECK SLAB IN THE FIRST SPAN WAS CONSTRUCTED WITH PRESTRESSED CONCRETE PLANKS COVERED WITH 4.5 INCHES OF CONCRETE. TO DATE ONLY MINOR DIFFERENCES HAVE BEEN NOTED BETWEEN THE TWO DIFFERENT BRIDGE CONSTRUCTIONS. THE FIRST CYCLE OF RESEARCH WILL CONTINUE THROUGH JUNE 1974.

Highway Research News, Hwy Res Board No. 53, Dec. 1973, pp 20-1

2A 207682

CHECKING THE PAVEMENT DESIGN OF THE EXPERIMENTAL SECTION ON THE SS NO 4 SALARIA. FULL DEPTH PAVEMENT.

THE FIRST EXPERIMENTAL FULL-DEPTH ASPHALT PAVEMENT IN ITALY WAS CONSTRUCTED IN 1970. AFTER NEARLY TWO YEARS OF SERVICE AND TWO PARTICULARLY HARD WINTERS THERE WAS NO SUBSIDENCE, LOOSENING OF AGGREGATES OR TRACKING, WHILE SIMILAR DEFECTS HAD TO BE REPAIRED ON ADJOINING SECTIONS OF CONVENTIONAL STRUCTURE. SYSTEMATIC DEFLECTION MEASUREMENTS AND CORE SAMPLING ARE BEING CARRIED OUT TO EVALUATE THE LONG TERM PERFORMANCE OF THE TEST SECTION, THE DESIGN AND CONSTRUCTION OF WHICH ARE DESCRIBED AND ILLUSTRATED. /TRRL/

Castagnetta, V *Autostrade /Italy/* Vol. 14 No. 11, Nov. 1972, pp 4-11, 5 Fig, 1 Tab, 5 Phot, 61 Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/IRRD 205 417, 2C26305417

2A 207699

DIMENSIONAL TOLERANCES AND QUALITY CONTROL IN WELDED STEEL CONSTRUCTION

RECENTLY THE AMERICAN WELDING SOCIETY ISSUED TWO REGULATIONS FOR WELDED CONSTRUCTION ONE FOR BUILDINGS AND THE OTHER FOR BRIDGES. A BRIEF DISCUSSION IS GIVEN OF THE PERTINENT CLAUSES DEvised TO PROVIDE AN ACCEPTABLE QUALITY OF WORKMANSHIP AND TO SPECIFY THE LIMITS OF DIMENSIONAL DEVIATION OBTAINED IN WELDED FABRICATION. /AUTHOR/

Amirkian, A *Highway Research Record, Hwy Res Board* 1965

2A 207700

STRUCTURAL STEEL CONSTRUCTION TOLERANCES

CHANGES IN STEEL CONSTRUCTION TOLERANCES ARE ANALYZED AND DISCUSSED FOR ACCURACY AS FOLLOWS: STRUCTURAL INTEGRITY, DIMENSIONAL FUNCTION AND APPEARANCE. THE ADEQUACY OF EXISTING SPECIFICATION TOLERANCES AND THE DESIRABILITY OF MODIFYING EXISTING TOLERANCE AS A RESULT OF CURRENT DEVELOPMENTS IN MATERIALS AND CONSTRUCTION METHODS ARE DISCUSSED. THE DESIRABILITY OF DEVELOPMENT OF SO-CALLED TOLERANCE CURVES IS ANALYZED. BASED ON A SAMPLING OF OPINIONS, THE TOLERANCES FOR FABRICATED STRUCTURAL STEEL WORK WHICH ARE PRESENTLY IN FORCE ARE CONSIDERED TO BE ADEQUATE. WHERE IT IS APPROPRIATE, ANY NEW TOLERANCE PROVISIONS SHOULD OBJECTIVELY BE BASED ON THE REQUIREMENTS FOR STRUCTURAL INTEGRITY, DIMENSIONAL FUNCTION, AND APPEARANCE.

Milek, WA *Highway Research Record, Hwy Res Board* 1965

2A 207711

FATIGUE STRENGTH OF 1/2-INCH DIAMETER STUD SHEAR CONNECTORS

COMPOSITE STEEL AND CONCRETE BEAMS WERE TESTED IN FATIGUE AT VARIOUS STRESS LEVELS. ALL TWELVE BEAMS TESTED HAD 1/2-IN. DIAMETER WELDED STUDS AS SHEAR CONNECTORS. THE BEAMS WERE DESIGNED SO THAT NORMAL WORKING STRESSES WOULD BE ACHIEVED AT PEAK LOADS DURING REPEATED LOADING WHILE THE SHEAR STRESS ON CONNECTORS WAS SUFFICIENTLY HIGH TO PRODUCE FATIGUE FAILURE. FATIGUE FAILURE OF CONNECTORS ACTUALLY OCCURRED IN ELEVEN OF THE BEAMS. ELECTRICAL RESISTANCE STRAIN GAGES WERE USED IN EIGHT OF THE TEST BEAMS TO DETECT WHEN FATIGUE CRACKS WERE INITIATED IN CONNECTORS. THE USE OF SUCH STRAIN GAGES ENABLED THE INVESTIGATORS TO DETERMINE THE EXTENT OF FATIGUE FAILURE AT ANY TIME DURING THE TESTING. THIS INFORMATION WAS COMPARED WITH END SLIP AND DEFLECTION DATA TAKEN DURING THE TESTS. THE CRITERION OF FAILURE WAS TAKEN AS THE INITIAL CRACKING OF A PAIR OF SHEAR CONNECTORS. ON THIS BASIS AN S-N CURVE WAS OBTAINED FROM THE RESULTS OF SEVEN OF THE BEAM TESTS. A STATISTICAL ANALYSIS OF THESE DATA WAS MADE AND THE 95 PERCENT CONFIDENCE LIMITS OF THE DATA WERE OBTAINED. THE DATA ON FATIGUE OF STUD CONNECTORS OBTAINED BY OTHER INVESTIGATORS FALL GENERALLY WITHIN THESE 95 PERCENT CONFIDENCE LIMITS. /AUTHOR/

King, DC Slutter, RG Driscoll, GC *Highway Research Record, Hwy Res Board* 1965

2A 207712

FATIGUE STRENGTH OF 3/4-INCH STUD SHEAR CONNECTORS

RESULTS OF FATIGUE TESTS PERFORMED ON SEVEN STEEL-CONCRETE COMPOSITE BEAMS ARE PRESENTED. THE SHEAR BETWEEN THE STEEL 24 WF 68 BEAMS AND THE 6-IN. THICK SLAB IS DEVELOPED BY MEANS OF 3/4-IN. DIAMETER HEADED STEEL STUDS. THE BEAMS WERE ALL IDENTICAL EXCEPT FOR THE NUMBER OF STUDS. THE BEAMS WERE 36.0 FT LONG AND WERE DIVIDED INTO TWO GROUPS: /A/ FOUR COMMERCIALY GOOD AND ACCEPTABLE SPECIMENS, AND /B/ THREE INFERIOR SPECIMENS NOT ACCEPTABLE TO THE TEXAS HIGHWAY DEPARTMENT. TEST RESULTS INDICATE THAT: /A/ THERE IS A DIFFERENCE /AS MUCH AS 3 KSI/ IN FATIGUE STRENGTH BETWEEN 1/2-AND 3/4-IN. STUDS; /B/ THE AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS /AASHO/ SPECIFICATIONS ALLOWABLE STRESS FOR STUD SHEAR CONNECTORS PRUDENTLY COULD BE INCREASED BY REDUCING THE FACTORS OF SAFETY PRESENTLY IN USE, /C/ TWO OF THE THREE DEFECTIVE SPECIMENS TESTED EXHIBITED FATIGUE STRENGTHS EQUAL

TO THOSE OF COMMERCIALY ACCEPTABLE SPECIMENS; AND /D/ FOR 10 MILLION CYCLES THE FATIGUE STRENGTH OF THE STUDS TESTED, EXPRESSED IN TERMS OF STRESS RANGE, IS AT LEAST 13 KSI. /AUTHOR/

Toprac, AA *Highway Research Record, Hwy Res Board* 1965

2A 207731

A STUDY OF LOAD DISTRIBUTION CHARACTERISTICS OF SINGLE AND LAYERED TIMBER BRIDGE DECKS SUPPORTED BY MULTIPLE STRINGERS

A THEORETICAL METHOD WAS DEVELOPED TO ANALYZE THE LOAD DISTRIBUTION CHARACTERISTICS OF MULTI-STRINGER BRIDGES, INCORPORATING THE STIFFNESS MATRIX METHOD AND THE THEORY OF HARMONIC ANALYSIS. THE METHOD WAS QUITE ADAPTABLE TO ELECTRONIC COMPUTATION. TESTS WERE CONDUCTED ON MODELS OF THREE DIFFERENTLY CONSTRUCTED TIMBER BRIDGE DECKS TO OBTAIN THEIR LOAD DISTRIBUTION CHARACTERISTICS FOR COMPARISON WITH THOSE OBTAINED FROM THE THEORETICAL METHOD. THE EXPERIMENTAL VALUES OBTAINED FOR THE INTERIOR STRINGERS ARE EXPRESSED AS A PERCENTAGE OF THE PREDICTED VALUES, AND WHEN LISTED IN ASCENDING ORDER OF TRANSVERSE FLEXURAL STIFFNESS OF THE MODEL DECKS THE PERCENTAGES WERE APPROXIMATELY 88 PERCENT, 93 PERCENT, AND 95 PERCENT. THE AASHO DISTRIBUTION FACTORS APPEARED TO BE QUITE CONSERVATIVE BASED ON THE EXPERIMENTAL RESULTS REPORTED. THIS CONSERVATISM SUGGESTED THAT THE LAYERED DECK BEING USED BY THE NORTH CAROLINA STATE HIGHWAY COMMISSION COULD SAFELY CARRY AN OCCASIONAL OVERLOAD OF ABOUT 50 PERCENT. THE SIMILARITY OF THE DISTRIBUTION FACTORS OBTAINED FOR THE THREE TYPES OF DECK TESTED INDICATED THAT THE SELECTION OF THE MOST DESIRABLE DECK SYSTEM WOULD PROBABLY BE CONTROLLED BY OTHER DESIGN CONSIDERATIONS, SUCH AS MAINTENANCE OR UNIT COST. /BPR/

Zia, P Wilson, WT Rowan, WH
North Carolina State University June 1964

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4610002 65)1C27020393, 1C27020062

2A 207781

AN INVESTIGATION OF LOAD DISTRIBUTION CHARACTERISTICS AND LOAD CAPACITY OF SMALL TIMBER BRIDGES

BRIDGES WITH TIMBER DECKING ARE USED EXTENSIVELY THROUGHOUT THE SECONDARY ROAD SYSTEM IN NORTH CAROLINA. HOWEVER, SUCH BRIDGES PRESENT A MAINTENANCE PROBLEM DUE TO THE LOOSENING OF THE TIMBER DECKING CAUSED BY THE ACTION OF REPEATED MOVING LOADS. THE PROBLEM IS GENERALLY, AND TEMPORARILY CORRECTED BY REDRIVING THE PLAIN SHANK SPIKES WHICH ARE USED DURING CONSTRUCTION. A MORE POSITIVE METHOD OF SECURING THE DECKING IS OBVIOUSLY NEEDED. THE FOLLOWING REPORT COVERS A LABORATORY STUDY AND ANALYSIS OF TIMBER JOINTS CONNECTED WITH FOUR TYPES OF NAILS AND AN ADHESIVE. THESE JOINTS WERE SUBJECTED TO STATIC PULL-OUT TESTS AND TO FATIGUE TESTS AT 20, 40, 60 AND 80 PERCENT OF THE STATIC PULL-OUT LOAD. THE NAILS WHICH WERE TESTED WERE THE PLAIN SHANK TYPE, A HELICALLY THREADED /SCREWTITE/ NAIL, AN ANNULARLY THREADED /STRONGHOLD/ NAIL, AND A CEMENT-COATED PLAIN SHANK NAIL. THE ADHESIVE WAS DURO-LOK 150, A THERMOSETTING EMULSION. THE TIMBER USED IN THE INVESTIGATION WAS PRESSURE-CREOSOTED SOUTHERN PINE. ANALYSIS OF THE STATIC TEST DATA SHOWS THAT THE THREADED TYPE CONNECTORS HAVE SIGNIFICANTLY GREATER HOLDING POWER. THE CONNECTORS IN DESCENDING ORDER OF THEIR ULTIMATE STRENGTH UNDER STATIC LOADING ARE STRONGHOLD, SCREWTITE, CEMENT-COATED, AND PLAIN SHANK. THE REPEATED LOAD FATIGUE TESTS INDICATE THE SAME ORDER

OF RELATIVE STRENGTH, BASED ON THE NUMBER OF CYCLES TO CAUSE A 1/2 INCH SEPARATION OF THE JOINT. THE PERFORMANCE OF THE ADHESIVE TYPE CONNECTION SHOULD NOT BE COMPARED WITH THE ABOVE DATA. HOWEVER, THE STATIC TESTS DO SHOW THAT THE ADHESIVE WILL BOND TREATED TIMBER TO A LIMITED EXTENT IF IT IS APPLIED UNDER CONTROLLED CONDITIONS. /BPR/

Zia, P. McDonald, D
North Carolina State University Jan. 1966

ACKNOWLEDGMENT: PB 173 728, 1C27020393

2A 208159
STUDY OF CHECKING AND DELAMINATION IN GLULAM BRIDGE MEMBERS

THE EXTENT, CAUSE AND EFFECT OF DELAMINATION IN GLUED LAMINATED TIMBER BRIDGE MEMBERS WAS STUDIED. THE PAPER PRESENTS THE RESULTS OF A FIELD SURVEY OF 57 BRIDGES WITH GLUED LAMINATED TIMBER LOCATED IN THE PROVINCES OF ONTARIO, MANITOBA, SASKATCHEWAN, ALBERTA AND BRITISH COLUMBIA AND IN THE STATES OF WASHINGTON, OREGON, IDAHO, MONTANA AND MINNESOTA. THE INSPECTIONS INDICATED THAT VERY LITTLE DELAMINATION OCCURS IN PROPERLY TREATED GLULAM BRIDGE MEMBERS AND THAT, WITH ONE EXCEPTION, WHERE DELAMINATION DOES EXIST, IT IS NOT SERIOUS. THE PAPER ALSO CONCLUDES THAT THERE IS SOME EVIDENCE THAT THE MOST EFFECTIVE PRESERVATIVE FOR STRUCTURAL TIMBER IS 100 PERCENT CREOSOTE WITH A RETENTION OF 8 POUNDS PER CUBIC FOOT. /CGRA/

Huggins, MW Aplin, EN *Engineering Journal /Canada/* JUN65

2A 208201
COMPOSITE STEEL-CONCRETE MULTI-BOX GIRDER BRIDGES

A DISCUSSION OF BACKGROUND STUDIES OUT OF WHICH EVOLVED THE "CRITERIA FOR DESIGN OF STEEL-CONCRETE COMPOSITE BOX GIRDER HIGHWAY BRIDGES" IS GIVEN, AS WELL AS THE RESULTS OF DESIGN STUDIES ON SEVERAL BRIDGES USING THE CRITERIA. THE TYPE OF BRIDGE UNDER CONSIDERATION IS OF MODERATE LENGTH (UP TO 350 FEET) AND CONSISTS OF RECTANGULAR OR TRAPEZOIDAL SECTION STEEL GIRDERS MADE COMPOSITE WITH A REINFORCED CONCRETE DECK SLAB. /CGRA/

Fountain, RS
Canadian Inst Steel Constr, Toronto Feb. 1968

ACKNOWLEDGMENT: Canadian Good Roads Association

2A 208258
ULTIMATE STRENGTH DESIGN FOR HIGHWAY BRIDGES
AN ULTIMATE STRENGTH DESIGN METHOD FOR HIGHWAY BRIDGES IS PRESENTED. HIGHWAY BRIDGES HAVE VARIABLE LIVE LOAD CAPACITY, AND THE SMALLER BRIDGES CONTROL HIGHWAY SYSTEM CAPACITY. IT IS DEMONSTRATED THAT THE PRESENT MINIMUM CAPACITY IS 2.0 LIVE LOADS. A LOWER BOUND LOADING OF 1.5 DEAD LOADS PLUS 2.0 LIVE LOADS IS ADVOCATED FOR ALL COMMON BRIDGES. THIS LOADING IS APPLIED TO CONCRETE DECKS, REINFORCED CONCRETE GIRDERS, PRESTRESSED GIRDERS, COMPOSITE STEEL GIRDERS, TRUSSES, AND SUBSTRUCTURES. THESE HAVE INTERMEDIATE GRADE REINFORCING STEEL AND A36 STRUCTURAL STEEL. CONCRETE GIRDER BRIDGES CAN BE COMPLETELY DESIGNED USING EXISTING SPECIFICATIONS. DEVELOPMENT WORK REMAINS TO BE DONE ON STEEL GIRDER BRIDGES AND TRUSSES. THE PROPOSED DESIGN METHOD OFFERS CONSISTENT SERVICE RATINGS AND MATERIAL ECONOMICS IN ALL COMMON BRIDGE TYPES. THE SAVINGS ARE ESTIMATED TO BE 4 PER CENT OF THE NATIONAL BRIDGE BUDGET. /AUTHOR/

Payne, HL Caldwell, LH *Am Soc Civil Engr J Structural Div* Oct. 1965

ACKNOWLEDGMENT: Highway Res Abstracts Hwy Res Board

2A 208542
STRUCTURAL WELDING INSPECTION
IN 1935, THE CALIFORNIA DIVISION OF HIGHWAYS FIRST USED WELDING AS A CONNECTING MEDIUM IN BRIDGE WORK. BARE ELECTRODES WERE USED FOR THE WELDING OF ALL MINOR CONNECTIONS ON BRADLEY OVERHEAD NEAR MERCED, CALIFORNIA. HOWEVER, IT WAS NOT UNTIL 1951 THAT WELDING IN CALIFORNIA WAS USED EXTENSIVELY. THUS, THE RAPID PROGRESS OF THE WELDING INDUSTRY, COUPLED WITH A LARGE PROGRAM FOR WELDED STEEL CONSTRUCTION, PROMOTED THE CALIFORNIA DIVISION OF HIGHWAYS TO RESTUDY ITS METHODS OF INSPECTION AND TESTING FABRICATION. THIS STUDY HAS STRONGLY REEMPHASIZED THE NEED FOR FULLY QUALIFIED VISUAL INSPECTION. IT HAS ALSO EMPHASIZED THE PROPER FUNCTION OF RADIOGRAPHY IN BRIDGE WELDMENT INSPECTION. THIS PAPER COVERS THE PROCEDURES, TECHNIQUES AND POLICIES OF WELDING INSPECTION AND TESTING. IT ALSO GIVES SUPPLEMENTAL PROVISIONS TO THE AWS SPECIFICATIONS. THE AUGMENTATION OF VISUAL INSPECTION INCLUDES THE USE OF PENETRANT DYES, TREPANNING AND HARDNESS TESTING DURING FABRICATION, FOLLOWED BY RADIOGRAPHIC INSPECTION OF COMPLETED WELDMENT. THE AUTHORS CONCLUDE THAT THE MOST IMPORTANT POLICY CONCERNING WELDMENT INSPECTION IS THAT OF DISCUSSING THE JOB WITH THE FABRICATOR BEFORE THE WORK IS BEGUN, ESPECIALLY IN RELATION TO ALL PROPOSED WELDING PROCEDURES AND SEQUENCES. THIS RESULTS IN A HARMONIOUS RELATION BETWEEN THE INSPECTOR AND FABRICATOR WHICH IS, CONSEQUENTLY, REFLECTED IN BETTER WELDED STRUCTURES. /ASCE/

Beaton, JL Jonas, PG *Am Soc Civil Engr Transactions* 1955

ACKNOWLEDGMENT: Highway Research Board

2A 208559
CRITERIA FOR PRESTRESSED CONCRETE BRIDGES
THIS IS THE NEAREST APPROACH TO AN OFFICIAL BUILDING CODE FOR PRESTRESSED CONCRETE CONSTRUCTION IN THE UNITED STATES.

Bureau of Public Roads /US/ 25 pp, 1954

2A 208698
EXPERINENCES FROM FATIGUE AND RUPTURE TESTS ON A PRESTRESSED CONCRETE BRIDGE
DETAILS ARE GIVEN OF EXTENSIVE FATIGUE TESTS AND A FINAL STATIC TEST, UP TO FAILURE, CARRIED OUT ON A 5 YEAR OLD MODERN HIGHWAY BRIDGE WHICH HAD TO BE DEMOLISHED TO MAKE WAY FOR A NEW EXPRESS HIGHWAY. INVESTIGATIONS INTO THE PROPERTIES OF THE CONSTRUCTION MATERIALS ARE DESCRIBED. THE TESTS REPRESENT A PROOF OF THE SAFETY AND RELIABILITY OF PRESTRESSED CONCRETE UNDER REPETITIVE LOADING. /RRL/

Rosli, A
Int'l Symp Concr Bridge Des Proc /Can/ 1969

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 208781
REPORT OF ROYAL COMMISSION INTO THE FAILURE OF WEST GATE BRIDGE, VICTORIA, PRESENTED TO BOTH HOUSES OF PARLIAMENT PURSUANT TO SECTION 7 OF THE WEST GATE BRIDGE ROYAL COMMISSION ACT 1970, NO 7989
THIS REPORT INVESTIGATES THE CIRCUMSTANCES SURROUNDING AND THE CAUSES OF THE FAILURE, ON THE 15TH OCTOBER, 1970, OF THE STEEL SPAN BETWEEN PIERS 10 AND 11 OF THE WEST GATE BRIDGE BEING CONSTRUCTED OVER THE LOWER YARRA RIVER AT SPOTSWOOD. THE REPORT DESCRIBES THE COLLAPSE OF THE BRIDGE, ITS DESIGN AND CALCULATIONS, PRESENTS THE SALIENT POINTS OF THE MAUNSELL, RODERICK AND GRASSL REPORTS, AND GIVES DATA ON THE TESTS CARRIED OUT AFTER THE COLLAPE ON

THE UPPER FLANGE PANELS AND DIAGONAL BRACE. DETAILS ARE ALSO GIVEN OF THE STEEL, CONCRETE, AND HIGH-STRENGTH FRICTION GRIP BOLTS USED IN THE CONSTRUCTION OF THE BRIDGE. THE COMPETENCE AND PERFORMANCE OF THE PARTIES AND THEIR RELATIONS DURING CONSTRUCTION ARE ASSESSED TOGETHER WITH THE SAFETY PRECAUTIONS AND INDUSTRIAL RELATIONS DURING THE ERECTION OF THE STRUCTURE. THE RESPONSIBILITY OF THE PARTIES IS EVALUATED. /TRRL/

Barber, EH
Rixon, C.H., Govt Printer /Australia/ 1971, 143 pp, 15 Fig, 1 Tab, 13 Phot, 14 Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

2A 208815

PROBABILISTIC STRUCTURAL ANALYSIS AND DESIGN
SOME OF THE IMPORTANT ADVANTAGES OF PROBABILISTIC DESIGN PROCEDURES ARE PRESENTED AND COMPARED WITH DETERMINISTIC TECHNIQUES. THE PROBLEM OF THE COMPOUNDING OF HAZARDS IS ILLUSTRATED BY COMPARING A SERIES TYPE OF STRUCTURE WITH A PARALLEL TYPE OF STRUCTURE. BOTH STRUCTURES HAVE THE SAME CHARACTERISTICS FROM A DETERMINISTIC VIEWPOINT, BUT THE PARALLEL TYPE CLEARLY IS SUPERIOR TO THE SERIES TYPE IF PROBABILISTIC CONCEPTS ARE EMPLOYED, THE SPECIFICATION OF MATERIAL PROPERTIES IN MANUFACTURE IS CLEARLY PROBABILISTIC. THESE SAME MATERIAL PROPERTIES ARE SPECIFIED AND TREATED DETERMINISTICALLY IN STRUCTURAL PRACTICE WITHOUT REGARD TO THE ACTUAL PROPERTIES OF THE MATERIALS. SIMILARLY, REAL LOADINGS, ALTHOUGH PROBABILISTIC IN NATURE ARE TREATED AS DETERMINISTIC. ANALYSIS AND DESIGN PROCEDURES EMPLOY MODELS OF LOADING AND RESPONSE THAT HAVE LITTLE RELATIONSHIP TO REALITY. THE DESIGN DECISION PROCESS FOR SEISMIC LOADING IS ILLUSTRATED USING STATISTICAL DECISION THEORY. THE FORMULATION OF OPTIMIZATION OF DECISIONS UNDER UNCERTAINTY IS CONSIDERED. /ASCE/

Benjamin, JR *Am Soc Civil Engr J Structural Div* July 1968

2A 208989

CANTILEVERED END SPAN STEEL PLATE GIRDERS
THE GEOLOGIC CONDITIONS AT A GIVEN STRUCTURE SITE MAY EXERCISE GREAT CONTROL OVER THE STRUCTURAL DESIGN. THIS IS PARTICULARLY TRUE IN UTAH WHICH WAS ONCE INUNDATED BY PREHISTORIC LAKE BONNEVILLE, WHICH DEPOSITED UP TO SEVERAL HUNDRED FEET OF FINE SAND, SILT AND CLAY. STRUCTURE AND ROADWAY FILLS ARE BOTH SUBJECT TO SETTLEMENT. ROADWAY FILLS HAVE BEEN FAIRLY WELL CONTROLLED THROUGH USE OF SAND DRAINS EITHER WITH OR WITHOUT SURCHARGE ON THE FILLS. IT WAS RECOGNIZED IN UTAH THAT IF BRIDGES COULD BE DESIGNED AND CONSTRUCTED INDEPENDENTLY OF THE APPROACH FILLS AND THE ASSOCIATED SETTLEMENT, THE MAINTENANCE PROBLEM WOULD BE REDUCED TO PERIODIC LIFTS OF NEW SURFACING TO MATCH WITH THE BRIDGE DECKS FOR GOOD RIDING QUALITY. THE IDEA WAS DEVELOPED TO UTILIZE STEEL SUPER STRUCTURES WITH CANTILEVERED END SPANS WHICH ELIMINATES DECK JOINTS AND ROADSIDE HAZARDS IN THE FORM OF BRIDGE PIERS ADJACENT TO THE TRAVELED-WAY. THE FIRST STRUCTURE CONSTRUCTED OF THIS TYPE WAS THE WHITE RIVER BRIDGE WHICH ACCOMMODATES A SINGLE LANE OF TRAFFIC AND CROSSES THE RIVER AT 90 DEGREES ON A FLAT GRADE. THE PIERS CONSIST OF A SINGLE LINE OF DRIVEN STEEL PILES ENCASED IN CONCRETE. THE GIRDERS ARE FIXED TO THE TOP OF THE PIERS AGAINST LONGITUDINAL MOVEMENTS BUT ARE FREE TO ROTATE. THE STRUCTURE WAS BUILT WITH A MAXIMUM IMPACT FACTOR OF 30%. BRIDGE STRUCTURES OF THIS TYPE OF DESIGN SINCE THE FIRST STRUCTURE HAVE UTILIZED A 100% LIVE LOAD IMPACT FACTOR IN THE CANTILEVERED SPANS. DETAILS OF DESIGN

AND CONSTRUCTION ARE PRESENTED; THIRTEEN STRUCTURES OF THIS TYPE HAVE BEEN COMPLETED. A FOUR SPAN BRIDGE HAS NOT YET BEEN CONSTRUCTED WITH CANTILEVERED AND SPANS. HOWEVER, CALCULATION HAS BEEN MADE OF THE THEORETICAL IDEAL PIER LOCATIONS.

Mansour, AE *Am Assoc State Highway Officials Proc* Oct. 1967

2A 209185

MEMOIRES, ABHANDLUNGEN, PUBLICATIONS
THIS VOLUME CONTAINS 15 PAPERS, 8 OF WHICH ARE IN ENGLISH, 5 IN FRENCH AND 2 IN GERMAN. DESPITE THEIR DIVERSITY THEY ALL TAKE UP THE MAJOR PROBLEMS WITH WHICH BRIDGE AND STRUCTURAL ENGINEERS ARE CONCERNED WHO WISH TO EXCEED THE NORMAL STANDARD OF ACCOMPLISHMENTS. SUBJECTS LIKE THE FOLLOWING ARE DEALT WITH: SAFETY, CONSTRUCTION MATERIALS, CREEP, TALL BUILDINGS, SPECIAL PROBLEMS REGARDING BRIDGE DECKS, CALCULATION METHODS, RELATION BETWEEN STATICS AND MATHEMATICS, STABILITY, PROBLEMS REGARDING APPLIED DYNAMICS AND OPTIMIZATION. /IABSE/

Intl Assoc Bridge & Struct Eng /Switz/ 1969

2A 209240

CONCRETE MASONRY STRUCTURES--DESIGN AND CONSTRUCTION

RECOMMENDATIONS ARE PROVIDED FOR THE DESIGN AND CONSTRUCTION OF REINFORCED AND NONREINFORCED CONCRETE MASONRY STRUCTURES. USING UNITS MANUFACTURED TO ASTM SPECIFICATIONS. THE MANUFACTURING PROCESS ITSELF IS NOT DISCUSSED, AND MORTARLESS MASONRY AND CONSTRUCTION USING RESIN-TYPE ADHESIVES BETWEEN THE UNITS ARE NOT COVERED. DESIGN RECOMMENDATIONS BASED ON THE WORKING STRESS METHOD GIVE ALLOWABLE STRESSES FOR BOTH REINFORCED AND NONREINFORCED MASONRY. CONSTRUCTION RECOMMENDATIONS INCLUDE CHAPTERS ON MATERIALS AND THE SPECIFICATIONS; MORTAR AND GROUT; PREFERRED CONSTRUCTION PRACTICES; DETERMINATION OF MASONRY STRENGTH; INSPECTION; CONNECTIONS TO EMBEDDED AND ADJOINING CONSTRUCTION; AND REINFORCING BAR DETAILS. DESIGN CHAPTERS DEAL SEPARATELY WITH REINFORCED WALLS AND COLUMNS AND NONREINFORCED WALLS AND COLUMNS. SHEAR, BOND, AND ANCHORAGE PROVISIONS ARE GIVEN FOR REINFORCED MASONRY. RECOMMENDATIONS FOR CONTROL OF WALL MOVEMENTS ARE MADE, AND CONSTRUCTION OF MASONRY VENEERS, SCREEN WALLS, AND FENCES IS DESCRIBED. NEARLY 200 TERMS RELATING TO MASONRY DESIGN AND CONSTRUCTION APPEAR IN THE APPENDIX. /AUTHOR/

Mackintosh, A *Am Concrete Inst Journal & Proceedings* May 1970

2A 209414

CONCRETE COLUMN DESIGN BY AASHTO SPECIFICATIONS
THE AASHTO SPECIFICATIONS OF CONCRETE COLUMN DESIGN FAIL TO ENSURE CONSISTENT AND UNIFORM RESULTS BECAUSE THE DESIGN METHOD FOR CRACKED AND UNCRACKED SECTIONS YIELD DISSIMILAR ANSWERS TO THEIR COMMON BOUNDARY, AND BECAUSE IT IS LEFT TO THE DISCRETION OF THE DESIGNER TO WORK WITH A MODULAR RATIO OF EITHER $n = 10$ OR $n = 20$. A METHOD IS PROPOSED BY WHICH THE DEMONSTRATED INCONSISTENCIES CAN BE ELIMINATED AND INTERACTION DIAGRAMS ARE PRESENTED WHICH PERMIT THE DIRECT DETERMINATION OF REINFORCING REQUIREMENTS FOR THE MOST COMMON COLUMN CONFIGURATION INCLUDING THE CASE OF BENDING ABOUT TWO AXES. THE PROPOSED METHOD IS PURELY PRAGMATIC, APPLIES TO WORKING STRESS DESIGN ONLY, AND IS SOLELY INTENDED TO OFFER A CONVENIENT MEANS OF OBTAINING UNIFORM AND CONSISTENT RESULTS WITHIN THE FRAMEWORK OF THE CURRENT SPECIFICATIONS. /AUTHOR/

Fickel, HH *Am Soc Civil Engr J Structural Div* Apr. 1971

2A 209428

TIMBER HIGHWAY BRIDGES IN OREGON

A TIMBER-DECK TYPE BRIDGE HAS BEEN DEVELOPED WHICH USES 4 IN. BY 12 IN. PLANKS FOR THE SUBDECK AND 2 IN. BY 2 IN. CEDAR OR TREATED FIR STRIPS, LAID LONGITUDINALLY, FOR A WEARING SURFACE, WHICH IS LAID IN HOT ASPHALT. A COMPOSITE TIMBER AND CONCRETE TRESTLE WAS ALSO DEVELOPED. BECAUSE OF WAR CONDITIONS, MANY TIMBER TRUSSES HAVE BEEN USED AT SITES WHERE SPANS LONGER THAN PRACTICAL WITH TRESTLE CONSTRUCTION HAVE BEEN REQUIRED. TREATED TIMBER CULVERTS ARE PRACTICAL EVEN UNDER NORMAL CONDITIONS. SELECTION OF BRIDGE TYPES SHOULD BE MADE ON COMPARATIVE TOTAL ANNUAL COST. /AUTHOR/

Mccullough, CB Paxson, GS Marilley, CG DISCUSSEER Seiler, JF DISCUSSEER *Highway Research Board Proceedings* 1943

2A 209449

DESIGN OF COLUMBIA RIVER PILE DIKES

DESIGNERS OF TIMBER RIVER CONTROL WORKS OFTEN NEED TO CONSIDER THE STRUCTURAL INTEGRITY OF THE PILE STRUCTURE IN ADDITION TO ITS NORMAL FUNCTION TO SHAPE A NAVIGATION CHANNEL. THE NATURE AND EXTENT OF FORCES TO WHICH THE PILES ARE SUBJECTED, AND A PRACTICAL PROCEDURE FOR DETERMINING THE REQUIRED PENETRATION DEPTH AND THE STRESSES IN PILES AND FOUNDATIONS ARE DEVELOPED. PREVIOUS DESIGN WORK WERE PERFORMED BY JUDGMENT AND EXTENSIVE OBSERVATION OF PROBLEM BARS. /ASCE/

Dodge, RO *Am Soc Civil Engr J Waterways & Harbors* May 1971

2A 209475

EXPERIMENTAL PRESTRESSED CONCRETE HIGHWAY PROJECT IN PITTSBURGH

THIS PAVEMENT, 5 IN. THICK BY 12 FT WIDE BY 530 FT LONG, WAS CONSTRUCTED IN PITTSBURGH, PA., NOT ONLY TO PROVIDE TECHNICAL DATA ON THE STRUCTURAL ACTION OF PRESTRESSED CONCRETE HIGHWAY PAVEMENTS BUT ALSO TO PROVIDE RELIABLE INFORMATION ON THE FEASIBILITY OF CONSTRUCTION AND THE RELATIVE ECONOMICS INVOLVED. ALMOST A YEAR WAS OCCUPIED IN WORKING OUT THE ENGINEERING PROBLEMS. CONSTRUCTION WAS STARTED IN SEPTEMBER 1956 AND THE FINAL PRESTRESSING OPERATIONS WAS COMPLETED IN FEBRUARY 1957. VALUABLE EXPERIENCE WAS DEVELOPED BY THE CONSTRUCTION OPERATION, WHICH GENERALLY WORKED SATISFACTORILY. AMONG SOME OF THE UNANTICIPATED PROBLEMS WAS A FAILURE RESULTING FROM PRESTRESSING BEFORE ADEQUATE CONCRETE STRENGTHS WERE OBTAINED. OTHER DESIRABLE CHANGES IN PRACTICE ARE A REDUCTION IN MAXIMUM SIZE OF AGGREGATE AND SOME REFINEMENT IN THE CONSTRUCTION AT THE ENDS OF THE SLAB SECTIONS. A UNIQUE SOLUTION TO THE AGE-OLD EXPANSION JOINT PROBLEM WAS DEVELOPED. THE JOINT, WHICH CONSISTS OF LAMINATIONS OF RUBBER AND STEEL RESTING ON A LONG FLEXIBLE SILL, HAS PERFORMED SATISFACTORILY TO DATE. AN EXTENSIVE TEST SERIES WAS CARRIED OUT WHICH INCLUDED BOTH STATIC TESTING AND MOVING LOAD TESTS, BUT BECAUSE OF THE TIME AND COST INVOLVED NO TRAFFIC LOAD TESTING WAS INCLUDED. RESULTS WERE CONSIDERED EXCELLENT AND THE STRUCTURAL ASPECTS OF A 5 IN. THICK HIGHWAY PAVEMENT WITH LONGITUDINAL PRESTRESSING ONLY APPEAR TO BE ENTIRELY ADEQUATE FOR MODERN HIGHWAY LOADS. /AUTHOR/

Moreell, B Murray, JJ Heinzerling, JE Melville, PL DISCUSSEER *Highway Research Board Proceedings* 1958

2A 209640

FPL TIMBER BRIDGE DECK RESEARCH

THE FOREST PRODUCTS LABORATORY (FPL) IN COLLABORATION WITH THE FOREST SERVICE DIVISION OF ENGINEERING, HAS A CONTINUING RESEARCH PROGRAM TO IMPROVE

TIMBER BRIDGE DESIGN AND PERFORMANCE. THE PROGRAM COVERS FIELD EVALUATIONS OF EXISTING BRIDGES, LABORATORY EVALUATIONS OF NEW OR REVISED DESIGN CRITERIA, AND EXPERIMENTAL FIELD BRIDGE STUDIES. MUCH OF THE ENGINEERING RESEARCH WAS CONCENTRATED ON THE DESIGN OF VERTICALLY GLUED LAMINATED WOOD PANELS FOR BRIDGE DECKS. THE RESULTS OF BOTH LABORATORY EVALUATIONS AND EXPERIMENTAL FIELD BRIDGE STUDIES HAVE INDICATED A GLUED SYSTEM TO BE STRUCTURALLY SUPERIOR TO THE CONVENTIONALLY USED NAILED- LAMINATED DECKING. THE USE OF GLUED PANELS SHOULD RESULT IN AN OVERALL ECONOMIC SAVING IN BRIDGE COSTS AND WILL GREATLY EXTEND THE SERVICE LIFE OF TIMBER BRIDGES. /AUTHOR/

Bohannon, B *Am Soc Civil Engr J Structural Div* Vol. 98 No. st3, Mar. 1972, pp 729-40

2A 209662

HIGHWAY BRIDGE DESIGN SPECIFICATIONS

THIS COMPILATION OF SPECIFICATIONS IS BASED ON THAT OF THE AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS, MODIFIED WHERE NECESSARY TO SUIT AUSTRALIAN CONDITIONS. SEPARATE SECTIONS DEAL WITH: GENERAL FEATURES OF DESIGN; LOADS; DISTRIBUTION OF LOADS; FOUNDATIONS, SUBSTRUCTURES, AND RETAINING WALLS; REINFORCED CONCRETE DESIGN; PRESTRESSED CONCRETE DESIGN; STRUCTURAL STEEL DESIGN; COMPOSITE STEEL AND CONCRETE GIRDERS; BEARINGS AND EXPANSION ARRANGEMENTS; CORRUGATED STEEL PIPES; PIPE-ARCHES, AND ARCHES; TIMBER STRUCTURES, LOAD CAPACITY RATING OF EXISTING BRIDGES.

Nat Assoc Austral State Road Auth 1970, 230 pp, Figs, Tabs

2A 209792

SUGGESTED DESIGN AND CONSTRUCTION PROCEDURES FOR PIER FOUNDATIONS

THE DESIGN AND CONSTRUCTION OF FOUNDATION PIERS MADE BY EXCAVATING A HOLE IN THE SOIL AND THE FILLING IT WITH CONCRETE, ARE DISCUSSED. CONSIDERABLE ATTENTION IS GIVEN TO SOIL PROPERTIES AND SOILS EXPLORATION. THE TWO-STEP DESIGN PROCEDURE INCLUDES: (1) DETERMINATION OF OVERALL PIER SIZE, AND (2) DETAILED DESIGN OF THE CONCRETE PIER ELEMENT ITSELF. EMPHASIS IS ON THE FORMER. CONSTRUCTION METHODS DESCRIBED INCLUDE EXCAVATION, SHEETING, CASING, AND PLACEMENT OF CONCRETE AND STEEL. RECOMMENDED PROCEDURES FOR INSPECTION AND EVALUATION, AS WELL AS CRITERIA FOR ACCEPTANCE, ARE PRESENTED. /AUTHOR/

Am Concrete Inst Journal & Proceedings Vol. 69 No. 8, Aug. 1972, pp 461-80, Figs, 40 Ref

2A 209880

PRESTRESSED COMPOSITE STEEL BEAM DESIGN

FOUR DECK-GIRDER HIGHWAY BRIDGES, LOCATED IN AN AREA WHICH HAS SINCE BEEN FLOODED AS A PART OF A TVA RESERVOIR, WERE TESTED TO FAILURE UNDER STATIC LOADING. A SYSTEM OF ROCK ANCHORS WAS USED TO DEVELOP THE NECESSARY FORCES. THE LOADS WERE APPLIED TO A BRIDGE SPAN AT EIGHT LOAD POINTS, SIMULATING THE REAR WHEELS OF TWO AASHO HS TRUCKS, ONE TRUCK IN EACH TRAFFIC LANE. ALL OF THE BRIDGES BUT ONE FAILED, AS EXPECTED, IN A FLEXURAL MODE. COMPOSITE ACTION WAS LOST IN THE PRESTRESSED CONCRETE BRIDGE, AND THE TWO INTERIOR GIRDERS FAILED IN SHEAR. THE FAILURE LOAD FOR EACH BRIDGE, ACHIEVED AT THE EXPENSE OF LARGE DEFLECTIONS, WAS SEVERAL TIMES THE DESIGN LOAD FOR THE BRIDGE.

Anand, SC Talesstchi, A *Am Soc Civil Engr J Structural Div* Vol. 99 No. st3, Mar. 1973, pp 301-19, 3 Fig, 5 Tab

2A 209944

INTERNATIONAL RECOMMENDATIONS FOR THE DESIGN AND CONSTRUCTION OF CONCRETE STRUCTURES

THESE RECOMMENDATIONS COVER THE WHOLE FIELD OF JOINT CONCRETE AND STEEL ACTION, FROM REINFORCED TO PRESTRESSED CONCRETE, AS REGARDS BOTH DESIGN AND CONSTRUCTION. STRUCTURAL LIGHTWEIGHT CONCRETES ARE CONSIDERED ALONG WITH NORMAL AGGREGATE CONCRETES. THE INFORMATION WAS COLLECTED OVER A PERIOD OF 16 YEARS AND IS PRESENTED HERE ORGANIZED UNDER THE TITLES OF PRINCIPLES, RECOMMENDATIONS, SUPPLEMENTS AND APPENDICES. THE PRINCIPLES DEAL ONLY WITH BASIC CONCEPTS FOR USE BY COMMITTEES PREPARING NATIONAL REGULATIONS. THE RECOMMENDATIONS PROVIDE AN EXAMPLE OF THESE PRINCIPLES. DIRECT APPLICATION OF THESE RECOMMENDATIONS IS DISCUSSED. JUSTIFICATIONS AND EXPLANATIONS, GRAPHS, TABLES AND EXAMPLES INTENDED TO ASSIST THE UNDERSTANDING OF THE PRINCIPLES AND RECOMMENDATIONS ARE PROVIDED IN THE SECTION ENTITLED "SUPPLEMENTS". APPENDICES WHICH WILL BE PUBLISHED AS SEPARATE VOLUMES, WILL REFER TO THE RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION OF CERTAIN TYPES OF STRUCTURES. THEY WILL ALSO COVER CERTAIN SPECIAL SUBJECTS SUCH AS CONCRETE EXPOSED TO HIGH TEMPERATURES, FIRE RESISTANCE OF REINFORCED AND PRESTRESSED CONCRETE, DURABILITY, AND TERMINOLOGY.

Fip 6th Congress, Prague June 1970, 80 pp, Figs

2A 210028

CAMBER/TOLERANCE RELATIONSHIP ON THE ACLU PROJECT

THE AMERICAN COLLEGE OF LIFE UNDERWRITERS' ADULT LEARNING RESEARCH CENTER (A SIX-STORY OFFICE BUILDING IN BRYN MAWR, PA.) IS A TYPICAL CAST-IN-PLACE REINFORCED CONCRETE BUILDING THAT REQUIRES THE SUBSEQUENT MECHANICAL TRADES TO SQUEEZE THEIR EQUIPMENT BETWEEN A LEVEL CEILING AND A DEFLECTED SURFACE. ON THIS PROJECT MANY CAREFUL MEASUREMENTS OF BEAM AND SLAB SOFFITS VERIFIED THAT DEFLECTIONS WERE PREDICTABLE, BUT THAT CAMBER IS NOT ALWAYS EQUIVALENT TO THE SPECIFIED, NORMALLY ANTICIPATED TOLERANCE SUCH AS ACI 347 INDICATES SHOULD BE ACHIEVED. DATA ARE TABULATED FOR 45 BUILDING LOCATIONS ON SIX DIFFERENT FLOORS DEMONSTRATING THAT UNDER PRESENT CONDITIONS, ACTUAL TOLERANCES ABUSE THOSE RECOMMENDED BY ACI 347. /AUTHOR/

Palmbaum, H *Am Concrete Inst Journal & Proceedings* Vol. 70 No. 10, Oct. 1973, pp 707-8, 1 Fig, 1 Tab, 1 Ref

2A 210063

MERSEY KINGSWAY TUNNEL: CONSTRUCTION PAPER 7481

THE PAPER DESCRIBES THE CONSTRUCTION UNDER THE RIVER MERSEY OF 'TUNNEL 2A' OPENED IN JUNE 1971, AND OF ITS DUPLICATION, 'TUNNEL 2B' STILL PROCEEDING. UNUSUAL ENGINEERING PROBLEMS, NOVEL FEATURES AND CONSTRUCTION DIFFICULTIES ARE DEALT WITH IN SOME DETAIL. THE TUNNEL WAS DRIVEN MAINLY IN BUNTER SANDSTONE BY MACHINE. THE ROCK DID NOT RESPOND SATISFACTORILY TO TREATMENT BY INJECTION. COPIOUS INFLOWS OF SALINE WATER AFFECTED PLANT, HAMPERED WORK, AND OFTEN TURNED THE SPOIL AT THE FACE TO SLURRY. POOR AND SLABBY ROCK IN THE ROOF PRODUCED MATERIAL VERY DIFFICULT TO HANDLE, PARTICULARLY WHEN MIXED WITH THE SLURRY. THE TREATMENT OF A MAJOR FAULT, THE CHANGING OF THE MAIN BEARING OF THE MOLE AND THE REPAIR OF SEVERE DAMAGE TO THE MACHINE CAUSED BY BREAKAGE OF A PINION, ALL NEAR MID-RIVER, PROVIDED SOME INTERESTING FEATURES IN DRIVING TUNNEL 2A. EXPERIENCE GAINED, ADDED TO THE SKILLS REQUIRED ON THAT DRIVE, ENABLED TUNNEL 2B TO BE DRIVEN AT MUCH GREATER SPEED (A).

Mckenzie, JC Dodds, GS *Inst Civil Engineers Proc, London /UK/* Vol. 51 Mar. 1972, pp 503-33, 9 Fig, 2 Tab, 7 Phot

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

2A 210066

MERSEY KINGSWAY TUNNEL: PLANNING AND DESIGN PAPER 7480

THE HISTORICAL BACKGROUND OF MERSEY CROSSINGS AND THE PLANNING OF THIS CROSSING FOR THE BENEFIT OF MERSEYSIDE AS A WHOLE IS SUMMARIZED. TOPOGRAPHY AND GEOLOGY ARE DESCRIBED AND IN PARTICULAR THE CHARACTERISTICS OF THE BUNTER SANDSTONE IN WHICH THE TUNNEL IS DRIVEN. THE ALIGNMENT, LEVELS AND GRADIENTS OF THE TUNNEL AND APPROACHES WERE DETERMINED TO UTILIZE THE DISUSED SEACOMBE RAILWAY AND TO PASS UNDER THE RIVER BED WITH SUFFICIENT COVER. THE TUNNEL LINING FOR USE IN THE ROCK IS OF PRECAST REINFORCED CONCRETE WITH A WELDED STEEL INNER FACE AND WAS DESIGNED FOR ERECTION BY A TUNNELLING MACHINE WHICH PROVIDED A SMOOTH AND ACCURATE BORE. CAST IRON SEGMENTAL LINING WAS USED WHERE THE TUNNEL ROSE OUT OF THE ROCK INTO BOULDER CLAY. THE ROAD DECK IN THE TUNNEL IS A COMPOSITE REINFORCED CONCRETE STRUCTURE WITH PRESTRESSED BEAMS AND IN SITU FILLING AND TOPPING, WHICH FORMS THE RUNNING SURFACE. VENTILATION SHAFTS AND DUCTS CONNECT TO THE TUNNEL UNDER TWO VENTILATION STATIONS. PORTAL CHAMBERS OF REINFORCED CONCRETE AT EACH END INCORPORATE DRAINAGE SUMPS AND RUMPS. AT THE LIVERPOOL END A CUT-AND-COVER SECTION AT A DEPTH OF 50-60 FT HAS A REINFORCED CONCRETE ARCH OF ABOUT 100FT SPAN RESTING ON WALLS FORMED BY 8 FT DIA. BORED PILES. VENTILATION IS ON THE SEMI-TRANSVERSE SYSTEM WITH A MAXIMUM FRESH AIR SUPPLY OF 740000 CU. FT/MIN FROM EACH OF TWO STATIONS. DRAINAGE AND PUMPING ARE PROVIDED FOR AT THE PORTALS AND AT MIDRIVER PRINCIPALLY TO DEAL WITH RAIN WATER ON THE APPROACHES AND WASHING DOWN WATER. THE PRINCIPAL FEATURES OF THE DECORATIVE FINISHES WITHIN THE TUNNEL ARE THE DIRECT EPOXY SPRAY APPLIED TO THE PRIMARY LINING WHERE THE WELDED STEEL FACINGS ARE USED, AND VITREOUS ENAMELLED STEEL CLAD PANELS ABOVE EACH WALKWAY. LIGHTING, OPERATIONAL SERVICES AND CONTROLS ARE DESCRIBED. COSTS ARE SUMMARIZED (A).

Megaw, TM Brown, CD *Inst Civil Engineers Proc, London /UK/* Vol. 51 Mar. 1972, pp 479-502, 7 Fig, 1 Phot, 1 Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/IRRD 202 723, 3C27234744

2A 210095

LATERAL STABILITY OF WOOD BEAM AND DECK

MODERN TIMBER STRUCTURES FREQUENTLY EMPLOY LARGE WOOD BEAMS BRIDGED BY 2 IN. WOOD DECKING. ECONOMY OF MATERIAL DICTATES THE USE OF DEEP NARROW BEAMS WHOSE DESIGN IS LIMITED BY CONSIDERATIONS OF LATERAL INSTABILITY. SUCH CONSTRUCTIONS MUST RELY UPON THE IN-PLANE SHEAR RIGIDITY OF THE ATTACHED DECK TO PREVENT COLLAPSE, YET WHEN DECKS OF LOW RIGIDITY SUCH AS 2 IN. DECKS ARE EMPLOYED, THE STABILITY OF THE RESULTING STRUCTURE IS SERIOUSLY IN QUESTION. THIS REPORT QUANTITATIVELY ANSWERS THE QUESTION OF HOW MUCH SHEAR RIGIDITY A DECK MUST POSSESS IN ORDER TO PROVIDE ADEQUATE LATERAL SUPPORT WHEN ATTACHED TO THE TOP OF A SET OF DEEP BEAMS. A VARIATIONAL METHOD OF DERIVATION IS EMPLOYED, AND BUCKLING CURVES ARE PRESENTED FOR FIVE CASES OF LOAD AND SUPPORT. THE USE OF THESE RESULTS BY STRUCTURAL ENGINEERS WILL FACILITATE THE SAFE DESIGN OF LIGHTWEIGHT ECONOMICAL WOOD STRUCTURES.

Zahn, JJ *Am Soc Civil Engr J Structural Div* Vol. 99 No. st7, July 1973, 18 pp, 1 Tab, 11 Ref

2A 210265
CONSTRUCTING LONGITUDINAL JOINTS IN HOT-MIX ASPHALT PAVEMENTS

THIS PAPER PRESENTS RESULTS OF DENSITY AND TENSILE STRENGTH TEST OF SAMPLES CUT FROM LONGITUDINAL JOINTS IN HOT -MIX ASPHALTIC PAVEMENT. AN UNANTICIPATED FINDING IS THAT IN SEMI-HOT AND COLD JOINTS THERE IS A LOW-DENSITY ZONE AT THE JOINT IN THE LANE PAVED FIRST AND A HIGH-DENSITY ZONE AT THE JOINT IN THE LANE PAVED SUBSEQUENTLY. THESE ZONES ARE NOT PRESENT IN HOT JOINTS MADE WITH PAVERS OPERATING IN ECHELON. THESE LOW-AND HIGH-DENSITY ZONES MAY WELL BE THE BASIC PROBLEM IN CONSTRUCTING DURABLE LONGITUDINAL JOINTS IN ASPHALT PAVEMENTS. /AUTHOR/

Foster, CR Hudson, SB Nelson, RS *Highway Research Record, Hwy Res Board* 1964

2A 210387
FINAL REPORT ON THE USE OF LIGHTWEIGHT SYNTHETIC AGGREGATE IN FLEXIBLE PAVEMENTS

A SUMMARY IS PRESENTED OF A STUDY ON THE USE OF LIGHTWEIGHT SYNTHETIC AGGREGATE IN FLEXIBLE PAVEMENTS. LABORATORY AND FIELD TESTS WERE CONDUCTED TO PROVE THAT LIGHTWEIGHT SYNTHETIC AGGREGATE IS QUITE SUITABLE AS A COVERSTONE FOR SEAL COATS AND SURFACE TREATMENTS. LIGHTWEIGHT AGGREGATE WAS FOUND TO CAUSE NO FLYING STONE PROBLEM AND THUS DAMAGE TO WINDSHIELDS AND HEADLAMPS WAS ELIMINATED WHERE THIS MATERIAL WAS USED. IT WAS FOUND THAT LIGHTWEIGHT SYNTHETIC AGGREGATE USED AS COVERSTONE FOR SEAL COSTS PRODUCED A SURFACE OF HIGH AND PROLONGED SKID RESISTANCE. EXPLORATORY RESEARCH IN THE LABORATORY AND FIELD WITH LIGHTWEIGHT SYNTHETIC AGGREGATE IN HOT-MIX ASPHALT PAVING MIXTURES SHOWS GREAT PROMISE FOR THIS NEW SOURCE OF AGGREGATE. MIXES DESIGNED TO INCLUDE AS MUCH AS FIFTY PERCENT (BY VOLUME) OF LIGHTWEIGHT SYNTHETIC AGGREGATE APPEAR ENTIRELY SUITABLE FOR HIGH QUALITY ASPHALT SURFACE COURSES. THE MIXTURES ARE HIGHLY STABLE, ARE NOT WATER SUSCEPTIBLE, AND PRODUCE A NON-SKID SURFACE. THE COEFFICIENT OF FRICTION AS MEASURED WET AT 40 MPH ON A LOCKED WHEEL TRAILER IS ABOVE 0.5. IN PLANT MIXES, THIS NEW AGGREGATE PRESENTS NO CONSTRUCTION DIFFICULTIES FOR WHICH EASY ADJUSTMENT CANNOT BE MADE.

Galloway, BM Harper, WJ
Texas Transportation Institute, Texas State Department of Highways & Public Transp, Bureau of Public Roads /US/ Aug. 1967

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4642164 68)1C31020785 PB 178, 120, 1C31021167

2A 210406
KENTUCKY ROCK ASPHALT HOT MIX SURFACES

DATA ARE PRESENTED PERTAINING TO THE PROPERTIES OF MATERIALS IN KENTUCKY ROCK ASPHALT MIXTURES, AND OF CONSTRUCTION PRACTICES, COSTS, AND SHORT TIME PERFORMANCE OBSERVATIONS OF PAVEMENTS USING THE MIXTURES. THE ROCK ASPHALT CONTAINS ABOUT 3.8% BITUMENS AND IS CRUSHED TO PASS A 3/8 INCH SCREEN, 85/100 PENETRATION GRADE ASPHALT IS ADDED SO THE HOT-MIX CONTAINS A TOTAL OF BETWEEN 9-10 PERCENT ASPHALT. SOME PROBLEMS WERE ENCOUNTERED WHEN HEATING THE ROCK ASPHALT AND CARE WAS NEEDED TO PREVENT A BUILD-UP OF MATERIAL IN THE PLANT. THE PERFORMANCE OF PAVEMENTS USING THIS MIXTURE IS RATED AS FROM SATISFACTORY TO GOOD UNDER LIGHT TRAFFIC. SKID RESISTANCE, WHICH IS THE PRINCIPAL ADVANTAGE OF THIS MIXTURE, IS RATED HIGH-COEFFICIENTS OF 0.57 TO 0.72. THE REPORT ALSO TRACES THE DEVELOPMENT OF THE SPECIAL

PROVISIONS TO THE SPECIFICATIONS WHEN THIS MATERIAL IS TO BE USED. /BPR/

Florence, RL
Kentucky Department Highways, Bureau of Public Roads /US/ Aug. 1968

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4652154 68)PB 180191, 1C31021513

2A 210422
RELATION OF VISCOSITY GRADED ASPHALT CEMENTS TO MIXTURE BEHAVIOR AND PAVEMENT PERFORMANCE

THE SCOPE AND TESTING METHODS ARE OUTLINED TO BE FOLLOWED IN A STUDY THAT WILL COMPARE THE PERFORMANCE OF BITUMINOUS PAVEMENTS USING ASPHALTS OF VARIOUS VISCOSITY AND PENETRATION GRADES. FOUR ADJACENT TEST SECTIONS WERE CONSTRUCTED: (1) AC 6 VISCOSITY GRADE, 150-200 PENETRATION GRADE; (2) AC 6 VISCOSITY GRADE, 85-100 PENETRATION GRADE; (3) AC 12 VISCOSITY GRADE, 60-70 PENETRATION GRADE; (4) AC 12 VISCOSITY GRADE, 85-100 PENETRATION GRADE. THE TEST SECTIONS WERE CONSTRUCTED UNDER SIMILAR CONDITIONS OF WEATHER, TERRAIN, CONSTRUCTION PROCEDURES, AND EQUIPMENT. EACH LANE IN EACH SECTION WILL BE SUBJECTED TO THE SAME VOLUME AND TYPE OF TRAFFIC. THE FOUR TEST SECTIONS WILL BE SAMPLED PERIODICALLY AND THE RECOVERED ASPHALT WILL BE TESTED FOR PENETRATION, VISCOSITY, AND DUCTILITY. THE PERFORMANCE AND SERVICEABILITY RATINGS OF THE PAVEMENTS WILL BE CHARACTERIZED BY TESTING WITH VARIOUS TYPES OF EQUIPMENT, NAMELY, THE ROAD LOGGER, DYNAFLECT, PROFILOGRAPH, NUCLEAR MOISTURE PROBE, AND THE VARIABLE LENGTH STRAIGHT EDGE. THE REPORT PRESENTS THE TEST RESULTS OF ORIGINAL ASPHALT CHARACTERISTICS, MARSHALL DESIGN DATA, CONSTRUCTION RECORDS AND TEST RESULTS OF PAVEMENT SAMPLES TAKEN ONE WEEK, THREE MONTHS, SIX MONTHS, AND NINE MONTHS AFTER CONSTRUCTION. NO CONCLUSIONS ARE DRAWN FROM THIS LIMITED DATA. THE STUDY WILL CONTINUE UNTIL ANALYSIS REVEALS SIGNIFICANT DATA FROM THE TEST SECTIONS. THE STUDY IS TENTATIVELY PROGRAMMED FOR FIVE YEARS. /BPR/

Delis, WR
Utah State Department Highways, Bureau of Public Roads /US/ Aug. 1969

ACKNOWLEDGMENT: Bureau of Public Roads /US/REPORT PENDING, 1C31021955

2A 210514
STEEL REINFORCED ASPHALT OVERLAY

THE WISCONSIN STATE HIGHWAY COMMISSION HAS RESURFACED ABOUT 1 1/2 MILE OF OLD TWO-LAND CARRIAGEWAY WITH A 3-IN OVERLAY OF BITUMINOUS SURFACING REINFORCED WITH WELDED WIRE FABRIC, AS AN EXPERIMENT. ON AN OLD FLEXIBLE PAVEMENT WHICH HAD HEAVED AND FAULTED. THE NEW SURFACING WAS LAID IN TWO 1 1/2-IN COURSES WITH THE REINFORCEMENT IN BETWEEN, THE TRANSVERSE WIRE BEING IN CONTACT WITH THE UPPER SURFACE OF THE LOWER COURSE. THE REINFORCING MESH SHEETS WERE PLACED 3 IN FROM THE EDGE OF THE LOWER COURSE OF ONE LANE, EXTENDING TO 9 IN BEYOND THE CARRIAGEWAY CENTRE-LINE. NARROWER SHEETS WERE USED FOR THE SECOND LANE AND BUTTED ON TO THE SHEETS ALREADY LAID. CURLING OF THE MESH AT THE CENTER-LINE WAS OVERCOME BY BENDING THE SHEET ABOUT A FOOT FROM ITS EDGE. /RRL/

Engineering News-record Jan. 1965

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 210551

REPORT ON EXPERIENCE WITH THE USE OF INTERMEDIATE BLANKETING IN ROAD CONSTRUCTION IN BADEN-WURTTENBERG

IN BADEN-WURTTENBERG, INTERMEDIATE BLANKETING HAS EVOLVED FROM THE NECESSITY OF FINDING A SYSTEM OF CONSTRUCTION WHICH BY SIMPLE MEANS, WOULD REDUCE THE FROST SENSITIVITY OF ROAD STRUCTURES. THE GOOD RESULTS OBTAINED IN MANY COUNTRIES WITH THE USE OF HOT TARMAK FOR MAKING BITUMINOUS COATINGS SUGGESTED THE USE OF THIS MATERIAL ALSO IN BADEN-WURTTENBERG ON A LARGE SCALE FOR IMPROVING FROST-BOUND ROADS. THE FORMER METHOD OF INTERMEDIATE BLANKETING TO IMPROVE FROST RESISTANCE BY THE SIMPLE APPLICATION OF A 30-40 KG/SQ.M BLANKET HAD BEEN FOUND INSUFFICIENT TO PREVENT THE PENETRATION OF SURFACE WATER INTO THE SURFACING AND SUBSTRUCTURE. SINCE 1965, AFTER RAISING THE ROAD VERGES AND ANY NECESSARY WIDENING, A BITUMINOUS COATING OF AT LEAST 7 CM THICKNESS OF HOT TARMAK WAS APPLIED AND REINFORCED WHERE NECESSARY TO 10-12 CM THICKNESS. THE SURFACING AND WEARING COAT WAS A 70 KG/SQ.M HEAVY ASPHALT CONCRETE LAYER. SUCH REINFORCEMENT OF THE ROADWAY EDGES BY HIGH OR SHALLOW CURB STONES LAID IN CONCRETE HAS BEEN FOUND HIGHLY EFFECTIVE. THIS FORM OF INTERMEDIATE BLANKETING WAS FOUND TO BE GOOD, AFTER INITIAL TROUBLES, SO THAT THE SYSTEM IS NOW IN GENERAL USE IN BADEN-WURTTENBERG. THE DECISIVE FACTOR WAS THE FACT THAT LENGTHS CONSTRUCTED IN THIS MANNER SHOWED NO FURTHER SIGNS OF DAMAGE, REMAINED CONTINUOUS IN STRUCTURE AND IN NO WAY DETERIORATED IN APPEARANCE. THE POSSIBILITY OF USING MATERIAL OF LOCAL ORIGIN FOR A LARGE PART OF THE ROAD STRUCTURE IS PARTICULARLY IMPORTANT FOR THIS REGION WHICH IS DEFICIENT IN STONE. /RRL/

Bitumen /Germany/ May 1965

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 210561

OIL TREATMENT FOR DUST CONTROL IN SASKATCHEWAN
THE HIGH PROPORTION OF UNPAVED ROADS IN SASKATCHEWAN DEMANDED AN ECONOMICAL, ADEQUATE SURFACE TREATMENT TO CONTROL DUST AND PROVIDE THE ROAD USER WITH IMPROVED RIDING QUALITY. OIL TREATMENT HAS BEEN USED FOR SEVERAL YEARS IN THIS RELATIVELY ARID AREA WHERE PRECIPITATION IS LESS THAN 20 INCHES OF RAIN. OIL TREATMENT IS DEFINED AS A VERY THIN ROAD-MIXED, BITUMINOUS SURFACING APPLIED TO AN OIL PRIMED GRAVEL SURFACED SUBGRADE. SLOW-CURING LIQUID ASPHALTS /SC-1 OR SC-2/ ARE GENERALLY USED IN CONSTRUCTING THIS ONE-INCH THICK SURFACE. THESE OIL-TREATMENT PAVEMENTS HAVE AN AVERAGE LIFE OF 3 TO 5 YEARS AND TRAFFIC VOLUMES OF 100 TO 400 VEHICLES PER DAY. THE TOTAL PAVEMENT CONSTRUCTION COST IS APPROXIMATELY 3000 DOLLARS PER MILE WITH ANNUAL MAINTENANCE COSTS RANGING FROM 100 TO 1500 DOLLARS PER MILE. SUCCESS OF THE OIL TREATMENT DEPENDS UPON THE METHOD OF CONSTRUCTION AND ON PROMPT MAINTENANCE. THE CONSTRUCTION AND MAINTENANCE PROCEDURES ARE DESCRIBED. /CGRA/

McMillan, JD Western Assoc Can Hwy Officials Proc Apr. 1965

2A 210566

FUNDAMENTAL VISCOSITY TESTING OF ASPHALT CEMENTS
THERE ARE CRITICAL POINTS ON THE TEMPERATURE CONSISTENCY CURVE OF ASPHALT CEMENT. SOME OF THESE POINTS, FOR ASPHALT MIX PAVING, ARE: MIXING AND COMPACTING TEMPERATURES, MAXIMUM PAVEMENT TEMPERATURE (140 DEGREES F.) AND TESTING TEMPERATURE FOR VOIDS (77 DEGREES F.). GRADING AND TESTING PROCEDURES FOR ASPHALT CEMENTS ADOPTED BY THE BRITISH COLUMBIA DEPARTMENT OF HIGHWAYS ARE DISCUSSED

AND THE MORE RIGID SPECIFICATIONS IN THEIR ROAD BUILDING PROCEDURES ARE OUTLINED. /CGRA/

Varady, B Western Assoc Can Hwy Officials Proc Apr. 1966

ACKNOWLEDGMENT: Canadian Good Roads Association

2A 210624

LABORATORY STUDIES OF ASPHALTIC CONCRETES CONTAINING ASBESTOS FIBERS, RUBBERIZED ASPHALT AND EPOXY-RESIN ASPHALT

A STUDY WAS MADE ON USES OF ADDITIVES FOR IMPROVING ASPHALTIC CONCRETE FOR HYDRAULIC CONSTRUCTION. THE ADDITION OF FINE ASBESTOS FIBERS /WASTE SCREENINGS/ CAN INCREASE COMPRESSIVE AND TENSILE STRENGTH, STABILITY AND EROSION RESISTANCE PROPERTIES. THE MATERIAL IS HIGHLY DURABLE AND CAPABLE OF WITHSTANDING THE MAJOR STRESSES THAT DEVELOP DURING SERVICE. ALSO, USE OF THE FIBERS PERMITS INCREASING THE ASPHALT CEMENT CONTENT BY 1/2 TO 1 PERCENT WITHOUT SACRIFICING DENSITY OR STABILITY. ALTHOUGH STRENGTH PROPERTIES WERE SOMEWHAT INCREASED AND FLEXIBILITY SIGNIFICANTLY IMPROVED WITH USE OF RUBBERIZED ASPHALT CEMENTS, DURABILITY OF ASPHALTIC CONCRETE WITH THIS BINDER IS QUESTIONABLE FOR HYDRAULIC CONSTRUCTION DUE TO REDUCED EROSION RESISTANCE. ALSO, INDICATIONS ARE THAT STABILITY IS ADVERSELY AFFECTED. OF THE TWO RUBBERIZED ASPHALTS TESTED, GRS AND NEOPRENE, IT WAS INDICATED THAT THE NEOPRENE ASPHALT PRODUCED THE BETTER ASPHALTIC CONCRETE, PARTICULARLY ON THE BASES OF STABILITY AND EROSION RESISTANCE. COMPARED TO THE CONTROL, ASBESTOS FIBERS AND RUBBERIZED ASPHALT MIXES, THE EPOXY-ASPHALT CONCRETE EXCELLED IN ALL PHYSICAL PROPERTIES DETERMINATIONS WITH THE EXCEPTION OF FLEXIBILITY, WHICH WAS LESS THAN THE RUBBERIZED ASPHALT MIXES. EROSION RESISTANCE WAS COMPARABLE TO THE ASBESTOS FIBER MIXES. THE EPOXY- ASPHALT CONCRETE APPEARS TO BE A VERY STRONG AND TOUGH MATERIAL FOR HYDRAULIC CONSTRUCTION APPLICATION. HOWEVER, MORE DATA ARE REQUIRED RELATIVE TO ITS LONG-TERM WEATHERABILITY. THE RELATIVELY HIGH COST OF EPOXY-ASPHALT /APPROXIMATELY FIVE TIMES THAT OF NORMAL HOT-MIX/ WOULD RESTRICT ITS USE TO SPECIAL APPLICATIONS.

Bureau of Reclamation /US/ July 1965

ACKNOWLEDGMENT: Hwy Res Bd Hwy Res Abstracts Vol36,no4

2A 210629

THE COMPACTION OF ASPHALTIC CONCRETE IN THE ROAD. PART 2

IT WAS DETERMINED THAT THE MOST EFFICIENT TYPE OF ROLLING SEQUENCE FOR THE COMPACTION OF BITUMINOUS CONCRETE WAS ONE THAT UTILIZED A STEEL ROLLER FOR BREAKDOWN ROLLING, A PNEUMATIC-TIRED ROLLER FOR INTERMEDIATE ROLLING AND A STEEL ROLLER FOR FINISHING. THIS PARTICULAR ROLLING SEQUENCE WAS UTILIZED TO DETERMINE THE EFFECTS ON COMPACTION OF INTERMEDIATE ROLLER SIZE, AND TIRE SIZE AND PRESSURE. THE TIRE PRESSURE WAS VARIED AND THE EFFECTS ON THE PERCENT COMPACTION ACHIEVED WERE DETERMINED. ALL RESULTS WERE ANALYZED BY STATISTICAL TECHNIQUES. LIGHT ROLLERS EQUIPPED WITH 7.50 X 15 TIRES, LOADED TO 2,000 POUNDS PER WHEEL AND WORKING AT 55 PSI. TIRE PRESSURE, ACHIEVED 97 PERCENT COMPACTION ONLY ON EASY TO COMPACT BITUMINOUS MIXTURES. MEDIUM SIZE PNEUMATIC-TIRED ROLLERS, EQUIPPED WITH 9.00 X 20 TIRES AND LOADED TO 4,000 POUNDS PER WHEEL ACHIEVED THE REQUIRED DEGREE OF COMPACTION ON ALL BUT THE MOST DIFFICULT TO COMPACT BITUMINOUS MIXTURES INVESTIGATED. THE PERFORMANCE OF THESE ROLLERS WAS AFFECTED BY TIRE PRESSURE /100 PSI. SEEMED TO BE THE BEST PRESSURE/. LARGE PNEUMATIC-TIRED ROLLERS EQUIPPED

WITH 13.00 X 24 TIRES AND LOADED TO 8,000 POUNDS PER WHEEL PRODUCED SATISFACTORY COMPACTION ON THE MIXTURES INVESTIGATED AND THEIR PERFORMANCE WAS NOT AFFECTED BY TIRE PRESSURE. TIRE PRESSURE OF 60 PSI. PROVED SUITABLE FOR ALL CONTRACTS STUDIED. /AUTHOR/

Fromm, HJ Phang, WA
Ontario Dept Hwys, Downsview /Canada/ Feb. 1966

ACKNOWLEDGMENT: Highway Res Abstracts Hwy Res Board

2A 210635

OKLAHOMA HIGHWAY EXPLORES CONTROLLED FAILURE
A TEST HIGHWAY 4800 FEET LONG WAS BUILT BY THE STATE OF OKLAHOMA ON A 5 MILE STRETCH OF STATE HIGHWAY SOUTH OF TECUMSEH TO TEST WHETHER MIXING ASBESTOS FIBERS WILL STRENGTHEN THE ROAD SURFACE BY REDUCING OXIDATION AND BE ECONOMICAL IN THE DESIGN AND CONSTRUCTION OF BINDER AND/OR SURFACE COURSES. SO AS NOT TO WAIT FOR A NORMAL TEST OF THE NEW MIXTURES, A CONTROLLED FAILURE PROGRAM WAS USED BY UNDER-DESIGNING THE BASE MATERIAL. ASBESTOS FIBRE CAN BE INTRODUCED INTO ASPHALTIC CONCRETE IN A MANNER SIMILAR TO THE INTRODUCTION OF A MINERAL FILLER. THE LAYING AND ROLLING OF THE ASBESTOS FIBRE MIX IS VERY SIMILAR TO THAT OF THE STANDARD MIX.

Hartroft, BC *Constructor* Nov. 1966

2A 210727

STRENGTH OF GUSSASPHALT AS INFLUENCED BY MINERAL FILLERS

AS A PAVING MATERIAL, GUSSASPHALT IS KNOWN TO PROVIDE A TOUGH, DURABLE, AND WATERTIGHT SURFACE. BUT LITTLE IS KNOWN CONCERNING ITS SPECIFIC ENGINEERING PROPERTIES. SINCE THIS MATERIAL IS POURED INTO PLACE AND REQUIRES NO COMPACTION, IT MAY BE POSSIBLE TO DEVELOP THE MATERIAL FOR SPECIAL PAVING APPLICATIONS IF APPROPRIATE STRENGTH AND OTHER PARAMETERS CAN BE OBTAINED. A TESTING PROGRAM WAS DEvised TO STUDY THE INFLUENCE OF TEMPERATURE, RATE OF LOADING AND TYPE OF MINERAL FILLER ON THE ULTIMATE COMPRESSIVE STRENGTH, ULTIMATE TENSILE STRENGTH, AND VISCOELASTIC BEHAVIOR IN TENSION OF GUSSASPHALT. FILLER MATERIALS USED AS ADDITIONS TO THE NORMAL LIMESTONE TO IMPROVE SOME STRENGTH PARAMETERS OF A CONTROL MIX OF GUSSASPHALT INCLUDED ASBESTOS AND FIBER GLASS. TESTS WERE CONDUCTED AT TEMPERATURES FROM 32 TO 120 DEGREES F. AND AT LOADING RATES FROM 0.005 TO 0.5 INCHES PER MINUTE. COMPARISON OF TESTS ON GUSSASPHALT WITH RESULTS FOR CONVENTIONAL BITUMINOUS MIXTURES SHOW THAT AT HIGH TEMPERATURES THE GUSSASPHALT EXHIBITS GREATER TENSILE AND COMPRESSIVE STRENGTHS, WHILE THE REVERSE IS TRUE AT LOW TEMPERATURES. THE INFLUENCE OF FIBER GLASS OR ASBESTOS FILLER MIXED WITH CONVENTIONAL LIMESTONE FILLER WAS SIGNIFICANT ONLY AT LOW TEMPERATURES, WHERE THE TENSILE STRENGTH AND STIFFNESS OF THE MATERIAL WERE ENHANCED BY THE USE OF THESE MATERIALS. THIS BEHAVIOR IS EXPLAINED IN TERMS OF THE GRIFFITH FRACTURE THEORY FOR BRITTLE MATERIALS. FINALLY, GUSSASPHALT IS SHOWN TO BE A LINEAR VISCOELASTIC MATERIAL FOR ALL TYPES OF FILLER MATERIAL USED IN THIS STUDY. /AUTHOR/

Schultz, BG Jones, RC *Assoc Asphalt Paving Technol Proc* Feb. 1967

2A 210753

SINGLE SURFACE TREATMENTS-MEXICO

THIS WORK PRESENTS THE CRITERION FOLLOWED IN MEXICO REGARDING THE METHODS TO SELECT THE ROADS THAT MUST BE PAVED WITH SINGLE SURFACE TREATMENTS, WHICH IN GENERAL, ARE THOSE WHERE THE EXPECTED DAILY TRAFFIC IS NOT GREATER THAN ONE THOUSAND

VEHICLES OF ALL TYPES, TRAVELLING IN BOTH DIRECTIONS, DURING THE FIRST FIVE YEARS. REQUIREMENTS THAT THE SUBGRADE SHOULD FULFILL ARE POINTED OUT, ALSO THE THICKNESS AND CONDITIONS OF THE SUBBASE AND THE BASE OF PAVEMENTS. THE IMPORTANCE THAT THE IMPREGNATION SPRAYING OF THE PAVEMENT BASE HAS UPON THIS TYPE OF BITUMINOUS SURFACE IS EMPHASIZED, AND THE PERTAINING RECOMMENDATIONS ARE INCLUDED. FINALLY, THOSE CHARACTERISTICS WHICH THE ROCK AGGREGATE MUST SATISFY ARE INDICATED, AS WELL AS THOSE CORRESPONDING TO THE MOST CONVENIENT ASPHALT PRODUCTS. THE PLACING METHODS ARE ALSO DESCRIBED FOR EACH OF THE CONSTRUCTION STAGES OF THIS ECONOMICAL TYPE OF BITUMINOUS SURFACE. /AUTHOR/

Velasco, MB Medina, JE *Perm Intl Assoc Road Congresses Proc* 1967

2A 210758

BASE STABILIZATION WITH CUT-BACK ASPHALT AND CHLORIDES, NOBLES COUNTY

THIS STUDY WAS UNDERTAKEN IN 1960 TO INVESTIGATE THE FEASIBILITY OF STABILIZING A LOCAL AGGREGATE BY THE USE OF CUTBACK ASPHALT, SODIUM CHLORIDE, AND CALCIUM CHLORIDE. FIVE TEST SECTIONS, EACH APPROXIMATELY ONE MILE IN LENGTH, WERE CONSTRUCTED IN WHICH THE BASE OR SUBBASE WAS TREATED WITH ONE OF THESE MATERIALS. AN UNTREATED SECTION WAS ALSO INCLUDED FOR CONTROL. THE PROJECT IS LOCATED IN SOUTHWESTERN MINNESOTA ON A COUNTY ROAD WITH A LOW TRAFFIC VOLUME. THE MERITS OF USING THE VARIOUS ADDITIVES WERE EVALUATED BY VISUAL OBSERVATIONS AND FIELD AND LABORATORY TESTS BOTH DURING CONSTRUCTION AND THE FIVE YEAR PERIOD WHICH FOLLOWED. AT THE END OF THIS PERIOD, MOST OF THE SALT HAD MIGRATED OUT OF THE ROADWAY STRUCTURE. NONE OF THE ADDITIVES INVESTIGATED PROVIDED ANY DEFINITE BENEFITS IN EXPEDITING CONSTRUCTION OR IN IMPROVING THE PERFORMANCE OF THE VARIOUS SECTIONS. /AUTHOR/

Korfhage, GR
Minnesota Department of Highways 1967

2A 210769

METHODS FOR CALCULATING TEMPERATURE PROFILES OF HOT-MIX ASPHALT CONCRETE AS RELATED TO THE CONSTRUCTION OF ASPHALT PAVEMENTS

METHODS OF PREDICTING THE TEMPERATURE OF HOT-MIX ASPHALT CONCRETE, AS A FUNCTION OF TIME AND PLACE, IN THE MIX FROM THE MOMENT IT LEAVES THE PAVER UNTIL COMPACTION TO SPECIFIED DENSITY IS COMPLETED WERE INVESTIGATED TO PROVIDE A MEANS FOR ENVIRONMENTAL CONDITIONS THAT MAY BE MARGINAL WITH RESPECT TO OBTAINING ADEQUATE COMPACTION AND TO STIMULATE THE DEVELOPMENT OF PROCEDURES FOR OBTAINING ADEQUATE COMPACTION UNDER ADVERSE ENVIRONMENTAL CONDITIONS. A NUMERICAL OR FINITE DIFFERENCE SOLUTION WAS USED AS THE BASIS FOR A COMPUTER PROGRAM FOR CALCULATING TEMPERATURES AS A FUNCTION OF TIME, PLACE IN THE MIX, AND VARIOUS ENVIRONMENTAL CONDITIONS. FOR USE IN THE COMPUTER PROGRAM, DATA FOR WIND VELOCITIES WERE CONVERTED TO BIOT NUMBERS AND DATA FOR SOLAR ALTITUDE WERE CONVERTED TO SOLAR RADIANT FLUX. CONSTANT PHYSICAL PROPERTIES FOR THE MIX AND BASE WERE ASSUMED AND USED DIRECTLY FOR DATA INPUT TO THE COMPUTER PROGRAM. THE EFFECT OF WIND VELOCITY, SOLAR RADIATION AND ATMOSPHERIC TEMPERATURE IS GREATER ON MIX TEMPERATURES NEAR THE UPPER SURFACE OF THE MIX THAN ON MIX TEMPERATURES NEAR THE LOWER SURFACE OF THE MIX. INITIAL BASE TEMPERATURE DISTRIBUTION AFFECTS TEMPERATURES NEAR THE LOWER SURFACE OF THE MIX TO A MUCH GREATER EXTENT THAN IT AFFECTS TEMPERATURES NEAR THE UPPER SURFACE. STUDY RESULTS INDICATE THAT TEMPERATURES OF THE HOT-MIX ASPHALT CONCRETE NEAR

THE LOWER SURFACE DECREASE MORE RAPIDLY THAN TEMPERATURES NEAR THE UPPER SURFACE. SINCE COMPACTIVE EFFORT IS LESS NEAR THE LOWER SURFACE, TEMPERATURES NEAR THE LOWER SURFACE ARE OF PARTICULAR SIGNIFICANCE IN OBTAINING SPECIFIC DENSITIES. THE NUMERICAL METHOD OF DETERMINING THE TEMPERATURE DISTRIBUTION IN HOT-MIX ASPHALT CONCRETE LENDS ITSELF WELL TO COMPUTER PROGRAMMING AND PROVIDES A MEANS OF INVESTIGATING THE EFFECT OF AN ALMOST LIMITLESS NUMBER OF ENVIRONMENTAL CONDITIONS ON THE COOLING OF HOT-MIX ASPHALT CONCRETE DURING CONSTRUCTION.

Corlew, JS Dickson, PF *Assoc Asphalt Paving Technol Proc* Feb. 1968

2A 210778

DESIGN AND CONSTRUCTION OF ASPHALTIC BRIDGE PAVEMENTS IN GERMANY

THE STRESSES TO WHICH BRIDGE PAVING SYSTEMS ARE SUBJECTED TO ENDURE THE BRIDGE OSCILLATIONS AND THE STRESSES ORIGINATING FROM MORE RAPID TEMPERATURE CHANGES ARE DISCUSSED. THE PAVINGS ARE REQUIRED TO HAVE HIGH STABILITY COMBINED WITH GREAT PLASTICITY AND HIGH DURABILITY UNDER VARYING STRESSES. A MULTI-LAYER SYSTEM IS ADVISABLE IN VIEW OF THE SAFETY OF THE BRIDGE AND THE REQUIREMENTS OF THE TRAFFIC. THE COURSES ARE INSULATED COURSE, INTERMEDIATE PROTECTIVE COURSE AND WEARING COURSE. THE METHODS USED MUST BE TAILORED TO THE SPECIFIC NEEDS OF BOTH THE BRIDGE AND THE TRAFFIC. USUAL METHODS FOR CONCRETE BRIDGES ARE THOSE WHICH INCORPORATE SEPARATOR, INSULATION, INTERMEDIATE COURSE AND SURFACE COURSE. THE SEPARATOR MOSTLY CONSISTS OF PERFORATED OR NON-PERFORATED GLASS FIBER MATERIAL, THE INSULATION OF MASTIC OR METAL FOILS, THE PROTECTIVE COURSE OF GUSSASPHALT AND THE WEARING COURSE OF EITHER GUSSASPHALT OR ASPHALTIC CONCRETE. THE INSULATION FOR STEEL BRIDGES MUST HAVE A FULL-PHASE TYPE BOND WITH THE STEEL DECKING. THE INSULATION MAY BE EITHER MASTIC, METAL FOILS, OR HOT-SPRAYED BONDING COMPOSITIONS. PROTECTIVE COURSE AND WEARING COURSE ARE THE SAME AS FOR CONCRETE BRIDGES. METHODS FOR ELIMINATING THE SEPARATOR ARE PRESENTLY BEING TRIED IN GERMANY. THESE PROVIDE THAT ALL LAYERS ARE BONDED TOGETHER AND, MOST IMPORTANT, THE INSULATION IS BONDED TO THE DECKING. THE DIFFICULTIES TO BE OVERCOME IN STEEL BRIDGES ARE TO OBTAIN THE REQUIRED FATIGUE STRENGTH AGAINST DEFLECTIONS AND THE NECESSARY SHEAR RESISTANCE. THOSE TO BE OVERCOME FOR CONCRETE DECKINGS ARE BOND FAILURE AND BLISTERING. FOR CONCRETE BRIDGES, THE DEVELOPMENT TREND IS TO DESIGN THE INSULATION SO THAT IT TAKES UP AND ELIMINATES WATER VAPOR PRESSURES BUT STILL MAINTAINS FULL-FACE BOND WITH THE CONCRETE DECKING. ADDITIONAL ANCHOR BARS ARE USED IN STEEL BRIDGES TO REDUCE DECK-PLATE DEFORMATIONS, AND TO PREVENT SHOVING OF THE PAVING. SPECIAL HOT-APPLIED BONDING COMPOSITIONS ARE USED TO PROVIDE 100 PER CENT SHEAR-RESISTING BOND. RUBBER, PLASTICS, AND ASBESTOS ARE BEING TRIED AS ADDITIVES TO IMPROVE THE CHARACTERISTICS OF THE PAVING MATERIALS.

Zichner, G *Assoc Asphalt Paving Technol Proc* Feb. 1966

2A 210780

COMPACTION OF DEEP LIFT BITUMINOUS STABILIZED BASE

A STREET CONSTRUCTION PROGRAM WAS CONDUCTED USING BITUMINOUS STABILIZED BASE WHICH IS A HOT-PLANT MIX OF BANK RUN GRAVEL AND ASPHALT CEMENT HAVING A PENETRATION OF 85 TO 100. PAVEMENT TEST CORES FROM A SINGLE FIVE INCH LIFT CONSTRUCTION PROVED TO BE 1 PERCENT BETTER COMPACTED THAN THE CORES FROM

PAVEMENT CONSTRUCTED WITH TWO 2-1/2 INCH LIFTS. INDICATIONS WERE THAT TEMPERATURE COULD BE A FACTOR IN OBTAINING THESE DENSITIES. THE TEMPERATURES WERE RECORDED WITH THERMOCOUPLES TO CONFIRM THAT TEMPERATURE ASSISTED THE COMPACTION EFFORT. IN SUBSEQUENT WORK, THE GRADATION OF THE MIX WAS ADJUSTED TO OBTAIN THE DESIRE TO PRESENT VOIDS. RESULTS INDICATE THAT MIXED DESIGN IS IMPORTANT IN SINGLE LIFT CONSTRUCTION. LIFTS OF 12, 15, AND 18 INCHES WERE CONSTRUCTED. TEST RESULTS REVEALED THAT: (1) HOT PLANT MIX STABILIZED BASE CAN BE CONSTRUCTED IN A SINGLE LIFT TO ANY DESIGN DEPTH, (2) THICK LIFTS RETAIN HEAT FOR A LONGER PERIOD OF TIME AND THUS PROVIDE AMPLE TIME FOR ROLLING, (3) HEAVY RUBBER TIRED ROLLERS ARE VERY EFFECTIVE FOR COMPACTING THICK LIFTS, AND (4) THE LAY-DOWN TEMPERATURE OF THE MIX IS IMPORTANT BECAUSE THERE IS A RELATIONSHIP BETWEEN LAY-DOWN TEMPERATURE, THE COMPACTION FORCE AND THE DEPTH OF LIFT. A TEMPERATURE-COMPACTION RELATIONSHIP WAS SUBSTANTIATED INDICATING CONSIDERATION OF: (1) VOLUME-THE DEPTH OF THE LIFT, (2) PRESSURE-THE COMPACTION FORCE AND (3) TEMPERATURE -THE LAY-DOWN TEMPERATURE.

Beagle, CW *Assoc Asphalt Paving Technol Proc* Feb. 1966

2A 210807

BITUMINOUS BRIDGE COVERING AND PACKING LAYERS ON CONCRETE

COMMON FAULTS IN BITUMINOUS CONSTRUCTIONS ARE DISCUSSED, WITH SPECIAL REFERENCE TO BUBBLE FORMATION DUE TO MINERAL OIL AND WATER VAPOR. THE CHARACTERISTICS AND PREPARATION OF THREE TYPES OF CONSTRUCTION ARE DESCRIBED, IN WHICH THE TOP AND PROTECTIVE LAYERS ARE OF CAST ASPHALT OR FINE ASPHALT CONCRETE, THE PACKING OF ASPHALT CEMENT OR CORRUGATED METAL, AND THE SEPARATING LAYER BETWEEN THE BITUMINOUS CONSTRUCTION AND THE BRIDGE OF GLASS WOOL, OR OTHER SUITABLE MATERIAL. IN ADDITION TO THE NORMAL CONSTRUCTION MATERIALS, THE USE OF RUBBER, ASBESTOS AND SYNTHETIC RESIN IS DISCUSSED. LABORATORY TESTS AND PRACTICAL OBSERVATIONS ON IMPERVIOUSNESS TO WATER ARE DESCRIBED. /AUTHOR/

Von, STOSCH HJ *Bitumen, Teere, Asphalte, Peche /Ger/* 1967

ACKNOWLEDGMENT: *Journal Applied Chemistry /UK/*

2A 210819

A STUDY OF VARIABILITY IN AN ASPHALT CONCRETE MIX BASIC STRUCTURAL PARAMETERS ASSOCIATED WITH THE SIGNIFICANT REQUIREMENTS AND CHARACTERISTICS SPECIFIED OR DESIGNED FOR HIGHWAY MATERIALS AND STRUCTURAL ELEMENTS WERE DETERMINED THROUGH STUDIES OF A BROAD SPECTRUM OF CURRENT GOOD HIGHWAY DESIGN AND CONSTRUCTION. DETERMINATIONS WERE MADE OF THE AVERAGES AND VARIATIONS IN TEMPERATURE, ASPHALT CONTENT AND AGGREGATE GRADATION IN AN ASPHALTIC CONCRETE WEARING COURSE MIXTURE PRODUCED BY ONE PLANT FOR A NORMAL JOB. AN EVALUATION WAS MADE OF THE EFFECTS OF INHERENT PROCESS VARIABILITY, SAMPLING PROCEDURE, AND TEST METHOD (MEASUREMENT PROCESS) ON THE VARIATIONS OBTAINED. RESULTS SHOWED THAT INHERENT PROCESS VARIABILITY WAS THE MAJOR FACTOR CONTRIBUTING TO VARIATION IN MIXTURE COMPOSITION AS DETERMINED BY EXTRACTION AND GRADATION TESTS. WHEN VARIABILITY IS EXPRESSED AS VARIANTS, APPROXIMATELY 60 PERCENT OF THE VARIATION IN ASPHALT CONTENT AND 85-98 PERCENT OF THE VARIATIONS IN GRADATION WERE ATTRIBUTABLE TO THE PLANT PROCESS. VARIATIONS ATTRIBUTABLE TO THE SAMPLING AND TEST PROCEDURES ACCOUNTED FOR THE REMAINDER OF VARIATION IN COMPOSITION. THE SAMPLING AND TESTING PROCEDURES USED IN THIS STUDY WERE MINOR FACTORS IN THE VARIATIONS OBSERVED IN MIX

COMPOSITION, ACCOUNTING FOR SUBSTANTIALLY LESS THAN HALF OF THE VARIATIONS FOUND FOR EACH ITEM OF COMPOSITION. DEVIATIONS OF THE TEST AVERAGES FROM THE DESIGN VALUES WERE THE MAJOR CAUSE OF THE DEVIATION OF INDIVIDUAL TEST RESULTS FROM THE PERMISSIBLE LIMITS (TOLERANCES). THE FEASIBILITY OF CONDUCTING STUDIES OF THIS TYPE WAS INDICATED WITHOUT APPRECIABLE INTERFERENCE WITH THE NORMAL COURSE OF PLANT PRODUCTION. A STATISTICAL ANALYSIS WAS MADE TO SHOW THE EFFECT OF TEST METHOD, SAMPLING PROCEDURE AND MATERIAL (BATCH-TO-BATCH) VARIATION ON THE OVERALL VARIATIONS OBTAINED.

Oglio, ER Zenewitz, JA *Assoc Asphalt Paving Technol Proc* Feb. 1965

2A 210823

CONSTRUCTION AND PERFORMANCE OF PLANT MIXED SEAL COATS

THE TYPE OF PLANT MIX SEAL COAT DISCUSSED IS ONE IN WHICH AGGREGATE SIMILAR TO THAT IN A NORMAL CHIP SEAL IS USED (OPEN GRADING, WITH MAXIMUM SIZE ABOUT 3/8 IN.) AND THIS AGGREGATE IS MIXED IN A PLANT WITH A RELATIVELY HIGH PERCENTAGE OF AN ASPHALT CEMENT AND PLACED TO A COMPACTED DEPTH OF 5/8-3/4 INCH BY AN ASPHALT PAVER. A THICKER COAT RESULTS WITH A CHIP SEAL. THERE ARE OTHER SIGNIFICANT DIFFERENCES: (1) THE PROBLEM OF LOSS OF CHIPS AND DAMAGE TO VEHICLES IS LARGELY ELIMINATED, (2) THE SURFACE HAS EXCEPTIONAL SMOOTHNESS, (3) THE SURFACE HAS UNIFORMLY GOOD SKID RESISTANCE AND IS OF A NATURE NOT SUBJECT TO HYDROPLANING, (4) THE SURFACE HAS A VERY PLEASING, UNIFORM APPEARANCE, (5) THE SURFACE HAS GOOD DURABILITY, (6) COSTS ARE REASONABLE, AND (7) BECAUSE OF HIGH MECHANICAL STABILITY AND GREATER THICKNESS, SOME STRUCTURAL VALUE CAN BE ALLOWED IN THE PAVEMENT THICKNESS DESIGN. PLANT-MIXED SEAL COATS ARE MOST COMMONLY PLACED ON EXISTING BITUMINOUS SURFACES, BUT THEY CAN BE AND ARE PLACED WITH GOOD RESULTS ON RIGID PAVEMENTS. THE TYPICAL HOT PLANT MIXED SEAL OF THIS TYPE USES OPEN-GRADED AGGREGATE OF HIGH QUALITY, CLEAN, HARD, TOUGH, NON-POLISHING, WITH A HIGH PERCENTAGE OF CRUSHED FACES AND GOOD RESISTANCE TO THE STRIPPING EFFECTS OF WATER. ADDITIVES SUCH AS HYDRATED LIME MAY BE NECESSARY TO PROVIDE ADEQUATE RESISTANCE TO STRIPPING. MIXING WILL BE DONE AT RELATIVELY LOW TEMPERATURE WITH A RELATIVELY THICK COAT OF AN ASPHALT CEMENT. THE MIX IS PLACED WITH A REGULAR BITUMINOUS PAVER TO A COMPACTED DEPTH OF 5/8-3/4 INCH. EXPERIENCE WITH PLANT MIX SEAL PROJECTS ARE DISCUSSED. COSTS DEPEND ON THE COST OF THE AGGREGATE AND IT IS AN EXPENSIVE AGGREGATE TO PRODUCE-ABOUT THE SAME AS GOOD AGGREGATE IN A CHIP SEAL. COSTS AVERAGE AROUND \$.25 A SQUARE YARD AND FOR COMPARISON, AN ORDINARY CHIP SEAL WOULD PROBABLY NOT COST MORE THAN \$.11 PER SQ. YD. AND WOULD ALSO BE LESS THAN HALF AS THICK. MIXING TEMPERATURES ARE QUITE CRITICAL. UNDER CONDITIONS OF VERY HEAVY TRAFFIC AND CONTINUED HIGH TEMPERATURES, ADDITIONAL CONSOLIDATION CAN TAKE PLACE WHICH MAY RESULT IN THE VOIDS BEING OVERFILLED WITH ASPHALT, WITH THE EXCESS ASPHALT THEN FLUSHING TO THE SURFACE AND ELIMINATING THE NON-SKID ADVANTAGES. THIS PROBLEM MAY BE PREVENTED BY SOME REVISION IN AGGREGATE GRADING OR USE OF A LOWER PENETRATION ASPHALT. CONSTRUCTION PROCEDURES ARE DESCRIBED.

Eager, WL *Am Assoc State Highway Officials Proc* Oct. 1967

2A 210825

EXPERIMENTAL PAVING PROJECTS USING CURTISS-WRIGHT'S COAL-MODIFIED, COAL-TAR BINDER THE OBSERVATION AND EVALUATION OF 13 SECTIONS OF EXPERIMENTAL PAVEMENT CONSTRUCTED IN KENTUCKY USING COAL-MODIFIED, COAL-TAR BINDER ARE DISCUSSED.

THESE ARE COMPARED WITH THE PERFORMANCE OF CONTROL SECTIONS IN WHICH NORMAL SPECIFICATION ASPHALT CEMENTS WERE USED. THE RESULTS OF LABORATORY AND FIELD TESTS ARE ALSO REPORTED TO SUPPORT AND SUPPLEMENT THE VISUAL SURVEYS. /AUTHOR/

Drake, WB *Highway Research Board Bulletin* Jan. 1962

2A 210827

COAL-MODIFIED TAR BINDERS FOR BITUMINOUS CONCRETE PAVEMENTS

THE POSSIBILITY OF MAKING AN IMPROVED BINDER FOR BITUMINOUS PAVEMENTS OF THE HOT-MIX HOT-LAY TYPE BY DISPERSING COAL IN DISTILLED COAL TARS AND COAL TAR OILS IS STUDIED. SUITABLE LABORATORY AND PILOT PLANT EQUIPMENT WAS ASSEMBLED AND OPTIMUM CONDITIONS FOR THE DISPERSION OF COAL IN TARS AND OILS WERE DETERMINED. VARIOUS COALS, TARS, AND OILS WERE COMPARED AS TO THEIR SUITABILITY FOR THE PURPOSE. EXPERIMENTAL QUANTITIES OF COAL-MODIFIED TAR BINDERS WERE PRODUCED AND ANALYZED AND THEN COMBINED WITH VARIOUS AGGREGATES IN HOT MIXES. THE LATTER WERE THEN COMPARED WITH HOT MIXES CONTAINING TYPICAL ASPHALT CEMENTS AND COAL-TAR BINDERS. THE TESTS APPEARED TO INDICATE THAT IT WOULD BE POSSIBLE TO MAKE HOT MIXES WITH COAL-MODIFIED TAR CEMENTS EQUAL OR SUPERIOR TO THOSE MADE WITH USUAL ASPHALT OR COAL-TAR BINDERS. A PILOT PLANT WAS BUILT TO PRODUCE 150,000 GALLONS OF COAL-MODIFIED TAR BINDER FOR COMPARISON WITH ASPHALT CEMENTS NORMALLY USED IN KENTUCKY IN CLASS I AND CLASS I-MODIFIED BITUMINOUS-PAVEMENTS. DURING A PERIOD OF THREE MONTHS IT PRODUCED 104 BATCHES OF BINDER, OF WHICH 100 BATCHES WERE OF THE THREE-COMPONENT TYPE (COAL, TAR, AND OIL), TWO OF THE TWO-COMPONENT TYPE (COAL AND TAR), AND TWO CONSISTED ONLY OF TAR (RT-12). THE BINDER WAS DELIVERED TO 14 TEST SITES IN VARIOUS PARTS OF THE STATE. AT TWO, THREE-COMPONENT BINDER WAS USED IN HOT MIX LAID 2 3/4 INCHES THICK ON A TAR-PRIMED SOIL BASE (CLASS I-MODIFIED). AT ALL OTHER SITES, THE BINDER WAS USED IN 1 1/2 INCH CLASS I OVERLAYS ON EXISTING BLACK-TOP PAVEMENTS WHICH FOR THE MOST PART HAD REQUIRED EXTENSIVE MAINTENANCE BECAUSE OF BASE FAILURES, EXCESSIVE CRACKING, OR THE DEVELOPMENT OF SLIPPERY SURFACES. COAL-MODIFIED TAR BINDERS APPEARED TO BE SOMEWHAT SUPERIOR TO USUAL ASPHALTIC HOT-MIXES WITH RESPECT TO SET-UP DURING ROLLING AND EARLY TRAFFIC, BUT INFERIOR WITH RESPECT TO FUMING, ESPECIALLY WHEN THE TEMPERATURES OF THE MIXES EXCEEDED 260 F. INSPECTION OF SOME OF THE TEST SECTIONS IN SPRING 1960, FOLLOWING UNUSUALLY SEVERE WINTER WEATHER, EMPHASIZED THE NEED FOR BETTER TEMPERATURE SUSCEPTIBILITIES TO PROVIDE GREATER FLEXIBILITY OF THE OVERLAYS AT LOW ATMOSPHERIC TEMPERATURES. COMPARISONS WERE MADE OF THE SUITABILITY OF APPROXIMATELY 40 DIFFERENT COALS FROM VARIOUS PARTS OF THE UNITED STATES AND FOREIGN COUNTRIES, THE USE OF LOW, MEDIUM, AND HIGH-TEMPERATURE TARS AS DISPERSING MEDIA FOR THE COALS, ATTEMPTS TO USE OILS OF PETROLEUM ORIGIN AS FLUXING AGENTS, AND THE ADDITION OF VARIOUS POLYMERS TO THE COAL-DISPERSIONS. ALSO, VARIOUS TYPES OF BINDERS WERE COMPARED AS TO THEIR VISCOSITIES AT SEVERAL TEMPERATURES AND NUMEROUS METHODS FOR COMPARING THE BRITTLINESS OF DIFFERENT HOT-MIX BINDERS AT LOW TEMPERATURES WERE TRIED. /AUTHOR/

Rhodes, EO *Highway Research Board Bulletin* Jan. 1962

2A 210833

SETTING RATE OF ASPHALT CONCRETE MIXES THAT SHOVE EXCESSIVELY UNDER STEEL WHEEL ROLLERS, DO NOT DENSIFY, OR ARE TENDER TO ANY TYPE OF DISTORTION ARE DEFINED AS 'SLOW SETTING.' AT TIMES,

THESE MIXES REMAIN TENDER FOR PROLONGED PERIODS AFTER LAYDOWN. FIELD AND LABORATORY STUDIES SHOW THAT AGGREGATE GRADATION AND ANGULARITY, FILLER CONTENT, MOISTURE, AND COMPACTION EFFORT ARE IMPORTANT IN DETERMINING THE SETTING RATE OR TOUGHNESS OF A COMPACTED MIX. CONSTRUCTION AND MIX VARIABLES ARE EXAMINED UNDER CONTROLLED CONDITIONS TO ISOLATE THOSE FACTORS RESPONSIBLE FOR SLOW SETTING. DATA PRESENTED SHOW THAT HIGH-QUALITY, HIGH-STABILITY MIXES COMPACT BETTER WITH INCREASING COMPACTION TEMPERATURE, BUT THAT IN MORE UNSTABLE MIXES INCREASING THE TEMPERATURE RESULTS IN POORER COMPACTION. THE AUTHORS SHOW THE IMPORTANCE OF MINERAL FILLER TO BOTH PAVEMENT DENSITY AND TOUGHNESS. AN OPTIMUM FILLER-TO-ASPHALT RATIO EXISTS FOR MAXIMUM COMPACTION UNDER STEEL WHEEL ROLLERS. IN ADDITION, THE AMOUNT OF MINERAL FILLER IN A MIX WAS FOUND TO INFLUENCE THE SETTING RATE OF AN ASPHALT PAVEMENT. PAVEMENT TOUGHNESS PROVED DEPENDENT ON THE TYPE AND DEGREE OF COMPACTION. PNEUMATIC ROLLING SUBSTANTIALLY IMPROVES PAVEMENT TOUGHNESS. PAVEMENT SETTING IS SHOWN TO BE MUCH FASTER IN A MIX WITH CRUSHED, ANGULAR AGGREGATE RATHER THAN ROUNDED GRAVEL. THE SETTING RATE OF ASPHALT CONCRETE PAVEMENTS IS LARGELY CONTROLLED BY THE CONSTRUCTION PRACTICES AND MATERIAL PROPERTIES INVESTIGATED IN THIS PAPER. SUGGESTIONS ARE GIVEN ON HOW TO ACHIEVE MAXIMUM DENSIFICATION AND PAVEMENT TOUGHNESS. /AUTHOR/

Santucci, LE Schmidt, RJ *Highway Research Board Bulletin* 1962

2A 210845
CORRELATION OF LOW TEMPERATURE TESTS WITH RESISTANCE TO CRACKING OF SHEET ASPHALT PAVEMENTS

CERTAIN PHYSICAL PROPERTIES OF SHEET ASPHALT PAVING MIXTURES AS DETERMINED BY LOW TEMPERATURE LABORATORY TESTS WITH RESISTANCE TO CRACKING OF SHEET ASPHALT PAVEMENTS WERE INVESTIGATED. SAMPLES OF 2 SHEET ASPHALT PAVEMENTS WERE TESTED TO DETERMINE PHYSICAL CHARACTERISTICS OF THE MIXTURES, PARTICULARLY AT LOW TEMPERATURES. ONE OF THESE PAVEMENTS IS IN GOOD CONDITION, WHILE THE OTHER PAVEMENT HAS CRACKED A GREAT DEAL. TEST RESULTS, PARTICULARLY MODULUS OF RUPTURE, INDICATE THAT THE ONE PAVEMENT HAS PROPERTIES TENDING TO RESIST CRACKING, BUT THE OTHER PAVEMENT HAS LOW RESISTANCE TO CRACKING. THE FOLLOWING CONCLUSIONS ARE REACHED OF PHYSICAL PROPERTIES OF HOT-MIX SHEET ASPHALT PAVING MIXTURES: (1) THE MODULUS OF RUPTURE AND THE MODULUS OF ELASTICITY ARE MEASURES OF THE RESISTANCE TO CRACKING OF SHEET ASPHALT PAVING MIXTURES, (2) TOUGHNESS OF A PAVING MIXTURE AT LOW TEMPERATURE IS A MEASURE OF THE RESISTANCE TO IMPACT AND MAY BE USED AS A CONTROL TEST TO EVALUATE MIXTURES WITH RESPECT TO THEIR ABILITY TO WITHSTAND THE ACTION OF TRAFFIC AT LOW TEMPERATURES, (3) AN ASPHALT PAVING MIXTURE SHOULD NOT BE DESIGNED TO HAVE GREAT RESISTANCE TO DISPLACEMENT AS MEASURED BY STABILITY TESTS WITHOUT CONSIDERATION OF THE RESISTANCE TO CRACKING OF THE MIXTURE, PARTICULARLY IF THE MIXTURE IS TO BE LAID IN LOCALITIES WHICH HAVE COLD WINTERS, (4) IT WOULD APPEAR THAT THOSE MIXTURES CONTAINING THE HIGHEST PENETRATION ASPHALT CONSISTENT WITH NECESSARY STABILITY SHOULD PROVE MOST RESISTANT TO CRACKING AT LOW TEMPERATURES, AND (5) THE IMPORTANCE OF PROPER CONTROL OF PLANT AND STREET CONSTRUCTION OPERATIONS TO INSURE PROPERLY PROPORTIONED AND WELL COMPACTED MIXTURES OF UNIFORM DENSITY AND TO PREVENT GREAT ALTERATIONS IN CHARACTERISTICS OF THE ASPHALT CEMENT SHOULD BE EMPHASIZED.

Rader, LF *Assoc Asphalt Paving Technol Proc* 1936

2A 210859
MECHANICAL PROPERTIES OF ASPHALT MATERIALS AND STRUCTURAL DESIGN OF ASPHALT ROADS
 NUMEROUS PROPOSED RATIONAL APPROACHES TO BITUMINOUS ROAD DESIGN CONTRIBUTED BY PREVIOUS INVESTIGATORS ARE REVIEWED. THE MECHANICAL PROPERTIES AND THE TEST METHODS FOR THE PROPERTIES OF MATERIALS ENTERING INTO CONSTRUCTION OF ROAD CARPETS ARE DISCUSSED. THE CHARACTERISTICS OF ASPHALTS AND AGGREGATES WHICH AFFECT BOTH THE ELASTIC AND PLASTIC BEHAVIOR OF MIXTURES ARE DESCRIBED. THE PROBLEM OF ANALYZING THE PROPERTIES AND FUNCTIONS OF BASE COURSES, SUB-BASES, AND SUB-SOIL LAYERS ARE DISCUSSED. DESIGN METHODS FOR ROAD CONSTRUCTIONS ARE PRESENTED. DESIGNS FOR THE ENTIRE LAYERS SYSTEM FOR STATIC LOADS AND THE DESIGN FOR ONLY THE ROAD CARPET FOR STATIC LOADS ARE DISCUSSED IN DETAIL. IT IS SHOWN THAT FOR SAND SHEET, TENSILE STRENGTH DECREASES WITH INCREASED DURATION OF LOADING IRRESPECTIVE OF TEMPERATURE. BONDING STRENGTH DECREASES WITH AN INCREASE IN THE NUMBER OF LOAD REPETITIONS APPLIED TO THE SPECIMEN. THIS INDICATES THE EFFECT OF FATIGUE. IT IS CONCLUDED THAT TO AVOID CRACKED FORMATION, THE LOWEST F/B RATIO COMPATIBLE WITH OTHER CRITERIA SHOULD BE EMPLOYED.

Nijboer, LW Herner, RC DISCUSSEER *Highway Research Board Proceedings* 1954

2A 210873
CONSTRUCTION OF OPTIMUM SEAL COATS

NO DATA WAS GIVEN BUT IMPORTANT CONSIDERATIONS WERE GIVEN TO THE FACTORS THAT SHOULD BE CONSIDERED IN SEAL COAT CONSTRUCTION. ONE OF THESE WAS SKID RESISTANCE AND ANOTHER WAS DESIRABLE FINISHED SURFACE CHARACTERISTICS. THE IDEA OF AN OPTIMUM AGGREGATE SIZE WAS INTRODUCED AND REQUIREMENTS WERE DISCUSSED THAT WOULD PROVIDE PROPER ADHESION OF THE AGGREGATE AND THE BINDER. A NUMBER OF FACTORS BASIC TO SEAL COAT DESIGN AND CONSTRUCTION WERE DISCUSSED. /AUTHOR/

Nevitt, GH *Assoc Asphalt Paving Technol Proc*

2A 210884
BASIC PRINCIPLES FOR THE DESIGN AND CONSTRUCTION OF SEAL COATS AND SURFACE TREATMENTS WITH CUTBACK ASPHALTS AND ASPHALT CEMENTS
 FAILURES, CONSTRUCTION, TECHNIQUES AND A THOROUGH DESIGN PROCEDURE ARE COVERED AS PERTAINS TO SEAL COATS AND SURFACE TREATMENTS. THE DESIGN IS BASED UPON HANSON'S WORK AND SOME MODIFICATION OF THIS BASIC WORK AS MADE BY THE COUNTY ROADS BOARD OF VICTORIA, AUSTRALIA. THE QUANTITY OF AGGREGATE AND BINDER ARE RELATED TO AN 'AVERAGE LEAST DIMENSION' OF THE AGGREGATE AND THE QUANTITY OF THE BINDER IS FURTHER RELATED TO THE VOIDS BETWEEN THE COMPACTED AGGREGATES. CHARTS ARE ALSO GIVEN THAT ALLOW THE SELECTION OF AN APPROPRIATE TYPE AND GRADE OF ASPHALT FOR THE SIZE OF AGGREGATE USED AND THE ROAD SURFACE TEMPERATURE AT THE TIME OF APPLICATION OF THE BINDER. /AUTHOR/

McLeod, NW *Assoc Asphalt Paving Technol Proc* 1960

2A 210887
ASPHALT SURFACE TREATMENTS
 THIS PUBLICATION DEALS ENTIRELY WITH MATERIALS, DESIGN AND CONSTRUCTION OF SURFACE TREATMENTS.

Asphalt Institute Manual Series 1964

2A 210890
BITUMINOUS AGGREGATE BASES
 REFERENCES ARE LISTED ON BITUMINOUS GRAVEL CONCRETE AS SUPPORTING BASE FOR BITUMINOUS PAVEMENTS,

TYPES OF PAVING MIXES, TESTS OF BITUMINOUS PAVING MIXTURES, USE OF BITUMINOUS MACADAM FOR CONSTRUCTION OF ROAD BASE, ASPHALTIC PAVEMENT ON THE NEW JERSEY TURNPIKE, AND LOAD CARRYING CAPACITY OF BITUMINOUS BASE COURSES OF HIGHWAYS.

Highway Research Information Service

2A 210926

THE PRESENT STATE OF THE ADHESION PROBLEM IN BITUMINOUS ROAD CONSTRUCTION

ADHESION MAY BE DEFINED AS THE RESISTANCE TO SEPARATION OF TWO ADJOINING MATERIALS. THIS ADHESION MAY BE DUE TO NON-SPECIFIC FACTORS SUCH AS MECHANICAL FACTORS, SPECIFIC SURFACE-PHYSICAL OR CHEMICAL PHENOMENA. A SURVEY OF THE SUBSTANCES WHICH ARE IMPORTANT EITHER AS COMPONENTS OR AS NATURAL ENEMIES OF MINERAL-BITUMEN SYSTEMS, MAKES IT EVIDENT THAT PURELY PHYSICAL ADSORPTION CAN PLAY ONLY A NEGLIGIBLE ROLE IN THE ADHESION PROBLEM AND THAT PRIMARY ATTENTION SHOULD BE PAID TO ORIENTATION AND REACTION PHENOMENA. REACTION PHENOMENA (POLAR ADSORPTION AND COMPOUND FORMATION) TAKE PLACE WITH CONSIDERABLE MORE ENERGY THAN PHYSICAL ADSORPTION. THE POSSIBILITIES AND TYPES OF POLAR ADHESION AND COMPOUND FORMATION MUST BE LOOKED FOR ON THE BASIS OF THE CHEMICAL COMPOSITIONS OF THE BINDER AND OF THE MINERAL SURFACE. HISTORICAL REVIEWS ARE PRESENTED ON STUDIES OF THE ADHESION PHENOMENA AND TESTS FOR DETERMINING ADHESIVENESS. WITH THE GRADUAL RECOGNITION OF THE FACTORS DETERMINING THE ADHESION OF BITUMINOUS FILMS TO MINERAL MATERIALS, ATTEMPTS FOR THE IMPROVEMENT OF THE BITUMINOUS BINDERS HAVE ADVANCED WITH THOSE FOR THE IMPROVEMENT OF THE SURFACE PROPERTIES OF THE AGGREGATES. THE SURVEY INDICATES THAT ENOUGH SCIENTIFIC AND PRACTICAL DATA HAVE BEEN ACCUMULATED TO ENABLE THE ENGINEER TO DESIGN GOOD PAVEMENTS WITH THE BITUMINOUS BINDERS.

Winterkorn, HF

Montana State Highway Commission Sept. 1937

2A 211000

PROPERTIES OF ASPHALTIC BITUMEN IN RELATION TO ITS USE IN ROAD CONSTRUCTION

THE PRINCIPAL PROPERTIES OF BITUMEN OF INTEREST TO THE ROADMAKER ARE ITS RHEOLOGICAL CHARACTERISTICS, ADHESIVE PROPERTIES, AND DURABILITY. THE TWO PROPERTIES OF BITUMINOUS ROAD SURFACINGS THAT ARE AFFECTED BY THE RHEOLOGICAL PROPERTIES OF THE BITUMEN BINDER ARE THE TENDENCY TO DEFORMATION OR FLOW, PARTICULARLY UNDER HEAVY TRAFFIC AT HIGH ROAD TEMPERATURES, AND THE POSSIBILITY OF FRACTURE AT LOW TEMPERATURES. BITUMEN MACADAM IS NOT GENERALLY LIABLE TO DEFORMATION BECAUSE, WHEN WELL COMPACTED, THE INTERNAL FRICTION DUE TO STONE-TO-STONE CONTACT IS ADEQUATE FOR RESISTING MOST TRAFFIC STRESSES. WITH DENSE MIXTURES, HOWEVER, INTERNAL FRICTION IS REDUCED AND SO THE PREPARATION OF A DURABLE DENSE SURFACING MATERIAL GIVES RISE TO THE RISK OF DEFORMATION. DEFORMATION OF A DENSE ASPHALT DEPENDS TO A CONSIDERABLE DEGREE ON THE AMOUNT AND VISCOSITY OF BITUMEN IN THE MIXTURE. THE HIGH TEMPERATURE COEFFICIENT OF VISCOSITY OF BITUMINOUS BINDERS EXPLAINS WHY DEFORMATION CAN BE A SERIOUS PROBLEM AT HIGH ROAD TEMPERATURES. FRACTURE OF AN ASPHALT ALSO DEPENDS TO A MAJOR DEGREE ON THE VISCOSITY OF THE BITUMEN USED. WHEN A BITUMINOUS BINDER IS SUBJECTED TO A CONSTANT TENSILE STRESS, DEFORMATION TAKES PLACE, THE STRAIN INCREASING WITH TIME, BUT NOT NECESSARILY AT A UNIFORM RATE. THE STIFFNESS OF THE BINDER IS DEFINED BY VAN DER POEL AS THE RATIO BETWEEN THE TENSILE STRESS AND THE

TOTAL AMOUNT OF STRAIN WHICH OCCURS. THIS RATIO DEPENDS ON THE TIME FOR WHICH THE STRESS ACTS BECAUSE STIFFNESS IS A DECREASING FUNCTION OF TIME. WHEN STIFFNESS IS PLOTTED AS A FUNCTION OF TIME, DIFFERENCES IN HARDNESS OR IN TEMPERATURE RESULT FOR BITUMENS OF THE SAME SHAPE, DISPLACED IN A DIRECTION PARALLEL TO TIME-AXIS IN CONFORMITY WITH A GIVEN RELATIONSHIP. WHEN BITUMEN IS USED IN A DENSE MIXTURE, THE STIFFNESS OF THE MIXTURE IS DEPENDENT ONLY ON THE STIFFNESS OF THE BITUMEN AND ITS VOLUME CONCENTRATION. IT IS INDEPENDENT OF THE GRADING OF THE AGGREGATE. RUPTURE IN AN ASPHALT IS OF TWO DISTINCT TYPES: A BRITTLE FRACTURE UNDER HIGH RATES OF STRAIN AT LOW ROAD TEMPERATURES, OR A DILATANT FRACTURE UNDER LOW RATES OF STRAIN, USUALLY AT HIGHER ROAD TEMPERATURES. THE ADHESION ATTRIBUTES OF BITUMEN ARE DISCUSSED. PREPARATION, TREATMENT AND TESTS OF BITUMEN AS A SURFACE DRESSING ARE DESCRIBED.

Lee, AR Nicholas, JH

Civil and Structural Engineers Review 1958

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 211009

A LABORATORY-FIELD STUDY OF HOT ASPHALTIC CONCRETE WEARING COURSE MIXTURES

RESULTS OF A LABORATORY-FIELD STUDY OF PROPERTIES AND PERFORMANCE OF ASPHALTIC CONCRETE PAVEMENTS, RANGING IN AGE FROM 3 TO 12 YEARS, FROM SIX TEST SECTIONS OF MARYLAND ROAD CONSTRUCTION PROJECTS ARE DESCRIBED. THE LOS ANGELES ABRASION WEAR LOSS FOR THE COARSE AGGREGATES USED IN THE TEST SECTIONS RANGED FROM 17 TO 39 PERCENT. COMPACTION FROM CONSTRUCTION AND TRAFFIC BOTH APPEARED TO HAVE CAUSED MINOR DEGRADATION OF THE AGGREGATES. THE DEGREE OF DEGRADATION WAS INSIGNIFICANT IN MOST INSTANCES AND IN NO CASE WAS SUFFICIENT TO AFFECT SERVICE BEHAVIOR OF THE PAVEMENTS. AIR VOIDS IN PAVEMENT FOLLOWING CONSTRUCTION COMPACTION RANGED FROM 5.6 TO 14.5 PERCENT. TRAFFIC COMPACTION PRODUCED APPRECIABLE REDUCTIONS IN PERCENTAGE OF AIR VOIDS. PAVEMENT PERFORMANCE AND RATE OF ASPHALT HARDENING WERE RELATED TO THE AMOUNT OF AIR VOIDS. A HIGH PERCENTAGE OF AIR VOIDS RESULTED IN EARLY DETERIORATION OF THE PAVEMENT. THE RESULTS OF THE STUDY TEND TO CONFIRM THAT THE 6 PERCENT AIR VOID CRITERION OF THE BUREAU OF PUBLIC ROADS MIX DESIGN PROCEDURE IS SATISFACTORY.

Goode, JF Owings, EP *Public Roads, Us Bureau Public Roads* DEC61

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 211016

DURABILITY OF BITUMINOUS MATERIALS

THESE REFERENCE ON THE DURABILITY OF BITUMINOUS MATERIALS INCLUDE SELECTIONS ON THEIR WEATHERING AND AGING, LABORATORY TESTS FOR DURABILITY, DURABILITY OF ROAD BINDERS, TAR SURFACINGS, AND ROAD ASPHALTS, ACCELERATED WEATHERING TEST, FACTORS AFFECTING THE WEATHER RESISTANCE OF ASPHALT COATINGS, RECOVERY AND EXAMINATION OF ASPHALT IN PAVING MIXTURES, STUDIES OF LIQUID ASPHALTIC MATERIALS OF THE SLOW-CURING TYPE, CORRELATION OF LOW TEMPERATURE TESTS WITH RESISTANCE TO CRACKING OF SHEET ASPHALT PAVEMENTS, OXIDATION OF ASPHALT AND ITS CONSTITUENTS, ROAD ASPHALT HARDENING, EFFECT OF ULTRA-VIOLET LIGHT ON VISCOSITY OF THIN FILMS OF ASPHALT CEMENTS, CURING RATE TEST FOR CUTBACK ASPHALTS, QUALITY OF ASPHALTIC ROAD MATERIALS, EFFECT OF FILLERS ON DURABILITY OF ASPHALT, FACTORS RELATING CHEMISTRY COMPOSITION AND RHEOLOGICAL PROPER-

TIES OF PAVING ASPHALTS WITH DURABILITY, AND PROPERTIES OF ASPHALTIC BITUMEN IN RELATION TO ITS USE IN ROAD CONSTRUCTION.

Highway Research Information Service Sept. 1970

**2A 211018
MODIFIED ASPHALTS**

THREE REFERENCES ON MODIFIED ASPHALTS INCLUDE SELECTIONS ON THE EFFECT OF SYNTHETIC ELASTOMERS AND OF RUBBER ON THE PROPERTIES OF PETROLEUM ASPHALTS, STUDIES OF RUBBER-ASPHALT PAVING MIXTURES, HEAT RESISTANT PROPERTIES OF ADDITIVES FOR BITUMINOUS MATERIALS, MODIFICATION OF ASPHALT WITH NEOPRENE, ANTI-STRIPPING ADDITIVES FOR HOT BITUMINOUS MIXES, AND DESIGN AND CONSTRUCTION OF EPOXY ASPHALT CONCRETE PAVEMENTS.

Highway Research Information Service Sept. 1970

**2A 211023
BASIC FACTS ON ROAD BINDERS AND VARIOUS TYPES OF BITUMINOUS MIXTURE. APPLICATION OF GEOTECHNICS TO ROAD CONSTRUCTION /IN FRENCH/**

BASIC FACTS ON ROAD BINDERS AND BITUMINOUS MIXTURES AND THE APPLICATION OF GEOTECHNICS TO ROAD CONSTRUCTION ARE DISCUSSED. DETAILS ARE GIVEN ON THE DETERMINATION OF THE THICKNESS OF FLEXIBLE PAVEMENTS, MOISTURE CONTENT IN SOILS AND THE ROAD STRUCTURE, AND SOIL PERMEABILITY AND CAPILLARITY. VISCOSITY AND WATER VAPOR TENSION ARE DEFINED, THE BASIC CHARACTERISTICS OF WATER ARE RECALLED, AND SOIL STABILITY AND COHESION ARE DISCUSSED. /LCPC/RRL/AUTHOR/

Duriez, M *Monit Trav Publics Batiment /France/* May 1967

ACKNOWLEDGMENT: Road Research Laboratory /UK/

**2A 211061
WIDERA-CONCRETE FOR THE RECONSTRUCTION AND REPAIR OF ROAD SURFACES, PARTICULARLY IN BUILT-UP AREAS /IN GERMAN/**

IN ORDER TO RECONSTRUCT OR REPAIR WORN BITUMINOUS ROAD SURFACES IN BUILT-UP AREAS, BUT STILL RETAIN THE SUBSTANCE PRESENT, TEERBAU G.M.B.H. DEVELOPED WIDERA CONCRETE WHICH, OWING TO ITS MINERAL MIXTURE BEING COMPOSED OF A MAXIMUM GRAIN SIZE OF 2, 3 OR 5 MM, AND TO A CAREFUL DETERMINATION OF THE EFFECT OF THE ADHESION PROPERTIES OF A SPECIAL BINDER ON THE ADHESIVENESS AND ROUGHNESS OF THE CHIPPINGS, RENDERS POSSIBLE THE CONSTRUCTION OF DURABLE THIN COATINGS WEIGHING ONLY 25-40 KG PER SQUARE METER. THEREFORE THE HEIGHT OF THE EXISTING CURBS, GUTTERS AND DRAINS DOES NOT HAVE TO BE ALTERED. ONLY SHARP-EDGED, HARD STONES ARE USED, DURING THE CHOICE OF WHICH ATTENTION MUST BE PAID TO A GOOD ADHESION BETWEEN THE BINDER AND MINERAL, AS OTHERWISE THIS TYPE OF SHARP-EDGED STONE IS EASILY TORN OUT OF THE SURFACING. TO PROVE THE SUITABILITY OF THE NEW ROAD CONSTRUCTION MATERIAL DETAILED EXAMPLES ARE QUOTED IN THE ARTICLE FROM WHICH THE PRACTICABILITY OF THE WIDERA CONCRETE CAN BE SEEN. /FG/RRL/

Steffen, H *Marscholek, Veroffent Strassenbau, Essen /Ger/* 1967

ACKNOWLEDGMENT: Road Research Laboratory /UK/

**2A 211063
THE USE OF CATION-ACTIVE PRODUCTS IN ROAD CONSTRUCTION /IN GERMAN/**

THE USE OF AMINES AS ANTI-STRIPPING AGENTS WAS INTRODUCED IN CUT-BACK BITUMEN, HOT BITUMEN FOR MIXTURES, BINDERS FOR OIL-GRAVEL ROADS (SCANDINAVIA)

AND IN PRETREATMENT OF ROADS FOR SURFACE DRESSINGS. THE PROPERTIES, CONTROL AND USE OF CATIONIC BITUMEN EMULSIONS AND BITUMINOUS SLURRIES ARE DESCRIBED. THE PREPARATION AND THE PLACEMENT OF THE SLURRIES IS EXPLAINED IN DETAIL. AFTER 15 MINUTES THE SLURRY CAN BE SUBJECTED TO CAREFUL USE BY TRAFFIC, AND AFTER 30 MINUTES, AT THE MOST, IT CAN BE SUBJECTED TO UNLIMITED USE. /FG/RRL

Von, SCHOTT T
Road Research Society /Germany/, Asphalt Und Teerstrassen, Vortrag /Ger/ Nov. 1966

ACKNOWLEDGMENT: Road Research Laboratory /UK/

**2A 211065
THE WEARING RESISTANCE OF ASPHALT SURFACINGS (IN GERMAN)**

THE FACTORS RESPONSIBLE FOR THE EXCESSIVE WEAR OF BITUMINOUS SURFACINGS (I.E. CONSTRUCTION MATERIALS, MIX COMPOSITION, PLACEMENT AND COMPACTION, AND STRESS BY WEATHERING AND TRAFFIC) ARE EXAMINED IN DETAIL. LABORATORY SIMULATION METHODS ARE CRITICALLY CONSIDERED, AND IT IS ESTABLISHED THAT AS YET NO METHOD IS SUITABLE FOR NUMERICALLY DETERMINING THE WEARING STRENGTH OF MIXTURES USED IN PRACTICE. /TRRL/

Schmidt, H *Bitumen /Germany/* 1968

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

**2A 211089
ON ROAD SURFACES ON AUXILIARY BRIDGES /IN GERMAN/**
SINCE TEMPORARY BRIDGES FOR MAINTENANCE OF TRAFFIC WOULD ONLY BE USED FOR HEAVILY USED ROAD STRETCHES, THE SURFACES MUST BE SUITABLE FOR HEAVY TRAFFIC, BUT NEED ONLY HAVE A SERVICE LIFE OF ONE TO TWO YEARS. THEY SHOULD BE FAIRLY FLEXIBLE OWING TO THE MOVABILITY OF CONSTRUCTIONAL COMPONENTS. FROM 1958 TO 1964, DETAILED OBSERVATIONS WERE MADE IN HAMBURG ON SURFACES ON AUXILIARY BRIDGES. THE ORIGINALLY USED THIN SURFACE WITH A MASTIC LAYER OF 1-CM THICKNESS PROVED UNSATISFACTORY, AS ALSO A SURFACE OF SEVERAL LAYERS OF ASPHALT MASTIC. SINCE A SURFACE OF HEATED BITUMINOUS SAND AND GRAVEL APPLIED IN TWO LAYERS TO A DEPTH OF 12-CM ALSO SHOWED SURFACE DEFECTS AFTER A SHORT TIME, IT WAS DECIDED IN 1964 TO CHANGE OVER TO SURFACES OF ASPHALTIC CONCRETE OF 5-CM THICKNESS WITH BINDING LAYERS FIRST IN FOUR-AND THEN IN TWO-LAYER-CONSTRUCTION, FOR THE ROAD FORMATION OF AUXILIARY BRIDGES ERECTED FOR A VERY LARGE BUILDING SITE, AS FOLLOWS: 100 KG/M OF BITUMINOUS CARPETING 8/18, AND 30 KG/M ASPHALTIC CONCRETE 0/5. FINALLY THE RECOMMENDATION IS MADE TO USE WARM-WORKING MIX MATERIALS, SINCE HOT-WORKING MATERIALS ARE REGARDED AS TOO BRITTLE. FG/RRL/

Ascher, G *Bitumen /Germany/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

**2A 211116
THE WETTING OF MINERAL MATERIALS WITH BITUMEN /IN RUSSIAN/**

TESTS DO NOT CONFIRM THE CLASSIFICATION OF ROAD CONSTRUCTION MATERIALS INTO HYDROPHOBIC AND HYDROPHILIC MATERIALS, OR THE GENERAL OPINION THAT HYDROPHOBIC MATERIALS ARE MORE SUITED TO WETTING BITUMEN THAN HYDROPHILIC MATERIALS. TESTS SHOW THAT A DIFFERENCE IN MINERALOGICAL COMPOSITION, VALUES OF SURFACE ENERGY AND HYDROPHILIC PROPERTIES OF ROCKS SUBJECTED TO TESTS, HAVE NO DECISIVE INFLUENCE ON THE RATE OF WETTING BY BITUMEN. /LCPC/RRL/

Gornaev, NA Kalashnikov, VP *Avtomobil Nye Dorogi /Ussr/* May 1968

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 211120

TECHNOLOGICAL PREPARATION OF HIGHWAY ASPHALTS FROM PETROLEUMS OF VARIOUS GROUPS /IN RUSSIAN/
ALL U.S.S.R. CRUDES HAVE A VERY LOW RATIO OF ASPHALTENES (A) TO RESINS (R) (A/R LESS THAN 0.4) WHICH REMAINS ALMOST UNCHANGED ON DISTRIBUTION OF DEASPHALTIZATION. FOR THIS REASON THE RESIDUE HAS TO BE CONCENTRATED TO A HIGH DEGREE TO OBTAIN AN ASPHALT (TO BE USED FOR ROAD BUILDING) WITH THE REQUIRED SOFTENING POINT. AS A RESULT THE ASPHALT HAS A LOW FROST RESISTANCE. A/R RATIO CAN BE INCREASED BY OXIDATION OF ASPHALTS WITH AIR AT HIGH TEMPERATURES. DURING OXIDATION THE OIL CONTENT (O) DROPS ABRUPTLY, WHILE THE RESIN CONTENT DOES NOT CHANGE GREATLY. TO PRODUCE OXIDIZED ASPHALT FROM CRUDES OF GROUP I, A STRAIGHT-RUN DISTRIBUTION RESIDUAL TAR FRACTION WITH A HIGH OIL CONTENT CAN BE USED, SO THAT THE REDUCTION OF THE OIL CONTENT IN OXIDATION IS COMPENSATED. TYPICAL TAR FRACTIONS OF THIS TYPE, OBTAINED BY CONCENTRATION OF THE CRUDES TO 50-60%, HAD THE FOLLOWING CHARACTERISTICS: A 4-7, R 30-33%; A/R LESS THAN 0.2, (A R) / O = 0.62. TO ASPHALTS OBTAINED BY OXIDATION OF THESE FRACTIONS, SURFACE-ACTIVE COMPOUNDS WERE ADDED TO INCREASE ADHESION TO INORGANIC MATERIALS USED IN ROAD BUILDING. THE COHESION WAS IMPROVED BY ADDING DISTRIBUTION RESIDUES FROM SYNTHETIC FATTY ACIDS PRODUCTION. THE FROST RESISTANCE OF THE RESULTING ASPHALTS (A/R = 0.5-0.8, (A R) O = 0.84-0.92) WAS GOOD BECAUSE OF THE HIGH OIL CONTENT (O = 46-53%). ASPHALTS FROM CRUDES OF GROUP II ARE BEST PRODUCED BY COMBINED OXIDATION AND COMPOUNDING. A HEAVY PRODUCT WITH A HIGH RESIN CONTENT (E.G. R = 39%) IS OXIDIZED TO THE DESIRED VALUE OF A/R AND THEN DILUTED WITH A LIGHT PRODUCT HAVING A HIGH OIL CONTENT. /LCPC(A)/RRL/

Akmetova, RS Fryazinov, VV
Nauch-issled Inst Pererab Nefti 1968

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 211131

GUSSASPHALT AND ASPHALTIC CONCRETE IN URBAN ROAD CONSTRUCTION /IN GERMAN/
THE EXTENT IS COMPARED TO WHICH THE PROPERTIES OF GUSSASPHALT AND ASPHALTIC CONCRETE SURFACINGS MEET THE REQUIREMENTS OF PRESENT-DAY AND ESTIMATED FUTURE TRAFFIC IN TOWNS AND BUILT-UP AREAS. IT IS CONCLUDED THAT GUSSASPHALT, DESPITE ITS PRONOUNCED PLASTIC BEHAVIOR UNDER PARKED VEHICLES AND THE DIFFICULTIES IN LIGHTENING ITS SURFACE, IS THE BETTER SURFACING MATERIAL BECAUSE OF ITS GREATER DURABILITY, ITS EASE OF APPLICATION IN ALL WEATHERS, ITS ABILITY TO BE REPAIRED PERFECTLY, AND ITS HIGH RESISTANCE TO THE EFFECT OF STEEL STUDDED TIRES. /FG/RRL/

Schmidt, HE *Bitumen, Teere, Asphalte, Peche /Ger/* Sept. 1968

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 211140

THE USE OF INFRA-RED SPECTRA IN THE ASSESSMENT OF BITUMEN DURABILITY
INFRA-RED ABSORPTION SPECTROSCOPY PROVIDES A VERY SIMPLE, RAPID, AND NONDESTRUCTIVE METHOD OF EXAMINING BITUMENS. THIS PAPER DISCUSSES EXPERIMENTAL TECHNIQUES AND PRESENTS SPECTRA FOR BITUMENS PRODUCED IN AUSTRALIA, INCLUDING THE SAME TYPES AS USED IN ROAD CONSTRUCTION BUT SOMEWHAT HARDER. CHEMICAL FUNCTIONAL GROUPS ATTRIBUTED TO ABSORPTION

BANDS ARE CONSIDERED, AND AN INVESTIGATION OF THE APPLICATION OF THE TECHNIQUE TO THE STUDY OF BOTH DARK AND PHOTO-OXIDATION OF BITUMENS IS REPORTED. COMPARISONS BETWEEN SPECTROPHOTOMETER AND MICROVISCOMETER ASSESSMENTS OF OXIDATION RATES ARE ALSO INCLUDED. /RRL/A/

Martin, KG *Australian Road Research Board Proc* 1966

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 211145

SEVENTH WORLD PETROLEUM CONGRESS VOLUME 8-APPLICATIONS AND NEW USES, PART 2
THIS VOLUME CONTAINS PAPERS PRESENTED AT THE CONFERENCE UNDER THE FOLLOWING GENERAL HEADINGS: CONTRIBUTION OF ADDITIVES TO THE PERFORMANCE OF PETROLEUM PRODUCTS; PROBLEMS RELATED TO THE USE OF HYDROCARBONS AT LOW TEMPERATURES; PETROLEUM AND MICROBIOLOGY (SPECIAL REFERENCE TO THE EDIBLE MATERIALS); NEW CONTRIBUTIONS OF PETROLEUM TO AGRICULTURE; NEW USES OF PETROLEUM PRODUCTS IN CIVIL ENGINEERING AND BUILDING (CONSTRUCTION); PETROLEUM WAX-NEW DEVELOPMENTS AND APPLICATIONS; AND PROPERTIES, APPLICATIONS AND PERFORMANCE OF ASPHALT AND ASPHALT EMULSIONS. /RRL/

Elsevier Publishing Company 1967

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 211149

SPECIFICATIONS PROPERTIES AND PERFORMANCE OF ASPHALTIC MATERIALS IN THE UNITED STATES
THE REQUIREMENTS OF TWO SPECIFICATIONS FOR THE USE OF ASPHALTIC MATERIALS IN ROAD CONSTRUCTION ARE COMPARED, AND DATA ON ASPHALTIC CEMENTS PRODUCED IN THE U.S. ARE SUMMARIZED. THE PROPERTIES MEASURED BY FUNDAMENTAL TESTS VARY APPRECIABLY IN THE LOW TEMPERATURE RANGE. CONTINUED RESEARCH IS RECOMMENDED TO DEVELOP KNOWLEDGE RELATING FUNDAMENTAL PROPERTIES OF ASPHALT TO THE FUNDAMENTAL PROPERTIES OF ASPHALT-AGGREGATE SYSTEMS, AND TO PAVEMENT PERFORMANCE. TESTS SELECTED FOR A RATIONAL SPECIFICATION FOR ASPHALT SHOULD BE RELIABLE, SIMPLE AND RAPID. REQUIREMENTS SHOULD RECOGNIZE VARIABILITY DUE TO MANUFACTURING, SAMPLING AND TESTING, BUT SHOULD CONTROL THE PROPERTIES THAT ARE CRITICAL TO OPTIMUM PAVEMENT PERFORMANCE. /RRL/

Welborn, JY
World Petroleum Congress Proc 1967

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 211150

DEEP-TEXTURE CARPETS IN ROAD CONSTRUCTION
PRESENTED FOR DISCUSSION AT A MEETING OF THE MIDLANDS BRANCH OF THE INSTITUTE OF QUARRYING IN NOVEMBER 1967, THE PAPER EXAMINES THE ROAD SURFACE REQUIREMENTS NECESSARY TO ACHIEVE ADEQUATE SKID RESISTANCE AND DESCRIBES THE VARIOUS MATERIALS WHICH CAN BE USED TO OBTAIN THE NECESSARY TEXTURE DEPTH. /RRL/

Morris, D *Quarry Managers Journal /UK/* Feb. 1968

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 211156

BITUMINOUS ROAD CONSTRUCTION: DEVELOPMENT AND RESEARCH IN GERMAN SPECIALIST LITERATURE 1925-1940 /IN GERMAN/
THE DOCUMENTATION IS ARRANGED ANNUALLY, AND INCLUDES LITERATURE ON MINERALS, BITUMINOUS BINDES, ASPHALT ROAD CONSTRUCTION, TAR ROAD CONSTRUCTION

AND THE CONSTRUCTION OF SUBGRADE AND SUBSOIL FOR BITUMINOUS ROADS. /FG/RRL/

Skopnik, A
Forschungsarbeit Aus Strwesen /Ger/ 1968

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 211168
USE OF ASBESTOS IN BITUMINOUS ROAD CONSTRUCTION
/IN GERMAN/

DETAILS ARE GIVEN OF RESEARCH PROJECTS INTO THE INFLUENCE OF ASBESTOS ADMIXTURES ON BITUMINOUS ROAD CONSTRUCTION A COMPARATIVE STUDY IS BEING MADE OF GUSSASPHALT AND FINE ASPHALTIC CONCRETE SURFACINGS CONTAINING VARYING PROPORTIONS OF ASBESTOS, BUT OTHERWISE HAVING SIMILAR STRUCTURE. THESE SURFACINGS WERE LAID IN CONGESTED AREAS AREAS AND AT BUS STOPS. MEASUREMENTS ARE CURRENTLY BEING CARRIED OUT. /FG/RRL/

Klotz, E *Strassen Und Tiefbau* /Germany/ Feb. 1969

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 211174
QUALITY CONTROL IN CONSTRUCTION METHODS
INVOLVING USE OF BITUMEN /IN GERMAN/

THE CAUSES OF UNAVOIDABLE FLUCTUATIONS IN THE QUALITY OF BITUMINOUS MIXTURES AND THE PAVEMENTS CONSTRUCTED WITH THEM ARE OUTLINED. THE USE OF QUALITY CONTROL TO PINPOINT THE EXTENT OF FLUCTUATIONS AND TO ENABLE THE NECESSARY CORRECTIVE MEASURES TO BE CARRIED OUT IS ALSO DISCUSSED. /FG/RRL/

Wester, K *Strassen Und Tiefbau* /Germany/ 1969

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 211221
THE CONSTRUCTION OF ROADS WITH ROUGH SURFACINGS
AND MAINTENANCE TREATMENT FOR RESTORING THE
ROUGH TEXTURE OF SURFACINGS /IN RUSSIAN/

DATA COLLECTED IN THE USSR, CZECHOSLOVAKIA AND POLAND ON ROUGH SURFACING CONSTRUCTION ARE PRESENTED. THREE CONSTRUCTION METHODS ARE DESCRIBED: (1) SPECIAL GRANULAR FORMULAS FOR ASPHALTIC CONCRETE, (2) SURFACE DRESSINGS, AND (3) SPRINKLING OF PRECOATED CHIPPINGS ON ASPHALTIC CONCRETE WITH A HIGH MORTAR CONTENT DURING COMPACTION. OTHER METHODS ARE BRIEFLY LISTED, AND THE SPECIFICATIONS FOR INGREDIENTS AND MIXTURES ARE GIVEN. ATTENTION IS DRAWN TO THE SPECIFIC TECHNOLOGICAL ASPECTS OF THE SPREADING AND COMPACTION OF THE MIXTURES. /LCPC/RRL/

Gorelyshev, NV
Soyuzdornii /Ussr/ 1967

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 211226
STUDY OF BITUMEN AND BITUMINOUS MIXTURES.
RESEARCH CARRIED OUT BY THE SOYUZDORNII, THE
FEDERAL INSTITUTE FOR ROAD RESEARCH AND STUDIES
IN THE USSR /IN RUSSIAN/

THIS COLLECTION OF ARTICLES DEALS WITH THE INFLUENCE OF THE STRUCTURE OF BITUMEN, BITUMINOUS MIXTURES, AND ASPHALTIC CONCRETE ON THE IMPROVEMENT IN THE MECHANICAL PROPERTIES AND DURABILITY OF ROAD SURFACINGS. CONTENTS: STUDY OF THE FORMATION OF THE LIQUID ASPHALTS AND BITUMINOUS MIXTURES. INFLUENCE OF SURFACE-ACTIVE AGENTS ON THE STRUCTURE OF ROAD BITUMENS. INFLUENCE OF THE NATURE OF BITUMEN AND AGGREGATES ON ADHESION. REMARKS ON THE IMPROVEMENT IN AND CONTROL OF THE BEHAVIOR OF

ASPHALTIC CONCRETE AND BITUMINOUS MIXTURES DURING APPLICATION. COATED CHIPPINGS FOR ROAD CONSTRUCTION UNDER UNFAVORABLE CLIMATIC CONDITIONS. CONSTRUCTION OF WARM-COATED SURFACINGS IN WESTERN SIBERIA. POSSIBILITIES OF INCREASING THE DEFORMABILITY OF ASPHALTIC CONCRETE AT TEMPERATURES BELOW FREEZING POINT. RHEOLOGICAL PROPERTIES OF ASPHALTIC CONCRETE AT TEMPERATURES BELOW FREEZING POINT. IMPERMEABILITY OF ASPHALTIC CONCRETE. DETERMINATION OF THE STRENGTH OF ASPHALTIC CONCRETE TAKING PLASTICITY AND SERVICE CONDITIONS OF THE SURFACING INTO ACCOUNT. SHEARING STRENGTH OF ASPHALTIC CONCRETE. RELATION BETWEEN STRESSES AND DEFORMATION OF ASPHALTIC CONCRETE DURING SHEAR. USE OF RESINS AS A SOLVENT FOR PETROLEUM BITUMEN. INFLUENCE OF THE DENSITY OF ASPHALTIC CONCRETE ON THE VELOCITY AND DAMPING OF ULTRASONIC WAVES. /LCPC/RRL/

Trudy Soyuzdornii /Ussr/ 1967

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 211300
THE PRACTICAL SAMPLING OF BITUMINOUS MIXTURES
THE REQUIREMENTS OF CONSTRUCTION MATERIALS VARY GREATLY DEPENDING ON THE PURPOSE FOR WHICH THEY ARE USED. SLIGHT CHANGES IN THE MIX DESIGN CAUSES CONSIDERABLE CHANGES IN THE RESULTS OF TESTS. THE REGULATIONS FOR THE TAKING OF SAMPLES SHOULD BE CAREFULLY OBSERVED IN ORDER TO OBTAIN RELIABLE TEST RESULTS. THE TOLERANCES AT THE MIXING STAGE AND ERRORS IN LABORATORY TESTING DO NOT INFLUENCE THE TEST RESULT TO THE SAME EXTENT AS ERRORS MADE DURING THE TAKING OF SAMPLES. /TRRL/

Eichhorn, W
Das Stationare Mischwerk /Germany/ No. 1, 1970, pp 12-6

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

2A 211371
FLOW BEHAVIOR OF ASPHALT CEMENTS
THE FUNDAMENTAL MECHANICAL PROPERTIES OF FLEXIBLE PAVEMENT MATERIALS WERE STUDIED BY CREEP TESTING OF 13 ASPHALT CEMENTS IN A ROTATING COAXIAL CYLINDER VISCOMETER. THESE ASPHALT CEMENTS WERE SELECTED TO REPRESENT A VARIETY OF CRUDE SOURCES, PENETRATION GRADES, AND MANUFACTURING PROCESSES. THE ROTATING COAXIAL CYLINDER VISCOMETER ENABLED THE ACCUMULATION OF DATA FOR A WIDE RANGE OF TEMPERATURE AND STRESS LEVELS AND LOADING TIMES WHICH EXTENDED INTO THE EQUILIBRIUM OR STEADY-STATE FLOW REGIME. THE CURVE-FITTING TECHNIQUE FOR EVALUATING THE PARAMETERS OF VISCOELASTIC BEHAVIOR PROVED TO BE EXTREMELY USEFUL AND RELIABLE. ALL OF THE ASPHALT CEMENTS EXHIBITED STEADY-STATE FLOW BEHAVIOR AT 77 AND 104 F. THE STEADY-STATE FLOW BEHAVIOR OF EACH OF THE ASPHALT CEMENTS IN THE LOW TEMPERATURE RANGE WAS FOUND TO BE SIMILAR TO THAT OF A BINGHAM PLASTIC. ALL OF THE ASPHALTS APPEARED TO BEHAVE LINEARLY UNDER THE CONDITIONS OF TESTS EMPLOYED. THE TIME-TEMPERATURE SUPERPOSITION PRINCIPLE APPEARS TO BE APPLICABLE TO THE BEHAVIOR OF NORMAL ASPHALT CEMENTS AT LEAST IN THE LOW-TEMPERATURE RANGE (0 F TO 104 F). A RELATIONSHIP EXISTS BETWEEN PLASTIC VISCOSITY EVALUATED WITH THE ROTATING COAXIAL CYLINDER VISCOMETER AND THE RESULTS OF STANDARD PENETRATION TESTS WHEN BOTH TYPES OF TESTS ARE CONDUCTED AT IDENTICAL TEMPERATURES. THE EFFECT OF PENETRATION GRADE WAS EVALUATED USING THE THREE ASPHALTS OBTAINED BY VACUUM AND STEAM DISTILLATION FROM VENEQUELAN CRUDE. THE EFFECT OF CRUDE SOURCE FOR MATERIALS OF THE SAME PENETRATION GRADE IS DIFFICULT TO EVALUATE. TEMPER-

ATURE SUSCEPTIBILITIES SHOW NEED FOR SPECIFYING THE CONSISTENCY OF ASPHALT CEMENTS AT MORE THAN ONE TEMPERATURE LEVEL.

Mossbarger, WA Deacon, JA
Kentucky Department Highways May 1967

2A 211373

REPORT ON DESIGNATION FOR SURFACE TREATMENTS

ALL TYPES OF SURFACE APPLICATIONS OF BITUMINOUS MATERIALS HAVE BEEN INCLUDED IN THE REPORT ON BITUMINOUS SURFACE TREATMENTS SINCE IT WAS POINTED OUT THAT THE SAME PROCEDURES ARE CALLED BY DIFFERENT NAMES IN DIFFERENT AREAS. THESE DIFFERENCES IN TERMINOLOGY MAKE IT DIFFICULT TO COMPARE PRACTICES, TECHNIQUES, BITUMINOUS MATERIALS, AND AGGREGATES USED BY VARIOUS STATES AND AGENCIES. THEREFORE, QUESTIONNAIRES WERE SENT TO EACH HIGHWAY DEPARTMENT DOING SURFACE TREATMENT WORK TO OBTAIN THE NOMENCLATURE AND DESCRIPTION OF THE PARTICULAR TYPE USED. FROM THE EXCELLENT RESPONSES A SYSTEM FOR IDENTIFYING SURFACE TREATMENTS WAS DEVELOPED IN WHICH TYPE OF TREATMENT, METHOD OF CONSTRUCTION, AND NOMINAL THICKNESS WERE CODED. IN THIS WAY, ANY SURFACE TREATMENT CAN BE IDENTIFIED WITHOUT HAVING TO DECIPHER LOCAL TERMINOLOGY.

Highway Res Circular, Hwy Res Board Feb. 1968

2A 211418

TEMPERATURE-VISCOSITY RELATION OF ASPHALTS USED IN THE UNITED STATES

VISCOSITY DATA ARE PRESENTED ON ASPHALT CEMENTS PRODUCED IN THE UNITED STATES FOR USE IN HIGHWAY CONSTRUCTION. ALL PROPERTIES WERE STUDIED BY THE BUREAU OF PUBLIC ROADS TO PROVIDE INFORMATION ON THE PROPERTIES OF ASPHALT PRODUCED FROM VARIOUS CRUDE SOURCES AND BY METHODS OF REFINING IN CURRENT USE. STATES HAVE DIFFERENT SPECIFICATION REQUIREMENTS FOR FUROL VISCOSITY AT CERTAIN TEMPERATURES. FUROL VISCOSITY TESTS WERE MADE ON THE ASPHALTS OF THIS STUDY. THE FUROL VISCOSITY OF 119 ASPHALTS RANGES FROM 85 TO 318 SECONDS. FOUR ASPHALTS HAVE VISCOSITY VALUES LESS THAN 100 SECONDS, WHILE TWO ASPHALTS MORE THAN 300 SECONDS. VISCOSITY OF 80 ASPHALTS IS WITHIN THE RANGE OF 150 TO 250 SECONDS. IT WAS CONCLUDED THAT THE VISCOSITY VARIES GREATLY AND THIS PROPERTY SHOULD BE RECOGNIZED IN PLANT MIXING OF ASPHALTIC MIXTURES, SPREADING AND COMPACTING OF THE MIXTURES ON THE ROAD, AND APPLICATION OF ASPHALTS BY SPRAYING.

Welborn, JY *Highway Research Board Special Reports 1960*

2A 211419

EFFECTS OF ASPHALT CEMENT VISCOSITY AT MIXING TEMPERATURE ON PROPERTIES OF BITUMINOUS MIXTURES

VISCOSITY IS A FUNDAMENTAL PROPERTY OF ASPHALTIC MATERIALS WHICH SHOULD BE GIVEN THOROUGH CONSIDERATION IN ALL OF ITS CONSTRUCTION APPLICATIONS. ASPHALT IS A THERMOPLASTIC MATERIAL WHICH IS MADE FLUID BY HEATING. IT MAY ALSO BE MADE FLUID BY EMULSIFICATION WITH WATER OR BY BLENDING WITH PETROLEUM SOLVENTS. PROPER FLUIDITY IS ESSENTIAL FOR THE SUCCESSFUL USE OF ALL OF THESE ASPHALT MATERIALS. VISCOSITY MEASUREMENT BY THE SAYBOLT FUROL VISCOSITY TEST IS DESCRIBED. THE SUBSTANTIAL DIFFERENCES THAT MAY BE ENCOUNTERED IN TEMPERATURE-VISCOSITY CHARACTERISTICS OF ASPHALTS ARE DISCUSSED. FOR A GIVEN TYPE AND GRADATION OF AGGREGATE THERE IS A CORRESPONDING OPTIMUM VISCOSITY FOR MIXING. THE ASPHALT INSTITUTE PRESENTLY RECOMMENDS THAT A MIXING TEMPERATURE BE SELECTED WHICH WILL RESULT IN AN

ASPHALT VISCOSITY OF 75-100 SECONDS, SAYBOLT FUROL. A PROPER UNDERSTANDING OF VISCOSITY, KNOWLEDGE OF HOW IT VARIES WITH DIFFERENT ASPHALTS, AND APPROPRIATE USE OF THIS KNOWLEDGE WILL LEAD TO MORE UNIFORM AND HIGHER QUALITY ASPHALT CONSTRUCTION.

Griffith, JM *Highway Research Board Special Reports 1960*

2A 211445

QUALITY ASSURANCE IN HIGHWAY CONSTRUCTION: PART IV-VARIATIONS OF BITUMINOUS CONSTRUCTION

PROGRESS IS REVIEWED IN THE BUREAU OF PUBLIC ROADS RESEARCH PROGRAM FOR THE STATISTICAL APPROACH TO QUALITY ASSURANCE IN HIGHWAY CONSTRUCTION. TO DETERMINE THE QUALITY CHARACTERISTICS OF CURRENT CONSTRUCTION, MANY STATES HAVE BEEN MEASURING VARIATIONS IN ACCEPTED BITUMINOUS PRODUCTION. IT HAS BEEN FOUND THAT THE PRODUCTION OF HIGHWAY QUALITY BITUMINOUS PAVEMENT REQUIRES THE DILIGENCE OF THE PRODUCER, THE CONTRACTOR AND THE CONTRACTING AGENCY. THE STATISTICALLY MEASURED VARIATIONS OF ACCEPTED CONSTRUCTION INDICATE THAT MUCH MORE VARIABILITY EXISTS THAN IS REVEALED BY THE USUAL ACCEPTANCE TESTS. VARIATIONS IN EXCESS OF THOSE NORMALLY EXPECTED FOR GOOD PRACTICE WERE PREVALENT ON ALMOST EVERY JOB STUDIED. LARGE SAMPLING AND TESTING ERRORS VIRTUALLY PREVENT A TRUE EVALUATION OF THE MATERIAL VARIATION ON A SPECIFIC JOB. IT IS DIFFICULT TO ASSESS THE DEGREE TO WHICH VARIATIONS AFFECT ACTUAL PAVEMENT PERFORMANCE. RESEARCH RESULTS INDICATE THAT MUCH IMPROVEMENT COULD BE OBTAINED AND TESTING LOAD REDUCED BY THE FOLLOWING CHANGES: (1) ADJUST TOLERANCE LIMITS ON GRADATION TO CONFORM TO THE PRINCIPLE OF MOST TOLERANCE ON LARGEST FRACTION RETAINED ON A SIEVE, (2) CONTROL THE UNIFORMITY OF GRADATION OF THE MIXTURE BY HOT BIN SIEVE TESTS, WHEN A PRINTED RECORD OF BATCH WEIGHTS IS AVAILABLE, (3) REDUCE TO A MINIMUM THE NUMBER OF SIEVES USED FOR CONTROL TESTING, (4) EXERCISE MORE DILIGENCE IN THE TRAINING AND SURVEILLANCE OF OPERATORS PERFORMING CONTROL AND ACCEPTANCE TESTS, (5) REQUIRE INSTALLATION OF AUTOMATIC FEATURES ON ASPHALT PLANTS AND FINISHERS TO REDUCE HUMAN ERROR, AND (6) USE RANDOM SAMPLING TO OBTAIN ALL TEST PORTIONS.

Granley, EC *Public Roads, Us Bureau Public Roads AUG69*

2A 211446

NEW IDEAS IN ASPHALT ROAD CONSTRUCTION

REGINA, CANADA, HAS A TREMENDOUS SURPLUS OF SAND AND SHORTAGE OF ROCK. BECAUSE OF THIS FACT, WAYS WERE INVESTIGATED OF UTILIZING SAND AND CONSERVING ROCK. IF SANDS ARE STABILIZED WITH PORTLAND CEMENT AS IN SOIL CEMENT OR WITH ASPHALT BITUMEN IN ASPHALTIC CONCRETE, THEY CAN PERFORM A VERY USEFUL FUNCTION. ADVANTAGES OF HOT MIX ASPHALT BASE WERE REVIEWED. FROM THE POINT OF CEMENT COSTS, IT IS OBVIOUS THAT PENETRATION GRADE ASPHALT CEMENT AS USED IN HOT MIX ASPHALT BASE IS CHEAP AND HAS A DISTINCT COST ADVANTAGE IN SASKATCHEWAN. HOT MIX ASPHALT BASE CAN BE LAID IN COLDER WEATHER AND NOT BE SUBJECT TO DAMAGE. SOIL CEMENT REQUIRES TWO DAYS FROST FREE CURING AND SEVEN DAYS CURING BEFORE LOADING. SOIL CEMENT REQUIRES A SURFACE OF ASPHALT CONCRETE TO PROVIDE A WEARING SURFACE. THEREFORE, A SOIL CEMENT CONTRACT REQUIRES BOTH SOIL CEMENT EQUIPMENT AND ASPHALT EQUIPMENT, WHEREAS HOT MIX ASPHALT BASE AND SURFACE COURSE IS MADE IN THE SAME PLANT. BY PUTTING HOT MIX ASPHALT DIRECTLY ON PREPARED SUB GRADE, THE NUMBER OF OPERATIONS ARE CUT DOWN AND, THEREFORE, THE TIME EXPOSED TO ADVERSE WEATHER IS REDUCED. IT IS SUGGESTED THAT THE DESIGN OF BASE AND CURBS BE MODIFIED TO ALLOW THE FOLLOW-

ING SEQUENCE: (1) EXCAVATION, (2) SUB GRADE PREPARATION AND COMPACTION, (3) LAYDOWN FIRST LIFT OF HOT MIX ASPHALT BASE ON CLAY SUB GRADE SO THAT IT EXTENDS UNDER THE AREA THAT THE CURB SITS ON, (4) CONSTRUCT CURB AND GUTTER ON TOP OF FIRST LIFT OF ASPHALT BASE, AND (5) FINISH FINAL LIFT OF ASPHALT BASE COURSE. BY PLACING CURBS ON PREPARED ASPHALT BASE, EITHER SLIP FORMED MACHINES LAID CONCRETE CURBS CONSTRUCTION PROCEDURES COULD BE USED OR PRECAST CURBS COULD BE LAID, SAVING TIME NORMALLY USED IN SETTING AND MOVING FORMS AND IN FINISHING CONCRETE. IT IS SUGGESTED THAT BY FLOODING THE ASPHALT CONCRETE MIX WITH INERT GASES DURING PRODUCTION, THE HIGH RATE OF OXIDATION OF THE ASPHALT CEMENT WHICH OCCURS DURING PRODUCTION COULD BE RETARDED.

Clapson, LL *Paving Forum /Napa/* June 1969

2A 211450

AN INVESTIGATION OF THE STRENGTH PROPERTIES OF SAND-EMULSIFIED ASPHALT MIXTURES

FOUR DIFFERENT ONTARIO SANDS WERE EXAMINED UNDER THE FOLLOWING HEADINGS: (1) THE GRADING CHARACTERISTICS OF THE SANDS, (2) STRENGTH CHARACTERISTICS OF THE UNTREATED SANDS, (3) STABILITY CHARACTERISTICS OF THE SANDS WHEN MIXED WITH VARYING AMOUNTS OF EMULSIFIED ASPHALT, AND (4) THE STRENGTH CHARACTERISTICS OF THE SAND-EMULSION MIXTURES. TENTATIVE RELATIONSHIPS WERE ESTABLISHED AMONG THE GRADING CHARACTERISTICS OF THE UNTREATED SANDS, STRENGTH CHARACTERISTICS OF FRICTION, COHESION, AND UNCONFINED COMPRESSION STRENGTH OF THE SAND-EMULSION MIXES, AND THE EMPIRICAL TEST RESULTS. A METHOD OF PREDICTING THE SUITABILITY OF SANDS, WHEN MIXED WITH EMULSIFIED ASPHALT, FOR USE AS HIGHWAY BASE OR SUBBASE MATERIAL, USING ONLY THE RESULTS OF A COMPLETE SIEVE ANALYSIS, IN CONJUNCTION WITH THESE RELATIONSHIPS IS SUGGESTED. AN ABBREVIATED SERIES OF TESTS WAS PERFORMED ON TWO ADDITIONAL SANDS IN AN ATTEMPT TO PROVIDE CONFIRMATION OF THIS METHOD. THE WATER CONTROL TEST INDICATED THAT WATER CONTENT AT TIME OF TEST HAS AN EFFECT ON THE STRENGTH OF SAND-EMULSION MIXES. /AUTHOR/

Davies, JR Stewart, JA
Ontario Dept Hwys, Downsview /Canada/ June 1969

2A 211467

ASPHALT PAVING TECHNOLOGY-SOME CURRENT DEVELOPMENTS AND TRENDS

A BRIEF SUMMARY IS PRESENTED OF RESEARCH AND DEVELOPMENT TRENDS IN THE DESIGN, CONSTRUCTION AND PERFORMANCE OF ASPHALT PAVEMENTS. IMPROVEMENT EFFORTS HAVE INCLUDED ACTIVITIES RELATED TO: (1) DEVELOPMENT OF IMPROVED SPECIFICATIONS FOR ASPHALT, (2) MEASUREMENT OF THE RESPONSE CHARACTERISTICS OF ASPHALTS AND ASPHALT PAVING MIXTURES IN MORE FUNDAMENTAL TERMS, (3) ANALYSIS OF SYSTEMS REPRESENTATIVE OF ASPHALT PAVEMENT STRUCTURES WITH SOME APPLICATIONS TO DESIGN, (4) CONSTRUCTION OPERATIONS INCLUDING THICK-LIFT ASPHALT CONCRETE CONSTRUCTION, USE OF PNEUMATIC-TIRED ROLLERS, AND INCREASED MIXTURE PRODUCTION CAPABILITIES, AND (5) CONSTRUCTION CONTROL INCLUDING STATISTICAL SPECIFICATIONS AND IMPROVED CONTROL OF THE COMPACTION OPERATION THROUGH ESTABLISHMENT OF COMPACTION EFFORT BY MEANS OF SMALL TEST SECTIONS, PAVEMENT PERMEABILITY MEASUREMENTS, OR NUCLEAR MEASUREMENTS. AN EXAMPLE IS PRESENTED TO DESCRIBE THE RESULTS OF SOME OF THESE STUDIES THAT HAVE BEEN UTILIZED TO DEVELOP A PAVEMENT DESIGN FOR A CITY-COUNTY HIGHWAY IN CALIFORNIA. TRENDS ILLUSTRATED IN THE EXAMPLE ARE THESE OF FIXED SECTIONS OF ASPHALT CONCRETE, PARTICULARLY

FOR HEAVY DUTY HIGHWAYS, THE USE OF THEORY TO ASSIST IN DESIGN, IMPROVED CHARACTERIZATION OF MATERIALS TO UTILIZE THEORY AND COMPACTION PROCEDURES TO ACCOMPANY THICK-LIFT DESIGNS. ADDITIONAL TOOLS ARE PRESENTED AS SUPPLEMENTING EXISTING PROCEDURES TO EXTEND THE SCOPE OF ASPHALT PAVING TECHNOLOGY.

Monismith, CL *Civil Engineering Asce* Aug. 1969

2A 211480

ASPHALT EMULSION-VERSATILE CONSTRUCTION MATERIAL

THE EXPERIENCE OF DOUGLAS COUNTY, OREGAN, WITH OPEN GRADED COLD MIX PAVING, HAS ESTABLISHED IT AS AN ECONOMICAL AND SATISFACTORY PAVING METHOD. CONSTRUCTION METHODS AND MATERIALS ARE DESCRIBED.

Grubb, GE *Public Works* Jan. 1970

2A 211492

THE USE OF FLYASH AS FILLER IN ASPHALTIC CONCRETE PRODUCTION IN NEW SOUTH WALES

IN THE PRODUCTION OF ASPHALTIC CONCRETE FOR ROAD CONSTRUCTION, A FILLER MATERIAL IS USUALLY REQUIRED TO PROVIDE A DENSE AND STABLE MIXTURE. LIMESTONE DUST WAS GENERALLY APPLIED AS FILLER IN NEW SOUTH WALES UNTIL THE DEPARTMENT OF MAIN ROADS HAD EXPERIMENTED WITH AND SUBSEQUENTLY ADOPTED THE USE OF FLYASH, AN INDUSTRIAL WASTE, AS ITS SUBSTITUTE. THIS PAPER DESCRIBES AN INVESTIGATION CARRIED OUT AT THE DEPARTMENT'S CENTRAL TESTING LABORATORY WHICH ESTABLISHES IN PRINCIPLE THAT FLYASH MAY BE USED AS FILLER IN ASPHALTIC CONCRETE TO REPLACE THE MORE EXPENSIVE LIMESTONE DUST. HOWEVER, THE PRESENCE OF CLINKERS AND FURNACE DEBRIS IN THE FLYASH FROM PYRMONT POWER STATION POSED A DIFFICULT PROBLEM IN HANDLING OF THE MATERIAL. AFTER A SERIES OF EXPERIMENTS A DEVICE WAS DESIGNED WHICH EFFICIENTLY FILTERED OFF THE UNDESIRABLE CLINKERS AND DEBRIS THEREBY ENABLING THE PRACTICAL UTILIZATION OF FLYASH IN THE DEPARTMENT'S ROSEHILL HOTMIX PLANT. AS A RESULT OF THE CHANGEOVER IN 1962, THE SAVINGS TO THE DEPARTMENT AMOUNT TO APPROXIMATELY \$70,000 P.A. /AUTHOR/

Fung, KY Dickinson, EJ DISCUSSER Brummelaar, TT
DISCUSSER Martin, KG DISCUSSER *Australian Road Research Board Proc* 1968

2A 211517

TEMPERATURE IN BITUMINOUS MIXTURES, INTRODUCTION

TEMPERATURE IS AN IMPORTANT FACTOR IN ASPHALT PAVEMENT CONSTRUCTION. THE EFFECTS OF TEMPERATURE MUST BE VIEWED FROM SEVERAL STANDPOINTS: (1) ITS EFFECT ON THE MIX CONSTITUENTS WHICH CHANGES THE VISCOSITY, THE WETTING ENERGY, AND PERHAPS SOME OF THE PROPERTIES OF THE AGGREGATE WHICH AFFECT BOTH THE SPREADING AND ABSORPTION OF THE ASPHALT, (2) ITS EFFECT ON THE MIXING, LAYING AND COMPACTION OPERATIONS AS A RESULT OF THESE CHANGES IN THE PROPERTIES OF THE MIX CONSTITUENTS, AND (3) THE RATE OF TRAFFIC DENSIFICATION. THE DISCUSSION TOPICS ARE PRESENTED: TEMPERATURE OF MATERIALS, EFFECTS OF TEMPERATURE ON MIXING, AND ON COMPACTION.

Lehmann, HL *Highway Research Board Special Reports* 1960

2A 211527

DISCUSSION OF REPORT OF COMMITTEE ON CHARACTER AND USE OF ROAD MATERIALS. II. BITUMINOUS MATERIALS

THE SUBJECT OF LABORATORY INVESTIGATIONS OF ASPHALT PAVING MIXTURES EMPHASIZE PAVEMENT CONSTRUCTION DETAILS, PARTICULARLY AS TO OBTAINING THE BEST PRACTICAL

TICABLE COMPRESSION OF THE MIXTURE AND UNIFORMITY OF CONTOUR. THE IMPORTANCE IS EMPHASIZED OF CONTROLLING CONSTRUCTION DETAILS. FIELD TESTS SHOULD BE UNDERTAKEN TO SECURE DEFINITE DATA ON CONSTRUCTION DETAILS, PARTICULARLY ON COMPACTION. THE EFFICIENCY OF OPERATION CAN BE DETERMINED BY DENSITY TESTS ON SAMPLES OF THE PAVEMENT TAKEN DURING AND IMMEDIATELY AFTER COMPACTION BY DETERMINING: (1) RELATIVE EFFICIENCY OF A 10 TON 3-WHEEL ROLLER, A 10 TON TANDEM ROLLER, AND A 4 TOM TANDEM ROLLER OPERATING FOR A GIVEN PERIOD ON A GIVEN MIXTURE WITH A GIVEN INITIAL TEMPERATURE, (2) TIME EFFICIENCY OF A 10 TON 3-WHEEL AND A 10 TON TANDEM ROLLER OPERATED CONTINUOUSLY OVER A GIVEN MIXTURE WITH A GIVEN INITIAL TEMPERATURE, TESTS TO BE MADE AT REGULAR INTERVALS UNTIL THE MIXTURE HAS COOLED TO APPROXIMATELY ATMOSPHERIC TEMPERATURE, (3) EFFECTIVE TEMPERATURE OF MIX UPON EFFICIENCY OF ROLLING WITH A 10 TON 3-WHEEL ROLLER AND A 10 TON TANDEM ROLLER, ROLLING TO BE CONDUCTED FOR SPECIFIED INTERMITTANT PERIODS DURING COOLING AND (4) EFFICIENCY OF TAMPING ROLLER AS COMPARED WITH THE USUAL 3- WHEEL AND TANDEM ROLLERS ON THE SAME MIXTURE WITH DIFFERENT INITIAL TEMPERATURES. GENERAL USE IS SUGGESTED OF A SIMPLE CONTOUR TESTING DEVICE SUCH AS THAT ADOPTED BY THE OHIO STATE HIGHWAY COMMISSION AND KNOWN AS THE BUMPOMETER. DETAILED INFORMATION SHOULD BE SECURED RELATIVE TO THE MIXING OPERATION FOR DIFFERENT TYPES OF FINE AGGREGATE MIXTURES AS AFFECTED BY TEMPERATURE OF THE MIX, TIME OF MIXING AND SIZE OF BATCH FOR THE USUAL MIX OF A GIVEN RATED CAPACITY. IT APPEARS THAT SOME FINE SANDS WHICH ARE UNSATISFACTORY FOR USE WITH THE ORDINARY FILLER MAY BE MADE TO PRODUCE SATISFACTORY MIXTURES IF COMBINED WITH A MUCH FINER FILLER THAN HAS BEEN CUSTOMARILY USED.

Hubbard, P DISCUSSER *Highway Research Board Proceedings* 1927

2A 211547
REPORT OF COMMITTEE ON CHARACTERISTICS OF ASPHALTS

A QUESTIONNAIRE RELATING TO THE SERVICE OF ASPHALTIC ROAD MATERIALS WAS ADDRESSED TO VARIOUS ORGANIZATIONS AND INDIVIDUALS HAVING TO DO WITH THE USE OF ASPHALT IN HIGHWAY CONSTRUCTION. NINETY-ONE REPLIES WERE RECEIVED AND THESE INDICATED THAT FAILURES OF ASPHALTIC SURFACES DUE TO THE QUALITY OF THE ASPHALT ARE PREVALENT AND MERIT SERIOUS ATTENTION. FAILURES WERE REPORTED FROM ALL SECTIONS OF THE COUNTRY AND WERE ASSOCIATED WITH MANY TYPES AND GRADES OF ASPHALT. ON THE BASIS OF THESE REPLIES A PROGRAM OF ASPHALT RESEARCH IS RECOMMENDED. DURING 1937, TEN LABORATORIES COOPERATED IN A STUDY OF FILM STRIPPING IN BITUMINOUS MIXTURES CONTAINING VARIOUS TYPES AND GRADES OF ASPHALTIC ROAD MATERIALS. WIDELY VARYING RESULTS WITH DIFFERENT AGGREGATES INDICATE AGGREGATE CHARACTER TO BE OF MAJOR IMPORTANCE IN CONNECTION WITH FILM STRIPPING. AS FOR THE BITUMINOUS MATERIALS, RESISTANCE TO STRIPPING INCREASED WITH CONSISTENCY AND CRACKED MATERIALS WERE MORE RESISTANT THAN UNCRACKED. THE CURING OF SAMPLES WAS FOUND TO HAVE AN IMPORTANT EFFECT ON TEST RESULTS. MODIFICATIONS OF THE TEST PROCEDURE ARE SUGGESTED. /AUTHOR/

Kelley, EF *Highway Research Board Proceedings* 1937

2A 211560
DESIGN CONSTRUCTION, AND INITIAL EVALUATION OF EXPERIMENTAL TEST SECTIONS OF ASPHALT CONTAINING SYNTHETIC RUBBER
THE 16 TEST SECTIONS OF ASPHALT CONTAINING RUBBER WERE CONSTRUCTED AS PART OF A PRIMARY HIGHWAY

PROJECT IN SOUTHEASTERN UTAH. THE EXPERIMENT CONSISTS OF 5 FACTORS AT 2 LEVELS, EACH INCORPORATED IN A ONE-HALF REPLICATE OF A 2 TO THE FIFTH POWER FRACTIONAL FACTORIAL EXPERIMENT. THE DESIGN PROVIDES THE BASIS FOR DETERMINING THE EFFECT OF EACH OF 5 FACTORS AND EACH OF 10 TWO-WAY INTERACTIONS ON PAVEMENT CONSTRUCTION, PERFORMANCE, AND DESIGN. THE EFFECT OF EACH VARIABLE WAS DETERMINED FOR THE CONSTRUCTION PROCESS, AND AN INITIAL EVALUATION WAS MADE. A DESCRIPTION OF THE CONSTRUCTION PROCESS, INCLUDING THE RUBBERIZING PROCESS, IS GIVEN. EVALUATION IS CONTINUING THROUGH MANY OBSERVATIONS AND PHYSICAL TESTS ON THE PAVEMENTS AND PAVING MATERIALS. FAILURE RATE OF PAVEMENTS WILL BE ACCELERATED BY THE REDUCTION OF HALF THE DESIGN THICKNESS. THE DESIGN PROVIDES A SOUND METHOD OF ANALYSIS AND OFFERS A DEFINITE BASIS TO DETERMINE WHICH FACTORS AND INTERACTIONS ARE SIGNIFICANTLY AFFECTING PAVEMENT PERFORMANCE AND DESIGN. /AUTHOR/

Darter, MI Peterson, DE Jones, GM Vokac, R *Highway Research Record, Hwy Res Board* 1970

2A 211601
BITUMINOUS CONSTRUCTION

THE HIGHWAY INDUSTRY IS RELUCTANT TO ABANDON TRADITIONAL METHODS AND SPECIFICATIONS AND ADOPT STATISTICALLY DERIVED TOLERANCES, EVEN THOUGH THE NEW LARGER TOLERANCES ARE DEMONSTRABLY SOUND. FOUR STEPS ARE NECESSARY TO IMPLEMENT STATISTICAL SPECIFICATIONS: (1) ESTABLISHMENT OF A REALISTIC VARIABILITY; (2) USE OF THE VARIABILITY TO ESTABLISH REALISTIC TOLERANCES; (3) SIMULATION OF THE NEW SPECIFICATION; AND (4) USE OF THE NEW SPECIFICATION AS THE BASIS OF ACCEPTANCE IN A CONTRACT. ONLY FOUR STATES HAVE REACHED THE LAST STEP. THE TYPICAL COMPONENTS OF STATISTICAL SPECIFICATIONS ARE: LOT SIZE, SAMPLE, NUMBER, ACCEPTANCE OF CENTRAL TENDENCY, ACCEPTANCE OF VARIABILITY, OTHER ACCEPTANCE CRITERIA (PERCENT DEFECTIVE PRODUCT QUALITY INDEX, SEQUENTIAL ANALYSIS LIMITS), ADJUSTMENT OF BID PRICE, CONTROL CHARTS, AND RETESTING AND REFEREE PROCEDURES. BECAUSE OF THEIR CLARITY AND DEFENSIBILITY, STATISTICAL SPECIFICATIONS SOLVE MANY OF THE PROBLEMS CAUSED BY INDEFINITE AND ARBITRARY SPECIFICATIONS. HOWEVER, THERE IS A LACK OF STATISTICAL TRAINING AMONG ENGINEERS, WHICH MUST BE REMEDIED BEFORE STATISTICAL SPECIFICATIONS CAN BE IMPLEMENTED.

Hughes, CS *Highway Research Board Special Reports* 1971

2A 211641
USE OF EXPANDED CLAY AGGREGATE IN BITUMINOUS CONSTRUCTION

THIS PAPER SUMMARIZES THE PRELIMINARY LABORATORY INVESTIGATION MADE BY THE LOUISIANA DEPARTMENT OF HIGHWAYS AND DISCUSSES THE USE OF EXPANDED CLAY AGGREGATE IN SURFACE TREATMENT AND HOT-MIX-HOT-LAID ASPHALTIC CONCRETE WORK IN REGARD TO DESIGN, CONSTRUCTION QUANTITIES, AND PERFORMANCE DURING 3-1/2 YEARS. THE RESULTS ARE VERY FAVORABLE AND COMPARABLE AND BETTER ROADS CAN BE BUILT WITH THIS MATERIAL IN LOCALITIES WHERE OTHER MATERIALS ARE IN SHORT SUPPLY. /AUTHOR/

Lehmann, HL Adam, V *Highway Research Board Proceedings* 1959

2A 211712
INTRODUCTION TO THE SYMPOSIUM ON ASPHALT PAVING MIXTURES
THESE PAPERS WERE PREPARED TO MAKE INVESTIGATIONAL DATA, OBTAINED TO DATE, AVAILABLE IN CONDENSED FORM TO HIGHWAY DESIGN AND CONSTRUCTION ENGINEERS. IN PAPER NO. 2, THE PRELIMINARY ANALYSIS

MADE TO SELECT TEST APPARATUS IS SUMMARIZED AND IN PAPER NO. 3, THE RESULTS OF THE FIRST LABORATORY STUDY ARE REVIEWED. IN PAPER NO. 4, THE CONSTRUCTION AND TESTING OF A FIELD TEST SECTION, TOGETHER WITH ANALYSIS OF THE DATA, ARE PRESENTED. PAPER NO. 5 PRESENTS THE ADJUSTMENTS THAT WERE MADE IN THE LABORATORY TEST PROCEDURES TO INSURE THAT SPECIMENS ON WHICH DESIGNS WOULD BE BASED WOULD CLOSELY APPROACH FIELD CONDITIONS. THE FINAL DETAILED TEST PROCEDURES FOR THE METHOD ARE PRESENTED IN PAPER NO. 6. PAPER NO. 7 SHOWS HOW THE METHOD IS USED IN THE ACTUAL DESIGN AND CONSTRUCTION OF A PAVEMENT AND THE CLOSING PAPER DISCUSSES THE DESIGNS AS RELATED TO OTHER FEATURES OF A FLEXIBLE PAVEMENT.

Mcfadden, G Ricketts, WC *Highway Research Board Research Reports* 1949

2A 211718

THE PRACTICAL APPLICATION OF THE DESIGN METHOD OF ASPHALTIC MIXTURES TO PAVEMENT CONSTRUCTION
THE SOLUTIONS TO THE FOLLOWING PROBLEMS ARE DISCUSSED: (1) ARE AGGREGATE MATERIALS WHICH ARE LOCALLY AVAILABLE SUITABLE FOR USE IN ASPHALT PAVEMENTS; (2) IF TWO OR MORE AGGREGATES ARE TO BE BLENDED, WHAT ARE THE DESIRABLE PROPORTIONS FOR EACH; (3) WHAT PERCENT ASPHALT IN THE PAVING MIXTURE SHOULD BE USED AS A BASIS OF ESTIMATE FOR TOTAL QUANTITIES REQUIRED; AND (4) IS THE ASPHALT MIXTURE AS PRODUCED AND LAID AS A PAVEMENT OF SATISFACTORY QUALITY, CONTAINING THE PROPER AMOUNT OF ASPHALT FOR THE MAXIMUM INTENDED SERVICE? ITEMS 1, 2, AND 3 INVOLVE PRELIMINARY DESIGN WORK AND SHOULD BE COMPLETED WELL IN ADVANCE OF ACTUAL CONSTRUCTION. ITEM 4 INCLUDES A FINAL DESIGN BASED ON MATERIALS ACTUALLY TAKEN FROM PLANT BINS AND INCLUDES CONSTANT SAMPLING, TESTING, AND ANALYSIS OF THE ASPHALT MIXTURE AS IT IS BEING PRODUCED. /AUTHOR/

Boyd, WK *Highway Research Board Research Reports* 1949

2A 211781

CONTROL OF INTERMEDIATE PRODUCTS-SESSION 4
THE REPORTS INCLUDED ARE: (1) SOME PROBLEMS IN THE SAMPLING AND TESTING OF BITUMINOUS MIXTURES AND CONCRETE, D. H. MATHEWS, G. D. GOODSALL; (2) THE STRABAG-DEUTAG INTERLABORATORY STUDY ON STONE-FILLED ASPHALTIC CONCRETE 0-12 MM GRAIN SIZE, H. HAAS; (3) MEASURED VARIATIONS IN PORTLAND CEMENT AND BITUMINOUS CONCRETE CONSTRUCTION IN THE U.S.A., T. F. MCMAHON, E. C. GRANLEY, W. M. BAKER; (4) INVESTIGATION INTO THE VARIABILITY IN THE CHARACTERISTICS OF BITUMINOUS MIXTURES, L. VOLKL; (5) CONTINUOUS IN-PROCESS CONTROL OF INTERMEDIATE PRODUCTS, R. SAUTEREY; (6) CONTROL AND ACCEPTANCE OF BITUMINOUS MATERIALS AND CONCRETE, D. H. MATHEWS, R. HARDMAN; (7) STATISTICAL SPECIFICATIONS FOR INTERMEDIATE PRODUCTS, S. D. HUDSON, G. W. STEELE; AND A SUMMARY OF DISCUSSIONS.

Hode-keyser, J
Oecd, Paris /France/ 1972, pp 103-45, Figs, Tabs, Refs

2A 211853

AUTOBAHN ASPHALTOBERBAU
FULL DEPTH PAVEMENT CONSTRUCTION ELIMINATES THE NEED FOR A FROST PROTECTION LAYER UNDER THE BASE COURSE. IT CONSISTS OF EMPLOYING ASPHALT MIXTURES FOR ALL COURSE ABOVE THE SUBGRADE OR IMPROVED SUBGRADE. TWO TEST SECTIONS WERE PLACED ON A FEDERAL (GERMAN) HIGHWAY BEFORE ISSUANCE OF A PRACTICAL THICKNESS DESIGN METHOD SUITED TO GERMAN CONSTRUCTION. FOLLOWING TESTS, FULL-DEPTH WAS USED FOR REBUILDING AND WIDENING A SECTION OF ONE OF THE COUNTRY'S MOST HEAVILY TRAVELED ROUTES. THE

PROJECT SERVED TO DEMONSTRATE THE EFFICACY OF THE METHOD AND ITS INHERENT ECONOMY. THE CAMBERG FULL-DEPTH DESIGN COMPRISES 16 INCHES OF ASPHALT MIXTURES PLACED DIRECTLY ON IMPROVED SUBGRADE. GUSSASPHALT WAS APPLIED TO THE PAVEMENT AS A DURABLE, SKID-RESISTANT FINISH. PERFORMANCE EVALUATIONS ON THE PROJECT ARE CONTINUING. BENKELMAN BEAM DEFLECTION MEASUREMENTS, TEMPERATURE AND SOIL MOISTURE CONTENTS, SMOOTHNESS AND SKID RESISTANCE READINGS WILL BE MADE.

Asphalt Institute Quarterly Vol. 25 No. 3, July 1973, 00 6-7

2A 211864

GUSSASPHALT: MACHINE-LAID MASTIC ASPHALT IN ROAD CONSTRUCTION

THE DEVELOPMENTS IN MANUFACTURING PROCESSES FOR AND THE PROPERTIES OF MASTIC ASPHALT, OR GUSSASPHALT, ARE DISCUSSED UNDER THE FOLLOWING HEADINGS: PRINCIPLES OF THE COMPOSITION OF GUSSASPHALT; SPECIFICATION OF GUSSASPHALT; MANUFACTURE OF GUSSASPHALT; LAYING GUSSASPHALT; AND ASSOCIATED BINDER COURSE. AN EXTRACT FROM GERMAN SPECIFICATION TV BIT 6/60 AND DETAILS OF INDENTATION TEST (DIN 1996 SHEET 13) ARE APPENDED. /TRRL/

Schoenian, E
Shell International Petroleum Co /UK/ R&d Rept 1971, 16 pp, 2 Fig, 4 Tab, 19 Phot

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

2A 211866

BITUMINOUS MATERIALS FUTURE RESEARCH AT THE TRANSPORT AND ROAD RESEARCH LABORATORY

THIS PAPER OUTLINES THE MAIN OPERATIONAL AND ENGINEERING REQUIREMENTS FOR BITUMINOUS ROAD-MAKING MATERIALS, SUMMARISES THE PRESENT STATE OF KNOWLEDGE, AND INDICATES THE MAIN LINES OF RESEARCH NEEDED IN THE NEXT FEW YEARS. IT WAS WRITTEN TO PROVIDE A BASIS FOR A REVIEW BY THE RRL'S RESEARCH COMMITTEE ON BITUMINOUS MATERIALS OF THE RESEARCH PROGRAMME IN THIS FIELD. IT IS NOW BEING PUBLISHED AS MANY ROAD ENGINEERS AND RESEARCH WORKERS MAY BE INTERESTED IN THE BACKGROUND TO, AND PLANS FOR, RESEARCH ON BITUMINOUS MATERIALS AT RRL. /AUTHOR/

Burt, ME Nicholas, JH *Roads & Road Construction, London* /UK/ Vol. 50 No. 589, Jan. 1972, pp 4-6, 3 Fig

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/IRRD 201 684, 3C31232325

2A 211876

REPLACEMENT OF CUTBACKS WITH EMULSIFIED ASPHALT
EMULSIFIED ASPHALTS HAVE REPLACED, IN LARGE MEASURE, THE USE OF CUTBACKS IN LARGE MEASURE, THE USE OF CUTBACKS IN MAINTENANCE SURFACE TREATMENTS. MOST CUTBACK CONSTRUCTION CAN BE DONE WITH EMULSIFIED ASPHALTS. THE RECOMMENDED USE OF THIS MATERIAL AS SUBSTITUTE FOR CUTBACK ARE TABULATED. ALL SURFACE TREATMENT AND PENETRATION MACADAM CONSTRUCTION CAN BE DONE WITH RAPID-SET TYPE EMULSIFIED ASPHALTS. TACK COATS CAN BE DONE WITH CRS-1 AND RS-1. SLURRY SEALS CAN BE DONE ONLY WITH EMULSIFIED ASPHALTS. HOWEVER, EMULSIFIED ASPHALTS CANNOT REPLACE ALL CUTBACK APPLICATIONS. THEY CANNOT PENETRATE DENSE, TIGHT SURFACES AND SO MANY NOT BE USED FOR PRIME COATS WHICH REQUIRE A BINDER THAT PENETRATES SOIL AND UNTREATED AGGREGATE. EMULSIFIED ASPHALTS CAN BE USED TO MAKE STOCKPILE PATCHING MIXES. COLD MIX BASE COURSE AND SURFACE CONSTRUCTION CAN BE DONE WITH EMULSIFIED ASPHALT. MIXED-IN-PLACE CONSTRUCTION, WHERE ASPHALT IS SPRAYED ON THE AGGREGATE FOLLOWED BY BLADE MIXING, IS MORE

DIFFICULT WITH EMULSIFIED ASPHALTS. COLD MIX EMULSIFIED ASPHALT SURFACE COURSE DESIGN REQUIRES AN AGGREGATE MODIFICATION. THE USE OF OPEN-GRADED EMULSION MIXES ARE OUTLINED. IN THE TREATMENT OF DUST WITH EMULSIFIED ASPHALT, SOME MIXING IS NECESSARY BEFORE APPLICATION. CURRENT AASHO EMULSIFIED ASPHALT GRADES HANDLE MOST WORK, EITHER AS DIRECT SUBSTITUTES OR WITH CHANGES IN CONSTRUCTION PROCEDURES. EMULSIFIED PRIMERS, STOCKPILE MATERIALS AND DUST PALLIATIVES HAVE BEEN DEVELOPED AND ARE SPECIFIED BY SOME USER AGENCIES. INFORMATION ON PRODUCT AND CONSTRUCTION TECHNOLOGY MUST BE DISSEMINATED THROUGH FHWA RESEARCH IMPLEMENTATION PROGRAMS, DEMONSTRATIONS AND STATE-OF-THE-ART REPORTS.

Kari, WJ *Highway Research News, Hwy Res Board* No. 53, Dec. 1973, pp 21-4, 2 Fig, 1 Tab

2A 211915

REVIEW PAPER 11. THE APPLICATION AND PERFORMANCE OF ASPHALTS

THE AUTHOR OUTLINES RECENT DEVELOPMENTS IN THE USE OF ASPHALT IN ROAD BUILDING AND HYDRAULIC ENGINEERING AND IDENTIFIES SOME SPECIFIC REQUIREMENTS. FACTORS CONSIDERED UNDER ROAD CONSTRUCTION INCLUDE THE WEARING COURSE, SKID RESISTANCE, EFFECT OF SNOW CHAINS AND STUDDED TYRES, PAVEMENT COLOUR, INFLUENCE OF SALT AND WATER, NOISE, MIX DESIGN, SURFACE TREATMENT, BINDER COURSES, ASPHALT BASES MIXING PLANTS, PAVERS, ROLLERS, AND QUALITY CONTROL. COMMENTS ARE PRESENTED ON THE INCREASING USE OF ASPHALT FOR AIRPORT RUNWAYS, DAMS, SEA BED PROTECTION, CANAL LININGS AND UNDER RAILWAY TRACKS.

Klomp, AJ
World Petroleum Cong Proc 22 pp, 8 Fig, 83 Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

2A 211954

STUDIES OF EARLY HYDRATION REACTIONS OF PORTLAND CEMENT BY X-RAY DIFFRACTION
MONITORING BY X-RAY DIFFRACTION OF HYDRATION OF TRICALCIUM ALUMINATE IN PASTES CONTAINING CALCIUM HYDROXIDE AND GYPSUM HAS DEMONSTRATED SUCCESSIVE FORMATION OF THE HIGH-SULFATE FORM OF CALCIUM SULFOALUMINATE HYDRATE /ETTRINGITE/, THE LOW-SULFATED HYDRATE AND TETRACALCIUM ALUMINATE HYDRATE. THESE REACTIONS AND EFFECTS OF VARIOUS FACTORS ON THEM CORRESPOND VERY CLOSELY TO THE EARLY HYDRATION BEHAVIOR OF C3A IN PORTLAND CEMENT. DIFFRACTION STUDIES OF HYDRATING SINTERED TRICALCIUM ALUMINATE SLABS HAVE DEMONSTRATED THE RETARDING EFFECT OF THE INITIALLY FORMED ETTRINGITE FILM. X-RAY AND DILATOMETER STUDIES HAVE SHOWN THAT THE HYDRATING C3A PASTES UNDERGO LARGE INCREASES IN VOLUME BECAUSE OF A TENDENCY TO IMBIBE LARGE QUANTITIES OF WATER. THE INDIVIDUAL EFFECTS OF OTHER PORTLAND CEMENT CONSTITUENTS ON THESE HYDRATION REACTIONS HAVE BEEN INVESTIGATED. A STUDY OF HYDRATION OF COMBINATIONS OF THE VARIOUS CONSTITUENTS HAS LED TO A FAIRLY COMPLETE PICTURE OF THE EARLY HYDRATION REACTIONS OF PORTLAND CEMENT. EXAMINATION OF A FEW WELL-KNOWN ACCELERATING AND RETARDING MATERIALS HAS SHOWN THEM TO AFFECT PRIMARILY THE HYDRATION RATE OF C3S. THEY MAY AFFECT THE RATES BUT NOT THE NATURE OF THE EARLY C3A REACTIONS. RETARDERS CAN PRODUCE A LARGE INITIAL ACCELERATION OF C3A HYDRATION. WHEN CONSIDERED IN RELATION TO THE STATE OF THE CALCIUM SULFATE IN THE CEMENT, THIS PREVIOUSLY UNRECOGNIZED EFFECT CAN ACCOUNT FOR MANY INSTANCES OF ABNORMAL SETTING OF CONCRETE. OPTIMUM SO₃ CONTENT IS CHARACTERIZED BY GYPSUM DEPLETION AT 18 TO 24 HR AFTER GAGING. HIGHER SO₃ CONTENTS CAUSE WATER IMBI-

BITION TO PRODUCE EXCESSIVE EXPANSION AND LOWERED STRENGTH. THIS WATER IMBIBITION IS A MAJOR FACTOR IN THE BEHAVIOR OF SHRINKAGE-COMPENSATING AND EXPANSIVE CEMENTS. /AUTHOR/

Seligmann, P Greening, NR *Highway Research Record, Hwy Res Board* 1964

2A 211961

EFFECTS OF SEAWATER ON CONCRETE

CONCRETE EXPOSED TO SEAWATER IS WETTED BY A SOLUTION OF SALTS PRINCIPALLY SODIUM CHLORIDE AND MAGNESIUM SULFATE. DAMAGE TO CONCRETE, IF IT OCCURS, USUALLY RESULTS FROM FAILURE TO USE GOOD PRACTICES IN CONCRETE CONSTRUCTION, AND OFTEN IS THE RESULT OF FREEZING AND THAWING OR WETTING AND DRYING, AS MUCH AS OR MORE THAN THE RESULTS OF THE EFFECTS OF SEAWATER AS SUCH. MAGNESIUM SULFATE MAY ATTACK MOST, IF NOT ALL, OF THE CONSTITUENTS OF HARDENED PORTLAND CEMENT PASTE, ESPECIALLY THE ALUMINATE CONSTITUENT. CHLORIDES MAY PROMOTE CORROSION OF STEEL. ALKALIES MAY PARTICIPATE IN ALKALI-AGGREGATE REACTION. THUS, CONCRETE EXPOSED TO SEAWATER SHOULD BE MADE WITH CEMENT OF CONTROLLED ALUMINATE CONTENT AND WITH NONREACTIVE AGGREGATE, EMBEDDED STEEL SHOULD BE WELL COVERED BY CONCRETE OF LOW PERMEABILITY, AND GOOD CONSTRUCTION PRACTICES SHOULD BE FOLLOWED. /AUTHOR/

Mather, B *Highway Research Record, Hwy Res Board* 1966

2A 212089

PERFORMANCE OF ULTRASONIC EQUIPMENT FOR PAVEMENT THICKNESS MEASUREMENT AND OTHER HIGHWAY APPLICATIONS

THE EQUIPMENT USED WAS A SONISCOPE AND AN ASSOCIATED FREQUENCY GENERATOR AND COUNTER FOR DETERMINING REASONANT FREQUENCY THROUGH THE DEPTH OF THE PAVEMENT SLAB. IT WAS CONCLUDED THAT THE EQUIPMENT IS NOT SATISFACTORY FOR MEASURING PAVEMENT THICKNESS. IN CONSIDERING OTHER APPLICATIONS IT WAS FOUND TO BE USEFUL IN DETERMINING THE CONTINUITY OF CONCRETE IN A STRUCTURE SUCH AS IN A SURVEY OF A BRIDGE DECK TO DETERMINE AREAS WITH DETERIORATED CONCRETE OR INCIPIENT SPALLING. USE OF PULSE VELOCITY FOR EVALUATING QUALITY OF FRESH CONCRETE WAS INVESTIGATED AND WAS NOT FOUND PROMISING FOR PRACTICAL CONTROL OF CONCRETE IN CONSTRUCTION. A LABORATORY INVESTIGATION OF THE EFFECT REINFORCING STEEL HAS ON PULSE VELOCITY MEASUREMENTS WAS CONDUCTED WITH STEEL VARYING FROM 0 TO 6 PERCENT OF THE VOLUME. IT WAS CONCLUDED THAT REINFORCING STEEL DOES NOT INFLUENCE PULSE VELOCITY WHEN THE PULSE MEASURING PATH CROSSES THE STEEL AS WOULD USUALLY BE THE CASE IN REINFORCED CONCRETE COLUMNS, SLABS AND BEAMS. /AUTHOR/

Scholer, CF
Purdue & Ind State Hwy Comm Jhrp, Indiana State Highway Commission, Federal Highway Administration /US/

ACKNOWLEDGMENT: Federal Highway Administration (4601424 70)REPORT PENDING, 1C32022302

2A 212243

COMPLEX METHODS OF NON-DESTRUCTIVE TESTS OF CONCRETE IN CONSTRUCTION AND STRUCTURAL WORKS
AN ANALYSIS OF NON-DESTRUCTIVE METHODS OF TESTING CONCRETE IS MADE WHERE THE COMPRESSIVE STRENGTH IS RELATED, FOR EXAMPLE, TO IMPULSE PROPAGATION VELOCITY, FREQUENCY OF FREE VIBRATIONS, DENSITY OF CONCRETE, HARDNESS, TENSILE STRENGTH ETC., DEPENDING ON THE METHOD USED, AND THERE ARE FOUND TO BE CONSIDERABLE INHERENT ERRORS. THE ARTICLE SUGGESTS METHODS FOR THE SELECTION OF COMPLEX TESTS, AND THEIR

CLASSIFICATION, AND FORMULAS FOR CALCULATING THE STRENGTH OF CONCRETE OBTAINED BY SEVERAL METHODS. /RRL/

Skramtaev, BG Leschinsky, MJ *Mats & Structures, Res & Testing /Fr/* Mar. 1966

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 212262

PERFORMANCE OF CONCRETE-RESISTANCE OF CONCRETE TO SULPHATE AND OTHER ENVIRONMENTAL CONDITIONS CONSTRUCTION IS NORMALLY THE LARGEST OF A NATION'S INDUSTRIES AND THE USE OF CONCRETE EXCEEDS BY FAR THE USE OF ALL OTHER CONSTRUCTION MATERIALS COMBINED. THIS BOOK ON CONCRETE IS A COMPILATION OF SCIENTIFIC AND TECHNICAL PAPERS PRESENTED AT A SYMPOSIUM HELD IN HONOUR OF A CANADIAN SCIENTIST OF INTERNATIONAL STATURE, THE LATE THORBERGUR THOWALDSON. IT IS INTENDED AS A MEMORIAL IN RECOGNITION OF HIS GREAT CONTRIBUTION TO THE DEVELOPMENT OF SULPHATE RESISTANT CEMENT AND CONCRETE. THE ESTABLISHMENT OF SPECIFICATIONS AND RECOMMENDED PRACTICES REQUIRES KNOWLEDGE OF FIELD PERFORMANCE AS WELL AS CONCLUSIONS DRAWN FROM LABORATORY TESTING AND RESEARCH. THIS SYMPOSIUM PRESENTED AN UNUSUAL OPPORTUNITY TO DEVELOP THE MUCH NEEDED ORIENTATION TO FIELD PERFORMANCE OF CONCRETE. ALTHOUGH MOST OF THE PAPERS DEAL WITH RESISTANCE OF CONCRETE TO SULPHATE ATTACK, SOME ARE CONCERNED WITH OTHER ASPECTS OF CONCRETE DURABILITY WHICH ARE PARTICULARLY PERTINENT TO CANADA. /CGRA/

Nrc Div Bldg Research /Can/

ACKNOWLEDGMENT: Canadian Good Roads Association

2A 212280

SAFE COMBINATIONS OF MIX PROPORTIONS, TEMPERATURE AND PROTECTION TIME IN WATER CONCRETING

THE PROBLEM FOR WINTER CONCRETING PRACTICE IS TO CONVERT THE NECESSARY PREHARDENING TIME INTO ACTUAL TIME UNITS FOR STRUCTURAL CONCRETE MEMBERS. A CONCRETE STRUCTURE SHOULD BE PROTECTED AGAINST FREEZING DURING A PERIOD CORRESPONDING TO THE NECESSARY PREHARDENING TIME. THE PROTECTION CAN BE PROVIDED BY COVERINGS AND INSULATION. THE PREHARDENING TIME CAN BE DETERMINED FROM THE TEMPERATURE HISTORY WHICH IS DEPENDENT ON MANY VARIABLES. THESE VARIABLES ARE DISCUSSED: WATER-CEMENT RATIO, MATURITY FACTOR, CONCRETE COMPOSITION, AND CEMENT CONTENT. AN EXAMPLE IS GIVEN COMPUTING HARDENING TIME FROM THE TEMPERATURE HISTORY VARIABLES GIVEN IN A TABLE OF RULES.

Jessing, J *Highway Research Board Special Reports* 1966

2A 212332

POZZOLANIC CLAYS OF INDIA: THEIR INDUSTRIAL EXPLOITATION AND USE IN ENGINEERING WORKS

AN INVESTIGATION INTO THE USE OF BURNT CLAY AS A POZZOLANA IS REPORTED. DUE TO THE SHORTAGE OF CEMENT EXPERIENCED DURING THE PAST, THE CENTRAL ROAD RESEARCH INSTITUTE CONDUCTED FUNDAMENTAL AND APPLIED STUDIES ON THE USE OF BURNT CLAY AS A POZZOLANA WITH A VIEW TO EFFECT ECONOMY IN THE USE OF CEMENT AND IMPROVE THE PROPERTIES OF CONCRETE. AN ATTEMPT HAS BEEN MADE TO UNDERSTAND THE BASIC REACTION THAT TAKES PLACE WHEN SURKHI IS PROCESSED FOR USE AS POZZOLANA, WHICH HAS LED TO CERTAIN ORIGINAL TRENDS OF THOUGHT. AS A RESULT, THE FUNDAMENTAL ASPECTS OF SURKHI ARE MUCH BETTER UNDERSTOOD NOW. IT HAS NOW BEEN POSSIBLE TO BRING FORTH

FOR THE INDUSTRY AN IMPROVED BUILDING MATERIAL NAMED REACTIVE SURKHI WHICH COULD CONSIDERABLY EASE THE DIFFICULTIES FACED BY BUILDERS DUE TO SHORTAGE OF CEMENT. COMPARED TO THE SURKHI WHICH IS COMMONLY AVAILABLE IN THE MARKET AS A COARSE POWDER DERIVED FROM WASTE BRICKS, THE REACTIVE SURKHI COULD DEVELOP 4 TO 5 TIMES THE STRENGTH WITH LIME IN MORTARS. THE VOLUME CONSISTS OF A SURVEY OF DEPOSITS OF THE CLAYS IN VARIOUS PARTS OF INDIA; CHAPTERS ON INDUSTRIAL EXPLOITATION OF LOCATED DEPOSITS; AND UTILIZATION OF REACTIVE SURKHI IN VARIOUS TYPES OF CONSTRUCTION. A BIBLIOGRAPHY ON POZZOLANAS, /1925-1963/, CONSISTING OF 32 PAGES IS APPENDED. /AUTHOR/

Central Road Research Inst of India 1964

ACKNOWLEDGMENT: Highway Res Abstracts Hwy Res Board

2A 212399

ULTRASONIC MEASUREMENTS ON REINFORCED GRAVEL-AGGREGATE CONCRETES

POSSIBLE APPLICATION OF MEASUREMENTS OF ULTRASONIC PULSE VELOCITY AS A TEST METHOD FOR PRACTICAL CASES IN CONCRETE BUILDING IS BEING INVESTIGATED. RESEARCH WORK IS ESPECIALLY AIMED AT THE USEFULNESS OF THE VARIATION OF MEASURED VALUES FOR ESTIMATING THE CRACK STATE OF A CONSTRUCTION. A DISTINCT AND REPRODUCIBLE DEPENDENCY OF THE VARIATION OF TEST DATA ON THE DEGREE OF PRE-LOAD WAS ESTABLISHED WITH 27 GRAVEL- AGGREGATE HEAVY-WEIGHT CONCRETES OF DIFFERENT COMPOSITION. THE INVESTIGATIONS HAVE BEEN EXTENDED TO DIFFERENT TRANSVERSAL REINFORCEMENT CONTENTS. WITHIN THE RANGE UP TO 7% TRANSVERSAL STEEL III REINFORCEMENT THERE WAS A SLIGHT INFLUENCE OF THE REINFORCEMENT ON THE ABSOLUTE VALUES OF PULSE VELOCITY MEASURED. NEVERTHELESS, THE CHARACTERISTIC DEPENDENCY OF TEST DATA VARIATION ON THE CRACK STATE COULD BE FULLY ESTABLISHED FOR THIS WHOLE RANGE. /AUTHOR/

Kordina, K Roy, V Waubke, NV *Material Prufung /Germany/* Mar. 1967

ACKNOWLEDGMENT: Highway Res Abstracts Hwy Res Board

2A 212555

THE INITIAL CRACKING OF HIGHWAY CONCRETE

SOMETIMES A CONCRETE PAVEMENT CRACKS DURING THE FIRST FEW DAYS AFTER IT HAS BEEN LAID, BEFORE BEING SUBJECTED TO TRAFFIC. THIS CRACKING HAS A TWIN ORIGIN: IT IS RELATED TO HYGROMETRIC AND THERMAL SHRINKAGE. HYGROMETRIC, OR DRYING, SHRINKAGE IS IMPORTANT, BECAUSE IT VERY RAPIDLY AFFECTS THE MASS OF THE PAVEMENT. WHEN THE CONCRETE IS PROPERLY PROTECTED AGAINST EVAPORATION, THERMAL SHRINKAGE BECOMES THE MAIN CAUSE OF CRACKING. THE INCREASE IN THE INTERNAL TEMPERATURE OF THE PAVEMENT DURING THE FIRST FEW HOURS IS DUE TO EXOTHERMIC SETTING REACTIONS. THE REDUCTION OF THE INTERNAL TEMPERATURE DEPENDS ON THE MORE OR LESS SUDDEN STOPPAGE OF THE SETTING REACTIONS AND ON THE ENVIRONMENT OF THE PAVEMENT. THE AMBIENT TEMPERATURE DOES NOT SEEM TO BE ONE OF THE MOST IMPORTANT FACTORS INFLUENCING THE INTERNAL TEMPERATURE OF THE PAVEMENT. WHEN AN ISOLATED CRACK APPEARS, ITS CAUSE CANNOT BE FOUND AMONG THE FACTORS WHICH INFLUENCE THERMAL OR DRYING SHRINKAGE. AS A RULE IT HAS AN ACCIDENTAL CAUSE RESULTING FROM THE HAZARDS OF CONCRETE PRODUCTION OR OF THE LAYING OF THE PAVEMENT. IN ORDER TO REDUCE THE RISKS OF CRACKING ON A CONSTRUCTION SITE, IT IS ADVISABLE TO CHOOSE WITH CARE THE AGGREGATES & CEMENT USED, AND TO MAKE SURE THAT PRODUCTION AND LAYING ARE REGULAR. /BLLRPC/

Brachet, M Baron, J *Bull Liaison Labs Routiers /France/* July 1967

2A 212562

THE EARLY STRENGTH OF CONCRETE UNDER NATURAL CONDITIONS OF HARDENING

THE OBJECT OF THE PRESENT ARTICLE IS NOT MERELY TO DESCRIBE THE ALREADY FUNDAMENTALLY KNOWN QUALITATIVE EFFECT OF TEMPERATURE, AGE, KIND OF CEMENT AND WATER/CEMENT RATIO UPON THE EARLY STRENGTHS OF CONCRETE. IN ADDITION, IT INDICATES WAYS AND MEANS WHEREBY THE CONCRETE MANUFACTURER CAN, WITH SIMPLE AND CONVENIENT METHODS ESTIMATE THE ORDER OF MAGNITUDE OF THE EFFECTIVE STRENGTHS OF CONCRETE AT AN EARLY AGE. A TENTATIVE START HAS BEEN MADE WITH CLASS 475 PORTLAND CEMENT (SPECIFIED 28-DAY STRENGTH 475 KG/CM). IT COULD BE ADVANTAGEOUS TO EXTEND THESE INVESTIGATIONS TO INCLUDE OTHER KINDS OF CEMENT. THIS WILL, IT IS TRUE, INVOLVE CONSIDERABLE EXPENDITURE, BUT IS INDEED JUSTIFIED, HAVING REGARD TO THE INCREASE IN OUR KNOWLEDGE OF CONSTRUCTION MATERIALS AND TO THE POSSIBLE EASIER WORKING PROCEDURES THAT WILL RESULT THEREFROM. /AUTHOR/

Henk, B *Betonstein-zeitung, Weisbaden /Germany/ Aug. 1966*

2A 212589

APPLICATION OF INSTRUMENTAL METHODS FOR EVALUATING HIGHWAY MATERIALS

A RELIABLE COLORIMETRIC METHOD FOR DETERMINING PLASTIMENT A RETARDER IN HARDENED CONCRETE CONTAINING GRAVEL, LIMESTONE, OR SLAG AGGREGATES HAS BEEN DEVELOPED WHICH GENERALLY YIELDS AN ABSOLUTE ACCURACY OF PLUS OR MINUS 0.4 OZ PER SACK OF CEMENT. DETAILS OF THE METHOD ARE GIVEN, AND DEVELOPMENT OF SIMILAR TECHNIQUES ARE RECOMMENDED FOR OTHER RETARDERS. THE STUDY RESULTED FROM INSTANCES OF OVERDOSAGE OF RETARDER IN BRIDGE DECK CONCRETE. THE ANALYTICAL METHOD WILL ALSO DETECT OMISSION OF RETARDER THAT WOULD RESULT IN EARLY SETTING OF CONCRETE. /AUTHOR/

Frederick, WL Ellis, JT
Michigan Dept State Highways Nov. 1966

2A 212650

USE OF NEUTRON ACTIVATION TO DETERMINE CEMENT CONTENT OF PORTLAND CEMENT CONCRETE

MANY MILLIONS OF DOLLARS ARE SPENT EACH YEAR BY THE CONSTRUCTION INDUSTRY FOR PORTLAND CEMENT CONCRETE. THIS CONCRETE, PRODUCED BY A VARIETY OF CONCRETE MIXER DESIGNS, VARIES IN SPECIFIED QUALITY FROM LOW-STRENGTH CONCRETE USED IN UNSTRESSED MEMBERS TO HIGH-STRENGTH CONCRETE USED IN PRESTRESSED AND REINFORCED CONCRETE CONSTRUCTION. UNIFORMITY OF MIXING IS A GOOD CRITERION BY WHICH TO JUDGE THE QUALITY OF THE CONCRETE MIX AND MIXING ADEQUACY. IN THIS RESEARCH, CEMENT CONTENT OF MORTAR, FINENESS MODULUS OF THE AGGREGATE, ULTIMATE COMPRESSIVE STRENGTH, AND USUAL INSPECTION OF MIXING QUALITY WERE USED TO INDICATE THE UNIFORMITY OF THE MIXED CONCRETE. WITH THE EXCEPTION OF CEMENT CONTENT, ALL TESTS TO DETERMINE THE PHYSICAL CHARACTERISTICS OF THE CONCRETE WERE MADE BY CONVENTIONAL ASTM METHODS. CEMENT CONTENT OF THE CONCRETE MORTAR WAS DETERMINED BY NEUTRON ACTIVATION AND ANALYSIS OF CA49 PRODUCED IN THE CALCIUM IN THE PORTLAND CEMENT. THE METHOD OF CEMENT CONTENT DETERMINATION PROVED TO BE FEASIBLE AND COULD BE USED TO PREDICT THE CEMENT CONTENT WITHIN APPROXIMATELY PLUS OR MINUS 0.007 G 95 PERCENT OF THE TIME. ANALYSIS OF VARIANCE GENERALLY INDICATED THAT NO SIGNIFICANT EFFECT WAS OBSERVED FOR FINENESS MODULUS, ULTIMATE COMPRESSIVE STRENGTH, AND CEMENT CONTENT FOR THE MAIN EFFECTS OF MIXING TIME, REPLICATION, AND POSITION IN A CONCRETE MIXER FOR THE EXPERIMENT USED IN THIS RESEARCH. /AUTHOR/

Covault, DO Poovey, CE *Highway Research Board Bulletin Jan. 1962*

2A 212668

APPLICATION OF STATISTICAL METHODS TO LABORATORY CONCRETE FREEZE-THAW TEST DATA

THIS PAPER WAS WRITTEN FOR RESEARCHERS IN THE FIELD OF CONSTRUCTION MATERIALS IN AN EFFECT TO DEMONSTRATE AND EXPLAIN A FAIRLY COMPLICATED STATISTICAL ANALYSIS. THE AUTHORS DISCUSS EXPERIMENTAL DESIGNS, THE MATHEMATICAL MODEL, THE ASSUMPTIONS WHICH MUST BE SATISFIED BEFORE THE ANALYSIS OF VARIANCE MAY BE USED, THE MECHANICS OF THE ANALYSIS OF VARIANCE, AND A METHOD FOR DETERMINING WHERE THE DIFFERENCES LIE AMONG A SET OF MEANS. AN EXAMPLE IS USED TO ILLUSTRATE THE MECHANICS OF THE ANALYSIS OF VARIANCE.

Irick, PE Blackburn, JB *Highway Research Board Proceedings 1955*

2A 212681

FLY ASH IN CONCRETE, AN EVALUATION-ANNOTATED BIBLIOGRAPHY

REFERENCES ARE LISTED ON FLY ASH IN CONCRETE AND RELATED SUBJECTS INCLUDING LIGHTWEIGHT AGGREGATE CONCRETE, CONCRETE AND CEMENT PROPERTIES, PULVERIZED FUEL FLY ASH, CONCRETE ADMIXTURES, POZZOLANS, PULVERIZED COAL ASH, WEATHER RESISTANCE, LEAN CONCRETE MIXES, DURABILITY, AIR CONTENT, WATER RESISTANCE, CORROSION, DAM CONSTRUCTION, AND CONCRETE MANUAL.

Abdun-nur, EA *Highway Research Board Bulletin 1961*

2A 212702

SYMPOSIUM ON EFFECT OF WATER-REDUCING ADMIXTURES AND SET-RETARDING ADMIXTURES ON PROPERTIES OF CONCRETE

A WATER-REDUCING ADMIXTURE WHEN ADDED TO A CONCRETE PERMITS A REDUCTION IN MIXING WATER WITH NO LOSS IN SLUMP, OR IF THE WATER CONTENT IS MAINTAINED CONSTANT, PRODUCES AN INCREASE IN SLUMP. A SET-RETARDING MIXTURE REDUCES THE EARLY RATE OF HARDENING AND SO PERMITS THE CONCRETE TO BE HANDLED AND VIBRATED FOR AN ADDITIONAL PERIOD AFTER MIXING. BOTH CLASSES OF MATERIALS, THE LIGNOSULFONIC ACIDS AND THE HYDROXYLATED CARBOXYLIC ACIDS ALONG WITH THEIR RESPECTIVE SALTS, WHEN ADDED TO CONCRETE REDUCE THE WATER REQUIREMENT AND ALSO RETARD THE SET. MODIFICATIONS AND DERIVATIVES OF THESE MATERIALS MAY RETAIN THE WATER-REDUCING PROPERTY OF THE ADMIXTURE WITHOUT MODIFYING THE HARDENING RATE OR MAY EVEN ACCELERATE THE SET. THE SYMPOSIUM SELECTED INFORMATION ON ADMIXTURES ACCORDING TO THE FOLLOWING: (1) THE MECHANISMS BY WHICH THESE MATERIALS MODIFY CONCRETE PROPERTIES, (2) THE EFFECTS OF THE ADMIXTURES ON THE PROPERTIES OF PLASTIC AND HARDENED CONCRETE AND THE VARIATION OF THESE EFFECTS DEPENDING UPON THE OTHER MATERIALS INVOLVED, THE TYPE OF CONCRETE, AND THE EXISTING TEMPERATURE, (3) THE TYPE OF CONSTRUCTION AND THE CONDITIONS UNDER WHICH THEIR USE IS PARTICULARLY ADVANTAGEOUS, (4) THE PROBLEMS IN CONTROL AND APPLICATION BROUGHT ABOUT BY THEIR USE, (5) THE PROBLEMS OF PREPARING ADEQUATE PURCHASE SPECIFICATIONS, AND (6) RESEARCH UNDER WAY TO PRODUCE EVEN BETTER AND MORE RELIABLE ADMIXTURES ECONOMICALLY.

Am Soc Testing & Mats Spec Tech Publ 1959

2A 212707

TESTS OF CERTAIN CEMENTS AND CEMENT BLENDS, REGARDING THEIR SUITABILITY FOR CONCRETE CONSTRUCTION

LABORATORY TESTS WERE PERFORMED ON MIXES CONTAINING UNIVERSAL ATLAS PORTLAND CEMENTS, STATE LINE

FLY-ASH, AND LOUISVILLE NATURAL CEMENT. THESE TESTS WERE CONDUCTED TO COMPARE CERTAIN PHYSICAL AND CHEMICAL PROPERTIES OF CONCRETE MADE WITH TYPE I AND TYPE II PORTLAND CEMENTS WITH CONCRETE MADE WITH SUCH PORTLAND CEMENTS AND FLY-ASH AND NATURAL CEMENT SUBSTITUTED FOR A PORTION OF THE PORTLAND CEMENT. THIS COMPARATIVE TEST DATA WAS DESIRED TO AID IN SELECTING THE PROPER TYPE OF PORTLAND CEMENT OR BLEND TO BE USED IN THE CONSTRUCTION OF ROADS, STRUCTURES, AND SEWERS AND SEWAGE TREATMENT PLANTS IN THE CHICAGO AREA. THE FOLLOWING TESTS WERE PERFORMED: COMPRESSION TEST, FREEZING AND THAWING TEST, VOLUME CHANGE TEST, ABRASION TEST, HEAT OF HYDRATION, SODIUM SULFATE TEST AND SULFURIC ACID TEST. THE BLENDED CEMENT MIXTURES WERE NOT ANY MORE ADVERSELY AFFECTED BY LOWER CURING TEMPERATURES THAN THE TYPE I AND TYPE II PORTLAND CEMENT MIXES TESTED. BLENDED CEMENT MIXTURES SIMILARLY CURED COMPARED FAVORABLY WITH STRAIGHT PORTLAND CEMENT EXCEPT AT EARLY AGES. A MANDATORY REQUIREMENT FOR PRODUCING CONCRETE RESISTANT TO THE ATTACK OF FREEZING AND THAWING WAS A SUFFICIENT AMOUNT OF PURPOSEFUL AIR-ENTRAINMENT. FLY-ASH WAS SHOWN TO HAVE A HEAT EVOLUTION CONSIDERABLY LESS THAN THE PORTLAND AND NATURAL CEMENTS. USING FLY-ASH AS AN ADMIXTURE, HOWEVER, INCREASES THE HEAT PRODUCING MATERIAL IN THE MIXTURE SO THAT MORE HEAT IS PRODUCED IN HYDRATING. CEMENT BLENDS OF TYPE I PORTLAND CEMENT WITH FLY-ASH OR NATURAL CEMENT PROVE TO BE MORE RESISTANT THAN MIXES MADE ENTIRELY OF STRAIGHT TYPE I PORTLAND CEMENT IN THE SODIUM SULFATE TEST. THE SULFURIC ACID TEST RESULTS CORROBORATE THE FINDINGS OF THE SODIUM SULFATE TEST. IT IS CONCLUDED THAT CONCRETE CONTAINING TYPE I PORTLAND CEMENT AND SUFFICIENT AIR-ENTRAINMENT SATISFIES THE COMPRESSION STRENGTH AND RESISTANCE OF FREEZING AND THAWING REQUIREMENTS AND PROVIDES SUFFICIENT EARLY STRENGTH TO PERMIT THE PAVEMENT TO BE OPENED TO TRAFFIC AT THE EARLIEST POSSIBLE TIME. WHEN THERE IS NO GREAT URGENCY TO OPEN HIGHWAYS TO TRAFFIC, AND EARLY STRENGTH REQUIREMENTS ARE NOT REQUIRED, A BLENDED MIX OF TYPE I PORTLAND CEMENT AND FLY-ASH MAY BE MORE ECONOMICAL.

Chicago Conf Com On Concrete Tests June 1953

2A 212798

THE USE OF STABILIZED PULVERIZED FUEL ASH IN ROAD CONSTRUCTION. A LABORATORY INVESTIGATION
THE REPORT IS DIVIDED INTO FOUR PARTS CONSISTING OF A STUDY OF THE VARIATION IN THE PHYSICAL AND CHEMICAL PROPERTIES OF PULVERIZED FUEL ASH, AN INVESTIGATION OF THE USE OF MIXTURES OF LIME AND P.F.A. AS STABILIZING AGENTS FOR NATURAL SOILS, AN ASSESSMENT OF THE SUITABILITY OF P.F.A. FOR STABILIZATION WITH LIME OR CEMENT, AND AN EXAMINATION OF THE SELF-HARDENING PROPERTIES OF P.F.A. THE INVESTIGATIONS SHOW THAT PULVERIZED FUEL ASH IS SUITABLE FOR USE IN THE CONSTRUCTION OF ROAD BASES AND SUBBASES. IT IS A CHEAP AND READILY AVAILABLE MATERIAL AND ITS USE WILL HELP TO REDUCE THE DEMAND FOR NATURAL AGGREGATE IN GREAT BRITAIN AND AT THE SAME TIME ELIMINATE THE DISPOSAL PROBLEMS THAT ARE ENCOUNTERED AT POWER STATIONS. /RRL/A/

Sherwood, PT Ryley, MD
Ministry of Transport, London /UK/ 1966

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 212808

INCREASED STRENGTH IN CEMENT CONCRETE REINFORCED WITH VARIOUS FIBRES, WITH PARTICULAR REFERENCE TO USE IN ROAD CONSTRUCTION. FIRST EXPERIMENTAL RESULTS

LABORATORY EXPERIMENTS WERE CARRIED OUT USING STEEL, NYLON OR ASBESTOS FIBRE. TABLES SHOW THE CALCULATED AND TESTED FLEXURAL AND COMPRESSIVE STRENGTHS OF THE REINFORCED CONCRETES AS COMPARED WITH THOSE OF PLAIN CONCRETE OF SIMILAR COMPOSITION. AFTER TESTING TO DESTRUCTION BY FLEXURAL LOADS, RESULTS OF THE EXPERIMENTS SHOWED THAT STEEL FIBERS TENDED TO INCREASE FLEXURAL STRENGTH, NYLON WAS USELESS BECAUSE OF INSUFFICIENT ADHESION TO THE MORTAR, THE FIBERS BEING EASILY EXTRACTABLE FROM THE BROKEN SAMPLES, AND ASBESTOS FIBERS HAD VERY LOW TENSILE STRENGTH BUT GOOD ADHESION TO THE MORTAR. IN INITIAL TESTS, FIBERS WERE USED IN THE FOLLOWING PROPORTIONS: 0.3 MM DIAMETER STEEL IN PIECES 2 CM LONG COMPRISING 4 PER CENT BY WEIGHT OF THE DRY MIX, 100/1 NYLON FIBRE IN PIECES 2 CM LONG COMPRISING 0.5 PER CENT BY WEIGHT OF THE DRY MIX, AND SHORT LOOSE ASBESTOS FIBERS COMPRISING 0.5 PER CENT BY WEIGHT OF THE DRY MIX. SOME RESULTS OF TESTS WITH GLASS AND SOFT IRON FIBERS ARE ALSO GIVEN. FURTHER LABORATORY TESTS AND PRACTICAL TESTS ON ROADS, VARYING THE AMOUNT AND SIZE OF THE FIBERS, ARE ENVISAGED. /RRL/

Balzano, M *Le Strade /Italy/* Feb. 1967

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 212853

EVALUATION OF PLASTICIZERS AND AIR-ENTRAINING AGENTS FOR USE IN CEMENT MORTAR AND CONCRETE

A NUMBER OF PROPRIETARY ADMIXTURES, WHICH HAVE HELPED IN DISPERSING CEMENT PARTICLES OR FLOCCULATING THE SAME, HAVE BEEN USED IN CONCRETE CONSTRUCTION TO IMPROVE THEIR QUALITY, STRENGTH AND DURABILITY. FOUR TYPES OF IMPORTED PLASTICIZERS AND FIVE DIFFERENT AIR ENTRAINING AGENTS HAVE BEEN STUDIED WITH A VIEW TO IMPROVE THE WORKABILITY AND STRENGTH OF CEMENT MORTAR AND CONCRETE. EFFICACY OF INDIGENOUSLY MADE AIR ENTRAINING AGENTS WITH RESPECT TO IMPORTED ONES HAS BEEN COMPARED. THE STUDY HAS REVEALED THAT BY INCORPORATION OF PLASTICIZERS IN CEMENT MORTAR AND CONCRETE, THERE WAS A DEFINITE IMPROVEMENT IN STRENGTH. AIR ENTRAINED CONCRETE GENERALLY EXHIBITED LOW STRENGTH BUT BY SUITABLE ADJUSTMENT OF SAND: AGGREGATE RATIO, IT WAS POSSIBLE TO COUNTERACT THE LOSS OF STRENGTH AND OBTAIN HIGH COMPRESSIVE AND FLEXURAL STRENGTHS IN COMPARISON TO PLAIN CONCRETE MIXES. /CRIC/FESR/LCPC/RRL/A/

Pais-cuddou, IC Rawal, AC *Intl Symp Admix Mortar & Concr /Eng/* 1967

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 213008

REGULATIONS FOR REINFORCED, AND PRESTRESSED LIGHTWEIGHT AGGREGATE CONCRETE IN VARIOUS COUNTRIES

THE SPECIFICATIONS AND RECOMMENDATIONS VALID IN VARIOUS EUROPEAN COUNTRIES, GREAT BRITAIN AND THE U.S.A ARE DISCUSSED. THESE RELATE TO COMPOSITION OF LIGHTWEIGHT CONCRETE, PROPERTIES OF LIGHTWEIGHT CONCRETE, DESIGN OF STRUCTURAL MEMBERS AND RECOMMENDATIONS FOR SPECIFIC MEMBERS. /RRL/

Wesche, K
Cement & Concrete Assoc, London /UK/ May 1968

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 213172

SYNTHETIC RESINS IN CONSTRUCTION. RILEM SYMPOSIUM, PARTS, 4-6 SEPTEMBER 1967 (VOLUME 1)
 "SYNTHETIC RESINS IN CONSTRUCTION" WAS THE THEME AT THE RILEM SYMPOSIUM IN PARIS, FRANCE IN SEPTEMBER 1967. SEVENTEEN PAPERS WERE PRESENTED ON THE THEME "CONCRETE AND MORTARS: IMPROVEMENT BY THE ADDITION OF RESINS" AND EIGHTEEN ON THE TOPIC "CONCRETES AND MORTARS WITHOUT CEMENT". /LCPC-RRL/

Editions Eyrolles /France/ Vol. 1 1970, 475 pp, Figs, Tabs, Photos, Refs

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

2A 213178

EMISSION OF HEAT BY CONCRETE

THE FOLLOWING TOPICS ARE DEALT WITH IN THE BOOK: IMPORTANCE OF THE HEAT EMITTED BY CONCRETE IN CONSTRUCTION AND PREFABRICATION, CHEMICAL AND PHYSICAL PHENOMENA OCCURRING SIMULTANEOUSLY WITH CEMENT HYDRATION, EQUATIONS GOVERNING HYDRATION AND HEAT EMISSION, ANALYSIS OF THESE EQUATIONS, CONTROL OF THEORETICAL PRINCIPLES AND CONSEQUENCES, CALORIMETERS USED TO MEASURE THE HYDRATION HEAT OF CEMENT, CALORIMETERS FOR CONCRETE, HEAT EMITTED BY PORTLAND CEMENT AS A FUNCTION OF ITS CHEMICAL AND MINERALOGICAL COMPOSITION, HEAT EMITTED BY OTHER TYPES OF CEMENT, INFLUENCE OF THE FINENESS OF GRINDING AND CALCIUM SULPHATE, INFLUENCE OF THE MIX-DESIGN OF CONCRETE ON THE HEAT EMITTED, ROLE OF THE TEMPERATURE IN THE HARDENING OF CONCRETE, ROLE OF ADMIXTURES, USE OF THE HEAT EMITTED DURING WINTER CONCRETING AND THERMAL TREATMENTS, SPECIFICATIONS FORCEMENT IN HIGH-DENSITY CONCRETE, MIX-DESIGN OF CONCRETE FOR DAM CONSTRUCTION, METHODS OF REDUCING SELF-HEATING OF CONCRETE. /IRF/

Zaporozets, ID Okorokov, DD Pariiskii, AA
 Izdatelstvolit Stroitelstvu /Ussr/ 1966, 300 pp, Figs, Tabs, 138 Ref

2A 213179

THERMAL TREATMENT OF CONCRETE

METHODS USED TO ACCELERATE THE SETTING AND HARDENING OF CONCRETE ARE OUTLINED. A STUDY IS MADE OF THERMAL TREATMENTS WITH PARTICULAR ATTENTION TO THE THERMOCHEMISTRY OF HYDRATION AND THERMAL CURING PROCESSES WHICH ACCELERATE SETTING BY RAISING THE TEMPERATURE OF THE BINDER. THE INFLUENCE OF THE HUMIDITY FACTOR IS CONSIDERED TOGETHER WITH THAT OF THE TEMPERATURE. ALL RESULTS ARE PRESENTED IN THE FORM OF NOMOGRAPHS. /IRRD-IRF/

Calleja, J
 Revista De Ciencia Aplicada /Spain/ No. 119, Dec. 1967, pp 481-92, 25 Fig, 1 Tab

2A 213194

INVESTIGATION OF THE IMPACT-TYPE CONCRETE TEST HAMMER

THIS WORK DESCRIBES A SERIES OF TESTS DESIGNED TO DETERMINE THE RELIABILITY OF RESULTS, THE FEASIBILITY OF USE, AND THE PRACTICAL APPLICATIONS OF THE TEST HAMMER IN CONSTRUCTION CONTROL. TEST RESULTS ARE COMPARED TO THE PUBLISHED FINDINGS OF OTHER INVESTIGATORS AND THE RELIABILITY OF CALIBRATION CURVES UNDER VARIOUS TEST CONDITIONS IS CAREFULLY INVESTIGATED. INDICATED STRENGTHS ARE SIGNIFICANTLY AFFECTED BY SPECIMEN SIZE, RESTRAINT OR CLAMPING IN TESTING MACHINE, SURFACE TEXTURE, MIX PROPORTIONS, AND TYPE OF AGGREGATE. COEFFICIENT OF VARIATION OVER A WIDE VARIETY OF SPECIMENS AVERAGE 18.8 PERCENT AND EXCEEDED 30 PERCENT FOR SOME GROUPS OF SPECIMENS. IT IS RECOMMENDED THAT SPECIAL CALIBRATIONS BE PROVIDED FOR EACH MIX OR CHANGE OF AGGREGATE,

AND THAT USE OF THE TEST HAMMER ON WEAK OR YOUNG CONCRETE BE KEPT TO A MINIMUM BECAUSE SUCH TESTING MAY PRODUCE SIGNIFICANT SURFACE BLEMISHES. /AUTHOR/

Mitchell, LJ Hoagland, GG *Highway Research Board Bulletin* 1961

2A 213202

COMPARISON OF TYPE I AND TYPE III PORTLAND CEMENTS FOR SOIL STABILIZATION

TEST DATA ARE PRESENTED WHICH INDICATE THE POSSIBILITY OF SIGNIFICANT ECONOMIC AND/OR STRUCTURAL ADVANTAGES IN USING TYPE III HIGH-EARLY-STRENGTH PORTLAND CEMENT INSTEAD OF TYPE I NORMAL PORTLAND CEMENT FOR SOIL-CEMENT ROAD CONSTRUCTION. THE DATA ALSO INDICATE THAT HIGH ALKALI CONTENT IN TYPE I CEMENT MAY BE BENEFICIAL TO THE STRENGTH OF CEMENT-TREATED SOIL IF THE SOIL CONTAINS A RELATIVELY HIGH PROPORTION OF CLAY-FREE QUARTZ SURFACES. TEST METHODS AND CRITERIA FOR EVALUATING THE STRENGTH AND DURABILITY OF CEMENT-TREATED FINE-GRAINED SOILS ARE PRESENTED AND DISCUSSED. THE MINIMUM TYPE I AND TYPE III CEMENT REQUIREMENTS FOR SOIL-CEMENT INDICATED BY THESE METHODS, FOR THE SANDY, SILTY AND CLAYEY SOILS STUDIED, WERE SURPRISINGLY LOW. /AUTHOR/

Davidson, DT Bruns, BW *Highway Research Board Bulletin* 1960

2A 213249

FLY ASH UTILIZATION

CONTENTS: OPENING REMARKS, GERARD C. GAMBS AVAILABILITY, QUALITY, AND PRESENT UTILIZATION OF FLY ASH. C. E. BRACKETT SPECIFICATIONS, LIMITATIONS, AND RESTRICTIONS, M. JACK SNYDER RAW MATERIALS FOR MANUFACTURE OF CEMENT, WILLIAM R. BARTON PRODUCING SPECIFICATION FLY ASH, HENRY C. SKAGGS PROBLEMS IN FLY ASH MARKETING, F. V. ZIMMER FLY ASH IN MASS CONCRETE, ROBERT E. PHILLEO FLY ASH IN READY-MIX CONCRETE, EDWARD J. HYLAND FLY ASH IN ROADWAY CONSTRUCTION, J. A. HESTER FLY ASH IN CONCRETE AND CONCRETE BLOCK MANUFACTURING, JOSEPH R. BELOT, JR. FLY ASH IN CONCRETE MANUFACTURING, JOHN SEABRIGHT LIME-FLY ASH-AGGREGATE MIXTURES, ERNEST J. BARENBERG THE UNITED NATIONS ECONOMIC COMMISSION FOR EUROPE AND ITS WORK IN THE FIELD OF THE UTILIZATION OF ASH PRODUCED BY THERMAL POWER PLANTS, ZYGMUNT FALECKI AN ATTEMPT TO EXPLAIN FRENCH SUCCESS IN THE UTILIZATION OF FLY ASH, ADOLPHE JARRIGE THE COMMERCIAL UTILIZATION OF PULVERIZED FUEL ASH FROM POWER STATIONS OF THE CENTRAL ELECTRICITY GENERATING BOARD, HENRY W. G. DEDMAN ASH PRODUCTION AND UTILIZATION IN THE GERMAN FEDERAL REPUBLIC, HERMANN ERYTHROPEL PRODUCTION AND UTILIZATION OF FLY ASH IN POLAND, ANTONI PAPROCKI FLY ASH IN CEMENTS AND CONCRETES, VLADIMIR V. STOLNIKOV EXPERIENCE IN PRODUCTION AND UTILIZATION OF LIGHTWEIGHT AGGREGATE AT CONSOLIDATED EDISON, ARTHUR S. PEARSON STATUS REPORT ON BRICKS FROM FLY ASH, H. E. SHAFER, JR. CONSUMER ECONOMICS: USE OF FLY ASH IN CONCRETE, LOU HOY FLY ASH IN AGRICULTURE, JOHN P. CAPP UTILIZATION OF FLY ASH IN THE CEMENTING OF WELLS, DWIGHT K. SMITH USE OF FLY ASH IN SPECIALIZED CONCRETE WORK, GEORG O. BERGEMANN, JR. FUTURE OF FLY ASH USE, GLYNN L. CORYELL ECONOMIC COMMISSION FOR EUROPE MEETING SUMMARY, HENRY W. G. DEDMAN NUCLEAR MEASUREMENT OF CARBON IN FLY ASH, ROBERT F. STEWART, WILLIAM F. FARRIOR, JR. ASTM SPECIFICATIONS ON FLY ASH FOR USE IN CONCRETE, RICHARD C. MIELENZ REACTIONS OF HYDRATED LIME WITH PULVERIZED COAL FLY ASH, L. JOHN MINNICK FLY ASH AND THE ELECTRIC UTILITY INDUSTRY, JOHN A. TILLINGHAST THE PUBLIC CONCERN FOR ENVIRONMENTAL IMPROVEMENT, KENNETH HOLM FLY ASH IN THE FUTURE, JOSEPH PURSGLOVE, JR.

Faber, JH Capp, JP Spencer, JD
Bureau of Mines /US/ 1967

2A 213342

GLASS FIBERS REINFORCE CONCRETE

LABORATORY TESTS ARE BEING CONDUCTED ON FYCRETE, A MATERIAL WHICH STRENGTHENS CONCRETE IN MUCH THE SAME WAY THAT GLASS FIBERS REINFORCE PLASTICS. THIS CONCRETE BUILDING MATERIAL SUBSTITUTES SMALL GLASS FIBER RODS FOR CONVENTIONAL STEEL REINFORCING BARS AND COULD SUBSTANTIALLY CUT THE COSTS OF ALL TYPES OF CONCRETE CONSTRUCTION. FLEXIBLE GLASS RODS ARE ADDED TO A BATCH OF CEMENT, AGGREGATE AND WATER AS AN INTEGRAL PART OF THE CONCRETE MIX. THE RODS ARE ABOUT AS LONG AS, BUT THINNER THAN A PIECE OF SPAGHETTI, CONSISTING OF 3,000 GLASS FIBER FILAMENTS EACH ONE-TENTH THE THICKNESS OF A HUMAN HAIR. THE FILAMENTS ARE BOUND TOGETHER WITH AN EPOXY RESIN. THEY ARE SAID TO HAVE SIX TIMES THE TENSILE STRENGTH OF MILD STEEL. ACCORDING TO THE INVENTOR, THE GLASS REINFORCING IS 55 PERCENT CHEAPER THAN STEEL, AND IN SIMPLY SUPPORTED BEAMS RESULTS IN MEMBERS THAT ARE ONLY 75 PERCENT AS DEEP AS NORMAL ONES. FYCRETE WILL RESIST THE CRACKING OCCURRING IN HIGHWAYS AND ROADWAYS WHICH FREEZE, THEN EXPAND AND CRACK.

Engineering News-record Jan. 1969

2A 213347

CONCRETE PERFORMANCE AS RELATED TO THE BEHAVIOR OF CARBONATE AGGREGATES

THE PROBLEM IS DISCUSSED OF FACTORS WHICH APPEAR TO BE ACTING TO DECREASE THE SERVICE PERFORMANCE OF CONCRETES MADE WITH PREVIOUSLY PROVED CARBONATE ROCKS. BOTH EXPANSIVE AND RIM-DEVELOPING CARBONATE ROCKS ARE BEING USED IN MISSOURI IN HIGHWAY CONSTRUCTION. SINCE GENERAL USE OF DE-ICING SALTS WAS STARTED, AN INCREASED AMOUNT OF CRACKING, WHICH APPEARS TO BE SIMILAR TO THAT ATTRIBUTED TO ALKALI-CARBONATE REACTIVITY, HAS BEEN OBSERVED IN PORTLAND CONCRETE CEMENT PAVEMENTS IN MISSOURI. EVIDENCE HAS BEEN PRESENTED OF EXCESSIVE EXPANSION OF CONCRETE CONTAINING AN UNAPPROVED COARSE AGGREGATE. ALTHOUGH INCREASED CRACKING IS OCCURRING, NO POSITIVE EVIDENCE OF SERIOUS REDUCTION IN SERVICE LIFE HAS BEEN OBTAINED. SINCE BOTH EXPANSIVE AND RIM-DEVELOPING CARBONATE ROCKS ARE BEING USED, THEIR PERFORMANCE IN CONCRETE IS BEING CAREFULLY WATCHED FOR EVIDENCE OF INCREASED RATE OF DETERIORATION. CONSIDERABLE WORK IS BEING CONDUCTED TO DETERMINE (1) THE SOURCE AND AMOUNT OF EXPANSIVE ROCK BEING USED, AND (2) THE PROBLEMS THAT WOULD BE ENCOUNTERED IN CONTROLLING THEIR USE.

Axon, EO *Highway Geology Symposium, Iowa State U July 1968*

2A 213363

FYCRETE-A NEW CONCRETE BUILDING MATERIAL

A NEW BUILDING MATERIAL, FYCRETE, CONCRETE REINFORCED WITH GLASS FIBER RODS HAS BEEN DEVELOPED AND TESTED TO SHOW THAT IT IS 50% CHEAPER, SIX TIMES STRONGER IN TENSILE STRENGTH, AND MORE CRACK RESISTANT THAN CONVENTIONAL STEEL-REINFORCED CONCRETE. FYCRETE IS COMPOSED OF SMALL LENGTHS OF GLASS FIBER STRANDS, IMPREGNATED WITH RESIN AND CONCRETE. JOINTLESS HIGHWAYS AND AIRPLANE RUNWAYS, CRACK RESISTANT BOMB SHELTERS, AND RESERVOIRS THAT WITHSTAND FREEZING AND THAWING ARE CLAIMED TO BE POSSIBILITIES WHEN CONSTRUCTED WITH THIS NEW MATERIAL.

Concrete Construction Apr. 1969

2A 213376

HIGH-STRENGTH STRAND REINFORCEMENT FOR CONCRETE

A NEW THREE-WIRE STRAND, KNOWN AS BRISTRAND 100, HAVING A GUARANTEED 0.2% PROOF STRESS OF 100,000 LB/IN SQUARED, HAS BEEN DEVELOPED FOR USE AT A PERMISSIBLE WORKING STRESS OF 50,000 LB/IN SQUARES AS REINFORCEMENT IN NORMAL (I.E. NON- PRESTRESSED) CONCRETE CONSTRUCTION. THE DEVELOPMENT AND MANUFACTURE OF THE STRAND ARE EXPLAINED. DETAILS ARE GIVEN OF TESTS ON RECTANGULAR AND T-BEAMS REINFORCED WITH VARIOUS PERCENTAGES OF THREE-WIRE STRAND AND THE RESULTS OBTAINED ARE DISCUSSED AND COMPARED WITH THEORETICAL VALUES GIVEN BY A SUITABLE DESIGN METHOD. PARTICULAR ATTENTION IS PAID TO DEFLECTIONS AND CRACK WIDTHS, WHICH ARE OFTEN THE CRITICAL FACTORS CONTROLLING THE USE OF ULTRA-HIGH-STRENGTH STEEL AS REINFORCEMENT. /AUTHOR/

Abeles, PW Gill, VL *Concrete /UK/ Apr. 1969*

2A 213423

CONCRETE DETERIORATION IN BRIDGES

A SURVEY IS MADE OF CONCRETE DETERIORATION IN BRIDGES. RECOMMENDATIONS ARE MADE FOR REMEDIAL ACTION TO SUCH BRIDGES BY REQUIRING: (1) MINIMUM COVER OF 2 1/2 INCHES BE PROVIDED FOR THE TOP REINFORCING STEEL, (2) DESIGNS WITHOUT CURBS TO FACILITATE FLUSHING OF SALT FROM THE DECK BY RAIN AND/OR WATER TRUCKS, (3) A CEMENT FACTOR OF NOT LESS THAN 6 1/2 SACKS BE USED, (4) AIR ENTRAINMENT BE CONTINUED WITH INCREASED EMPHASIS GIVEN TO CONTROL OF THE AMOUNT AND DISTRIBUTION, (5) LINSEED OIL TREATMENTS BE APPLIED TO ALL NEW CONSTRUCTION BEFORE THE BRIDGE IS OPENED TO TRAFFIC, (6) DE-ICING SALTS NOT BE APPLIED TO STRUCTURES OR ADJACENT PAVEMENT DURING THE FIRST YEAR OF LIFE, (7) SPECIFICATIONS GOVERNING CONCRETE CONSTRUCTION BE REVISED TO INCLUDE THE RECOMMENDATIONS OF ACI COMMITTEE 605 ON HOT WEATHER CONCRETEING, (8) INCREASED ATTENTION BE GIVEN TO OTHER WELL KNOWN REQUIREMENTS FOR OBTAINING QUALITY CONCRETE, PARTICULARLY ON SUCH MATTERS AS WATER ADDED TO THE MIX AND TO THE SURFACE BY ANY MEANS, AND (9) THE TRAINING LEVEL OF INSPECTORS BE INCREASED.

Yantis, CW *Oklahoma Highway & Street Conf Proc pp 17-24, Feb. 1967*

2A 213444

PREPLACED AGGREGATE CONCRETE FOR STRUCTURAL AND MASS CONCRETE

USES ARE OUTLINED OF THIS METHOD OF PREPLACED AGGREGATE CONCRETE CONSTRUCTION. SELECTION IS DISCUSSED OF MATERIALS AND GROUT MIX PROPORTIONING. RECOMMENDATIONS FOR FORM PREPARATION, AGGREGATE PLACING, ARRANGEMENT OF PIPING, GROUT PUMPING AND SEQUENCE OF INJECTION, FINISHING, CURING, AND METHODS OF QUALITY CONTROL ARE MADE. FUNDAMENTALS OF GOOD PRACTICE IN PREPLACED AGGREGATE CONSTRUCTION ARE RECOMMENDED BY WHICH, UNANTICIPATED PROBLEMS CAN BE REMEDIED OR AVOIDED. /ACIJP/

Am Concrete Inst Journal & Proceedings Oct. 1969

2A 213529

PLASTIC SHRINKAGE

PLASTIC SHRINKAGE AND PLASTIC SHRINKAGE CRACKING SOMETIMES OCCUR IN THE EXPOSED SURFACE OF FRESHLY-PLACED CONCRETE. THIS SHRINKAGE AND CRACKING IS CAUSED BY A RAPID EVAPORATION OF WATER FROM THE SURFACE OF THE CONCRETE. CONDITIONS THAT DETERMINE THE RATE OF EVAPORATION ARE DESCRIBED. CONSTRUCTION PROCEDURES AND PRACTICES THAT CAN MINIMIZE THE CAUSES OF THIS TYPE OF SHRINKAGE AND CRACKING

ARE RECOMMENDED. SPECIFIC CASES CITED SHOW HOW APPLICATION OF THESE PROCEDURES HAS SOLVED THE PROBLEM. IT IS BELIEVED THAT THE RECOMMENDED CORRECTIVE MEASURES WILL SOLVE THE PROBLEM OF PLASTIC SHRINKAGE AND PLASTIC SHRINKAGE CRACKING ON CONSTRUCTION PROJECTS. /PCA/

Lerch, W *Portland Cement Assoc R & D Lab Bull No 81*

ACKNOWLEDGMENT: Portland Cement Assoc R & D Lab Bull, No 228, July 1969

2A 213683

RESEARCH ON CONCRETE

PROBLEMS OF RESEARCH IN CONCRETE AND CEMENT ARE CRITICALLY CONSIDERED BECAUSE OF THE PROFIT SQUEEZE EXISTING IN THE INDUSTRY. A PROGRAM OF RESEARCH AND DEVELOPMENT IS ADVOCATED, CARRIED OUT IN WIDELY SEPARATED PLACES, BY PEOPLE OF DIFFERENT BACKGROUNDS, FOR CONTRIBUTING ULTIMATELY TO A UNIFIED UNDERSTANDING OF CONCRETE. THE FUTURE OF THE CONCRETE INDUSTRY DEPENDS TO A LARGE DEGREE ON THE SUCCESS OF MATERIALS SCIENTISTS USE IN FILLING THE GAPS IN KNOWLEDG RELATING TO THE FUNDAMENTAL NATURE, CONSTITUTION, MICROSTRUCTURE, FABRIC, AND EVOLUTION OF THE SYSTEM KNOWN AS CONCRETE. EVERY MAJOR CONSTRUCTION CONTRACT OF THE U. S. ARMY CORPS OF ENGINEERS CONTAINS A VALUE-ENGINEERING INCENTIVE CLAUSE THAT INVITES THE CONTRACTOR TO COME TO THE CONTRACTING OFFICER WITH PROPOSALS BY WHICH CHANGES WILL BE MADE IN THE SPECIFICATIONS TO INCREASE THE CONTRACTOR'S PROFIT AND DECREASE THE CONTRACT PRICE. IT IS POINTED OUT THAT CONCRETE CAN BE AND HAS BEEN PRODUCED SO THAT IT HAS A UNIT WEIGHT, HARDENED, OF AS LOW AS 10 LB/CU FT OR AS HIGH AS 300 LB/CU FT, SO THAT IT HAS NO MEASUREABLE PERMEABILITY TO WATER UNDER A WATER PRESSURE OF SEVERAL HUNDRED PSI OR SO THAT WATER FLOWS THROUGH IT AS THROUGH LOOSE SAND, SO THAT IT HAS AN ULTIMATE COMPRESSIVE STRENGTH OF LESS THAN 50 PSI OR AS MUCH AS 25,000 PSI, AND WITH COMPARABLE EXTREME RANGES OF NUMEROUS OTHER PROPERTIES. NO WAY IS NOW KNOWN BY WHICH SOME OF THESE EXTREMES CAN BE ATTAINED SIMULTANEOUSLY IN THE SAME CONCRETE. FOR EXAMPLE, NO WAY IS KNOWN TO HAVE VERY LIGHTWEIGHT CONCRETE ALSO BE OF VERY HIGH STRENGTH. RESEARCHERS SHOULD BE LEARNING WHAT HAPPENS WHEN CEMENT AND WATER ARE MIXED, WHY CEMENT PASTE HARDENS, WHY CEMENT PASTE CHANGES VOLUME ON DRYING, WHAT HAPPENS AT THE BOUNDARY BETWEEN CEMENT PASTE AND AGGREGATE, HOW WATER MOVES A CONCRETE, AND HOW CAN CEMENT BE MADE MORE ECONOMICALLY. RESEARCH NEEDS TO DEVELOP MORE ACCURATE PROCEDURES OF ANALYSIS OF HARDENED CONCRETE TO ESTABLISH THE ORIGINAL PROPORTIONING OF CEMENT AND WATER. THERE IS NEED FOR RELIABLE DETERMINATION OF ORIGINAL WATER-CEMENT RATIO. HOWEVER, IT IS EMPHASIZED THAT RESEARCHERS SHOULD AVOID THE TENDENCY TO BELIEVE THAT MERELY USING A NEW PIECE OF GEAR OR EQUIPMENT WILL SOLVE PROBLEMS. IT IS POINTED OUT THAT IN THE DECADE FROM 1956-65, THE CORPS OF ENGINEERS REALIZED SAVINGS IN COST OF CIVIL WORKS CONSTRUCTION AS RESULT OF RESEARCH, OF MORE THAN FIVE TIMES THE COST OF THAT RESEARCH. CONCRETE RESEARCH HAS AN INCREASINGLY IMPORTANT ROLE TO PLAY IN PROVIDING THE KNOWLEDGE THAT WILL PERMIT SOCIETY TO PROVIDE PAVEMENTS AND OTHER CONCRETE STRUCTURES FOR PEOPLE AND TO REDUCE POLLUTION.

Mather, B
Maryland University 1969

2A 213688

INVESTIGATION OF CONCRETE IN SERVICE

AN ANALYSIS OF PROCEDURES, TECHNIQUES, AND EXAMPLES OF INVESTIGATION OF CONCRETE IN SERVICE IS

NEEDED BECAUSE OF THE INCREASING FREQUENCY WITH WHICH SUCH STUDIES ARE UNDERTAKEN AND BECAUSE NEW METHODS FOR ANALYSIS AND EVALUATION OF CONCRETE IN SERVICE HAS BEEN DEVELOPED RECENTLY. INVESTIGATION OF ANY SUBSTANTIAL FAILURE OF CONCRETE SHOULD BE UNDERTAKEN IN ACCORDANCE WITH AN AGREED-UPON SCOPE, OBJECTIVE, PLAN OF ATTACK, AND PROSPECTIVE TIME SCHEDULE. THE TWO MOST IMPORTANT OBJECTIVES OF THE EXAMINATION OF CONCRETE IN SERVICE ARE: (1) TO ESTABLISH THE PROBABLE NATURE AND EXTENT OF ACTUAL OR IMMINENT FAILURE, AND (2) TO CHOOSE APPROPRIATE REMEDIAL OR PROTECTIVE MEASURES. DIAGNOSIS OF REAL OR APPARENT FAILURE OR UNSATISFACTORY PERFORMANCE OF CONCRETE MAY BE UNDERTAKEN FOR SEVERAL REASONS: (1) CONCRETE INVOLVED IN UNSATISFACTORY PERFORMANCE MIGHT BE INVESTIGATED TO ESTABLISH THE ABILITY OF THE CONCRETE TO CONTINUE TO PERFORM UNDER ANTICIPATED CONDITIONS OF SERVICE, (2) STUDY TO IDENTIFY PROCESSES THAT HAVE CAUSED OR CONTRIBUTED TO UNSATISFACTORY PERFORMANCE, (3) DISCOVER ANY DEFECTS IN THE CONCRETE OR THE CONSTRUCTION THAT CONTRIBUTED TO THE UNSATISFACTORY CONDITION, (4) TO ESTABLISH REMEDIAL OR PROTECTIVE MEASURES THAT SHOULD BE APPLIED TO PROVIDE FOR CONTINUING SERVICE, AND (5) THE FIXING OF FINANCIAL OR LEGAL RESPONSIBILITY FOR THE FAILURE OR UNSATISFACTORY PERFORMANCE. IT IS HOPED THAT THIS CONFERENCE WILL PROVIDE GUIDANCE IN THE DEVELOPMENT OF MORE EFFECTIVE INVESTIGATIONS OF PERFORMANCE OF CONCRETE IN SERVICE.

Mielenz, RC *Highway Research Board Special Reports 1970*

2A 213717

STRENGTHS OF SULPHUR-BASALT CONCRETES

THE USE OF ELEMENTAL SULFUR IN STRUCTURAL MATERIALS IS ADVANCED BY DEMONSTRATING ITS VALUE IN BONDING HIGH-STRENGTH WELL-GRADED BASALT AGGREGATES TO FORM SULFUR-BASALT CONCRETES. SULFUR IS AN EXCELLENT BONDING AGENT, AND THE STRENGTH OF A THERMOPLASTIC SULFUR-AGGREGATE MIXTURE DEPENDS, TO A LARGE DEGREE, ON THE STRENGTH AND GRAIN-SIZE DISTRIBUTION OF THE AGGREGATE USED. SULFUR CONTENT OF SEVERAL MIXTURES WAS VARIED TO OBTAIN THE BEST WORKABILITY WITH A MINIMUM OF SULFUR IN EXCESS OF THAT NECESSARY TO FILL THE VOIDS. THE AVERAGE GRAIN SIZES AND GRAIN-SIZE DISTRIBUTION WERE ALSO VARIED TO DETERMINE THEIR EFFECTS ON STRENGTH. UNCONFINED COMPRESSION TESTS OF FORTY-FIVE 6-BY 12-INCH CYLINDERS YIELDED AVERAGE STRENGTHS OF 3,348 PSI TO 10,398 PSI. THE HIGHEST STRENGTH SINGLE CYLINDER WAS 10,717 PSI. THE CYLINDERS WERE TESTED FROM 24 HOURS TO SIX DAYS AFTER POURING; AFTER 24 HOURS THE RISE IN STRENGTH WAS VERY SLIGHT. FROM THE RESULTS OBTAINED IT APPEARS THAT SULFUR CAN BE A USEFUL CONSTRUCTION MATERIAL. /AUTHOR/

Crow, LJ Bates, RC
Bureau of Mines /US/ Mar. 1970

NTIS PB 190 649, 1P32211831

2A 213729

DISCUSSION OF REPORT OF COMMITTEE ON CHARACTER AND USE OF ROAD MATERIALS

AN EXTENSIVE INVESTIGATION WAS MADE OF ALUMINATE CEMENT IN THE LABORATORY. THE CYLINDERS WERE CURED IN MOIST AIR AND 24 HOUR STRENGTHS WERE COMPARED. TESTS SHOWED THAT A PEAKING OF STRENGTH AT THE END OF A FEW DAYS SEEMS TO BE CHARACTERISTIC OF ALL PLOTTED COMPRESSION TESTS OF BOTH CONCRETE AND MORTAR. IN THE MAJORITY OF CASES THE FRACTURE WAS THROUGH THE AGGREGATE EVEN AT VERY EARLY PERIODS, SO THAT IT IS POSSIBLE THAT WITH VERY STRONG AGGREGATES THE COMPRESSIVE STRENGTH OF THE CON-

CRETE WOULD BE HIGHER. DUE TO THE HIGH COST OF ALUMINATE CEMENT THE POSSIBILITY OF MIXING IT WITH PORTLAND CEMENT WAS MENTIONED. THE DIFFICULTY WITH THIS IS OBTAINING A UNIFORM MIXTURE. THE BOND WAS INVESTIGATED BETWEEN FRESH ALUMINATE CEMENT CONCRETE AND OLD PORTLAND CEMENT CONCRETE. RESULTS INDICATE THAT A GOOD BOND IS EASILY OBTAINED AND THE STRENGTH OF THE BOND WILL BE INCREASED BY PAINTING THE CONCRETE WITH NEAT ALUMINATE CEMENT. PATCHING WAS SUCCESSFULLY CONDUCTED WITH ALUMINATE CEMENT IN CONCRETE PAVEMENTS IN MICHIGAN. THE BEST RESULTS ARE OBTAINED WHEN NO EARTH OR OTHER COVERING IS APPLIED, THUS GIVING OPPORTUNITY FOR THE DISSIPATION OF HEAT. NO FAILURES OCCURRED WHERE THE CONCRETE WAS CURED BY THE SPRINKLING ONLY.

Morrison, RL *Highway Research Board Proceedings* 1926

2A 213731

CONCRETE AND CONCRETE AGGREGATES

THE SODIUM SULFATE TEST DESCRIBED IN THE U.S. DEPARTMENT OF AGRICULTURE BULLETIN IS DISCUSSED. AGGREGATES WHICH FAIL THIS TEST ARE USUALLY SOUND AND DURABLE AND SOME OF THESE AGGREGATES MAY MAKE CONCRETE OF SATISFACTORY DURABILITY. SEVERAL LABORATORIES ARE USING THE REPEATED FREEZING AND THAWING TESTS IN PREFERENCE TO THE SOUNDNESS TESTS. OTHER TYPES OF ACCELERATED TESTS FOR AGGREGATES ARE BEING STUDIED. AT PRESENT, THE ALTERNATE FREEZING AND THAWING TEST APPEARS TO BE THE BEST FOR DETERMINING THE DURABILITY OF CONCRETE TO WEATHERING. ATTENTION IS CALLED TO THE RAPID GROWTH IN THE USE OF THE CROSS-BENDING TEST AS A METHOD OF FIELD CONTROL OVER THE TRANSVERSE STRENGTH OF CONCRETE FOR ROAD CONSTRUCTION. THE DESIRABILITY OF ASCERTAINING THE EFFECT OF SHAPE AND SURFACE CONDITION OF THE CONSTITUENT AGGREGATE PARTICLES ON THE STRENGTH OF CONCRETE SEEMS TO BE A VERY IMPORTANT PROBLEM.

Withey, MO *Highway Research Board Proceedings* 1927

2A 213815

DURABILITY OF CONCRETE CONSTRUCTION

A BRIEF DISCUSSION IS PRESENTED OF THE PRINCIPAL FEATURES OF THE NATURE OF CONCRETE WHICH ARE OF IMPORTANCE IN DEVELOPING ITS DURABILITY. THE GREATEST DURABILITY PROGRESS SEEMS TO HAVE BEEN MADE IN CONNECTION WITH THE CEMENTITIOUS MATRIX OF CONCRETE, THE HARDENED CEMENT PASTE. IT SEEMS THAT SOMEWHAT LESS SUCCESS HAS BEEN EXPERIENCED IN SOLVING PROBLEMS OF AGGREGATES. THE DURABILITY OF CONCRETE IN VARIOUS CIRCUMSTANCES IS DETERMINED VERY LARGELY BY THE PHYSICAL AND CHEMICAL NATURE OF ITS COMPONENT PARTS. AN INTENSIVE DISCUSSION IS PRESENTED OF VOIDS SPACE, INCLUDING ENTRAPPED AIR BUBBLES, CAPILLARY CAVITIES, CEMENT GEL AND MACROPORES WHICH LEADS TO THE DISCUSSION OF POROSITY OF VARIOUS AGGREGATES, AND THE PERMEABILITY OF ACCEPTABLE AGGREGATES. IT IS SHOWN THAT THE SMALLER VOID SPACES IN AGGREGATE, LIKE THE CAPILLARIES IN CEMENT PASTE CAN, UNDER CERTAIN CIRCUMSTANCES, BECOME PARTIALLY OR WHOLLY FILLED WITH WATER. FREEZING OF THIS WATER CAN HAVE IMPORTANT CONSEQUENCES FOR THE DURABILITY OF AGGREGATE. THE DETERIORATION OF CONCRETE IN FREEZING AND THAWING CAUSED BY THE FREEZING OF WATER THEREIN IS DESCRIBED EXTENSIVELY. TABLES ARE PRESENTED ILLUSTRATING THE RESULTS OF CONTROLLED TESTS OF THE FREEZING BEHAVIOR. THE ROLE OF ENTRAINED AIR IN THIS DETERIORATION PROCESS IS DISCUSSED AND IT IS CONCLUDED THAT ENTRAINED AIR HAS LITTLE INTRINSIC EFFECT ON THE ABSORPTION OR PERMEABILITY OF CONCRETE. THE FREEZING OF FRESH CONCRETE AND THE FROST RESISTANCE AFFORDED BY ENTRAINED AIR IS ILLUSTRATED, TOGETHER WITH TEST

PROCEDURES FROM FROST RESISTANCE AND FREEZING AND THAWING TESTS OF CONCRETE. FIVE DIFFERENT TYPES OF CEMENT ARE DESCRIBED IN RELATION TO THE PROBLEMS OF FREEZING AND THAWING. DETERIORATION OF CONCRETE IN PAVEMENTS BRIDGES, AND OTHER STRUCTURES, DUE TO EXPANSIVE REACTION BETWEEN CONSTITUENTS OF SOME AGGREGATE AND ALKALIES FROM CEMENTS IS DISCUSSED. PHOTOGRAPHS SHOWING ADVANCED CASES OF CRACKING CONCRETE STRUCTURES CAUSED BY ALKALI-SILICA REACTION, AS WELL AS METHODS FOR AVOIDING ALKALI-SILICA EXPANSION ARE SHOWN AND DISCUSSED.

Woods, H
American Concrete Institute 1968

ACKNOWLEDGMENT: Am Concrete Inst Journal & Proceedings

2A 213838

INTERNAL ELECTRICAL CURING OF PRESTRESSED CONCRETE

THE EFFECTS OF ELECTRICAL CURING ON THE BOND STRENGTH BETWEEN CONCRETE AND PRESTRESSING STRANDS IS STUDIED TO DETERMINE IF FULL SCALE PRECAST PRESTRESSED CONCRETE BEAMS COULD BE PRODUCED UNDER PLANT CONDITIONS. THE TEST DATA INDICATE THAT THE INTERNAL ELECTRICAL CURING METHOD DOES NOT ADVERSELY AFFECT THE QUALITY OF THE CONCRETE NOR THE STRENGTH OF PRESTRESSED CONCRETE BEAMS. NONE OF THE TESTS HAVE REVEALED ANY ADVERSE EFFECTS CAUSED BY INTERNAL ELECTRICAL CURING WHICH WOULD RESTRICT THE USE OF THE METHOD. THE TESTS ALSO INDICATE THAT THE METHOD IS AN EFFECTIVE AND ECONOMIC METHOD FOR CURING CONCRETE. THE FLEXIBILITY OF THE HEAT OUTPUT MAKES THE METHOD ADAPTABLE TO MANY FIELD CONDITIONS INCLUDING OUTDOOR WINTER CONSTRUCTION. /AUTHOR/

Chi, CT Barnoff, RM Cady, PD
Pennsylvania State University 235 pp, Jan. 1970

2A 213848

TTI STUDY EXPLORES DURABILITY OF STRUCTURAL LIGHTWEIGHT CONCRETE FOR HIGHWAY BUILDING

AS PART OF A PROGRAM OF SYNTHETIC AGGREGATE RESEARCH, THE TEXAS TRANSPORTATION INSTITUTE INVESTIGATED THE PHYSICAL, MECHANICAL, CHEMICAL, AND VOLUME CHANGE DURABILITY OF SIX STRUCTURAL LIGHTWEIGHT AGGREGATES HAVING AT LEAST 10 YEAR SERVICE RECORDS. ADDITIONAL, NON-COMMERICAL AGGREGATES WERE INCLUDED WHOSE PROPERTIES VARIED OVER A WIDER RANGE. TESTS INDICATED THAT THE AGGREGATES CONTINUE TO ABSORB WATER FOR LONG PERIODS AND HAVE TOTAL POROSITIES RANGING WIDELY AROUND 40%. THAT THE CONCRETE CAN BE MADE PHYSICALLY DURABLE IF THE AGGREGATE IS DRY WHEN INTRODUCED, THAT COARSE LIGHTWEIGHT AGGREGATES WILL ABRASE OVER A LONG PERIOD OF WEAR, AND THAT CERTAIN LIGHTWEIGHT AGGREGATES CAUSE DISRUPTIVE CONCRETE EXPANSIONS. CONCLUSIONS DRAWN FROM THESE RESULTS ARE: (1) LIGHTWEIGHT COARSE AGGREGATES MORE THAN 25% SATURATED AT MIXING TIME SHOULD NOT BE USED IN CONCRETE EXPOSED TO FREEZING AND THAWING; (2) AN ABRASION-RESISTANT SURFACE SHOULD BE USED ON SUCH CONCRETE EMPLOYED IN BRIDGE DECKS OR PAVEMENTS; (3) THE AGGREGATES SHOULD NOT BE USED IF CONCRETE PRISMS MADE WITH THE EXHIBIT, IN THE AUTOCLAVE EXPANSION TEST, MORE THAN 0.0015 STRAIN; AND (4) WHERE HYDRATION SHRINKAGE MAY BE A PROBLEM, UNRESTRAINED SHRINKAGE MIGHT BE USED TO PREDICT RESTRAINED SHRINKAGE STRESS FOR A WIDE RANGE OF CURING ENVIRONMENTS.

Ledbetter, WB Buth, E *Highway Research News, Hwy Res Board* 1970

2A 213862

AIR-ENTRAINED CONCRETES: A SURVEY OF FACTORS AFFECTING AIR CONTENT AND A STUDY OF CONCRETE WORKABILITY

AIR-ENTRAINED CONCRETES ARE USED EXTENSIVELY IN MODERN ROAD CONSTRUCTION AS THEY ARE ABLE TO RESIST DAMAGE BY FROST AND BY THE USE OF DE-ICING SALTS. VARIATIONS IN THE AMOUNT OF ENTRAINED AIR LEAD TO CHANGES IN CONCRETE WORKABILITY AND TO LOSS OF CONCRETE STRENGTH OR DURABILITY DEPENDING UPON WHETHER THERE IS AN EXCESS OR DEFICIENCY OF ENTRAINED AIR. RESULTS ARE GIVEN OF A SURVEY OF THE LITERATURE WHICH WAS MADE IN ORDER TO IDENTIFY THE FACTORS AFFECTING THE YIELD OF ENTRAINED AIR FROM A GIVEN AMOUNT OF ADMIXTURE; SUGGESTIONS ARE MADE FOR LIMITING THE INFLUENCE OF THE MORE IMPORTANT FACTORS ON SITE. THE EFFECT OF ENTRAINED AIR ON CONCRETE STRENGTH IS ALSO DESCRIBED. A STUDY OF THE EFFECT OF ENTRAINED AIR ON THE WORKABILITY OF VARIOUS CONCRETES AS JUDGED BY THE COMPACTING FACTOR TEST AND THE VEBE TEST IS DESCRIBED. THESE WORKABILITY STUDIES SHOWED THAT THE RELATION BETWEEN COMPACTING FACTOR AND VEBE VALUE DEPENDS MARKEDLY UPON THE AGGREGATE USED IN THE CONCRETE. /AUTHOR/

Cornelius, DF

Road Research Laboratory /UK/ 1970

2A 213902

CREEP OF CONCRETE: PLAIN, REINFORCED, AND PRESTRESSED

A COMPREHENSIVE REVIEW OF 1300 PAPERS AND REPORTS DEALING WITH THE CREEP OF CONCRETE IS PRESENTED. TOPICS DISCUSSED DEVELOP A STATE-OF-THE-ART PICTURE AS AN AID IN UNDERSTANDING THE MECHANISM OF CREEP, IN MAKING CONCRETE WITH DESIRED CREEP CHARACTERISTICS, IN PREDICTING THE CREEP UNDER ANY CONDITIONS, AND IN DEALING WITH CREEP IN DESIGN AND CONSTRUCTION. DATA ON CREEP AS A FUNCTION OF ALL KNOWN VARIABLES ARE PRESENTED. /AUTHOR/

Neville, AM

Elsevier Scientific Publishing Feb. 1971

2A 213910

CONCRETE CONSTRUCTION

THE FIRST ELEMENT IN QUALITY CONTROL OF CONCRETE CONSTRUCTION IS PRODUCT CONTROL BY THE CONTRACTOR, AND THE SECOND IS ACCEPTANCE OF THE PRODUCT BY THE OWNER AS PART OF THE COMPLETED WORK, ALTHOUGH THESE PHASES HAVE BEEN COMBINED IN PRACTICE. THE PROPERTIES OF CONCRETE REQUIRED BY SPECIFICATION ARE BASED ON AASHO, ASTM, CSA, OR OTHER RECOGNIZED STANDARDS. HOWEVER, IT IS UNCERTAIN WHAT VARIATIONS IN CONCRETE AND CONCRETE MATERIALS CAN BE TOLERATED BEFORE ADVERSE EFFECTS SHOW UP; THUS THE PERFECT CONCRETE QUALITY SPECIFICATION HAS YET TO BE WRITTEN. CONVENTIONAL TESTS AND INSPECTIONS CAN PROVIDE SATISFACTORY QUALITY ASSURANCE ON MOST JOBS. THE MAIN CHANGE IS IN THE MANNER THESE TESTS ARE INTERPRETED AND APPLIED THROUGH THE USE OF A STATISTICAL BASIS FOR THE ANALYSIS, EVALUATION, AND SPECIFICATION OF CONCRETE STRENGTH AS THE OVERALL CRITERIA FOR CONCRETE ACCEPTABILITY. THIS PERMITS THE PROPORTIONING OF CONCRETE TO MEET REQUIREMENTS WITHOUT REFERENCE TO SUCH SAFEGUARDS AS A FIXED CEMENT FACTOR, WITH CONSEQUENT COST SAVINGS. ALTHOUGH IDEALIZED STATISTICALLY BASED SPECIFICATIONS HAVE BEEN DEVELOPED, THEY ARE NOT YET FEASIBLE, AND FURTHER INVESTIGATIONS ARE BEING MADE.

Smith, P *Highway Research Board Special Reports* 1971

2A 214003

RECOMMENDED PRACTICE FOR HOT WEATHER CONCRETING: PROPOSED REVISION OF ACI 605-59

CONCRETE MIXED, TRANSPORTED, AND PLACED UNDER CONDITIONS OF HIGH TEMPERATURE, LOW HUMIDITY, OR WIND, REQUIRES AN UNDERSTANDING OF THE EFFECTS SUCH ENVIRONMENTAL FACTORS HAVE ON CONCRETE PROPERTIES AND CONSTRUCTION OPERATIONS. WHEN THESE FACTORS ARE UNDERSTOOD, MEASURES CAN BE TAKEN TO ELIMINATE OR MINIMIZE UNDESIRABLE EFFECTS. THIS RECOMMENDED PRACTICE DEFINES HOT WEATHER, LISTS POSSIBLE UNFAVORABLE EFFECTS AND RECOMMENDS PRACTICES INTENDED TO MINIMIZE THEM. AMONG THESE RECOMMENDATIONS ARE SUCH IMPORTANT MEASURES AS PRECOOLING INGREDIENTS, LIMITATIONS OF CONCRETE TEMPERATURE AS PLACED, LENGTH OF HAUL, FACILITIES FOR HANDLING CONCRETE AT THE SITE, AND SPECIAL PLACING AND CURING TECHNIQUES. /AUTHOR/

Wescott, WF *Am Concrete Inst Journal & Proceedings* July 1971

2A 214011

PROPOSED ACI STANDARD-RECOMMENDED PRACTICE FOR CURING CONCRETE

CURING IS DEFINED AS THE PROCESS OF MAINTAINING A SATISFACTORY MOISTURE CONTENT AND A FAVORABLE TEMPERATURE IN CONCRETE DURING HYDRATION OF THE CEMENTITIOUS MATERIALS SO THAT DESIRED PROPERTIES OF THE CONCRETE ARE DEVELOPED. TWO SYSTEMS OF PROVIDING THE REQUIRED MOISTURE ARE EXPLAINED IN DETAIL: (1) MAINTAINING A MOIST ENVIRONMENT BY APPLICATION OF WATER; AND (2) PREVENTING LOSS OF MIXING WATER BY USE OF SEALING MATERIALS. BASIC PRINCIPLES OF SUCCESSFUL CURING ARE OUTLINED, AND COMMONLY ACCEPTED METHODS, PROCEDURES, AND MATERIALS ARE DESCRIBED. RECOMMENDATIONS ARE GIVEN FOR CURING PAVEMENTS AND OTHER SLABS ON GROUND; FOR STRUCTURES AND BUILDINGS; AND FOR MASS CONCRETE. FOR EACH OF THESE CATEGORIES, METHODS, MATERIALS, TIME AND TEMPERATURE OF CURING ARE RECOMMENDED. BRIEF SECTIONS COMMENT ON CURING REQUIREMENTS FOR PRECAST PRODUCTS, SHOTCRETE, PRE-PLACED AGGREGATE CONCRETE, REFRACTORY CONCRETE, PLASTER, AND OTHER APPLICATIONS. /AUTHOR/

Oleson, CC *Am Concrete Inst Journal & Proceedings* Apr. 1971

2A 214049

CONCRETE WITHOUT COARSE AGGREGATE

TWO CASES WHERE COARSE AGGREGATE WAS ELIMINATED FROM CONCRETE AND SAND-CEMENT-MORTAR WAS USED FOR CONSTRUCTION ARE DESCRIBED. CONSTRUCTION SITES WERE LOCATED IN DESERT AREAS (NORTH AFRICA AND ARABIAN GULF) WHERE DUE TO THE SPECIAL CONDITIONS ELIMINATION OF COARSE AGGREGATE HELPED EXPEDITE CONSTRUCTION WHILE RESULTING IN ECONOMY. TWO NEW METHODS OF MEASURING THE CONSISTENCY OF SAND-CEMENT MORTAR ARE EXPLAINED. THESE METHODS HAVE THE ADVANTAGE THAT THEY CAN BE PERFORMED USING SMALL QUANTITIES OF SAND, I.E., 50-500 G (0.1-1.0 LB) AS COMPARED TO THE 10 KG (22 LB) THAT ARE REQUIRED FOR THE CONVENTIONAL SLUM TEST. /AUTHOR/

Stamatopoulos, AC Kotzias, PC *Am Concrete Inst Journal & Proceedings* Sept. 1971

2A 214056

USE OF CONCRETES CONTAINING ANTIFROST ADDITIVES DURING THE CONSTRUCTION OF BRIDGES /IN RUSSIAN/

THE EFFECT OF TEMPERATURE (DOWN TO -23 C) AND ANTI-FROST ADDITIVES CALCIUM AND SODIUM CHLORIDE ON THE HARDENING PERIOD, STABILITY, AND STRENGTH OF CONCRETES USED IN THE CONSTRUCTION OF BRIDGES AND WATER PIPES IN THE NORTHERN REGIONS OF THE USSR IS DISCUSSED. THE FROST-RESISTANCE AND STRENGTH OF THE

CONCRETES DEPENDS ON THE AMOUNT OF THE SALTS ADDED AND INCREASES WITH INCREASING SALT CONTENT UP TO 7.5% OF THE AMOUNT OF CEMENT USED, BUT THE USE OF THE SALT ADDITIVES IN AMOUNTS EXCEEDING 7.5% MAY HAVE A NEGATIVE EFFECT ON THE FROST-RESISTANCE OF THE CONCRETE AT LOW TEMPERATURES. TESTS REVEALED THAT THE STRENGTH OF CONCRETE BRIDGES AND PIPES CONSTRUCTED DURING THE PAST 10 YEARS VARIES BETWEEN 350 AND 500 KG (FORCE) /SQ. CM. /CA/

Kostyacy, PS *Chemical Abstracts, Beton I Zhelezobeton /Ussr/* Nov. 1971

2A 214066

POLYETHYLENE FOAM COATS CONCRETE FORMS

HIGH-DENSITY PE FOAM HAS JOINED REINFORCED POLYESTER IN THE FIELD OF CONCRETE FORMS. MITSUI PETRO-CHEMICAL INDUSTRIES LTD. OF TOKYO HAS JUST BROUGHT OUT NEW FORMS CONSISTING OF GALVANIZED STEEL, COATED WITH LOW-FOAMED HIGH DENSITY POLYETHYLENE. THE FORM WILL COME ONLY IN ONE RECTANGULAR SHAPE MEASURING APPROXIMATELY 2 BY 6 FT. AND 1/2 IN. THICK. EACH PANEL WEIGHS SLIGHTLY LESS THAN 22 LB. ACCORDING TO MITSUI, PE WAS CHOSEN FOR ITS DURABILITY IN HARSH CONDITIONS AND ITS HIGH RESISTANCE TO SHOCK. OTHER FEATURES OF THE FORMS INCLUDE EASY REMOVAL FROM CONCRETE, LOW MAINTENANCE WHILE IN STORAGE, SIMPLE HANDLING FOR TRANSPORT, AND PRODUCTION OF AN ATTRACTIVE SURFACE ON CONCRETE WITHOUT BASE TREATMENT BY MORTAR. THE PANELS CAN BE NAILED OR DRILLED LIKE PLYWOOD. THE DESIGNATED POLYPANEL WILL BE PRODUCED IN A NEW PLANT WITH AN OUTPUT OF 900,000 SQ. YD./YR. /MP/

Modern Plastics Aug. 1970

2A 214110

LIGHTWEIGHT CONCRETE

THE PAPERS PRESENTED HERE EMPHASIZE THE IMPORTANCE AND ACCEPTANCE OF STRUCTURAL LIGHTWEIGHT CONCRETE IN CONSTRUCTION. INFORMATION ON LOW DENSITY CONCRETES, SUCH AS TYPES AVAILABLE AND PROPERTIES, IS REFERENCED.

Am Concrete Inst Journal & Proceedings Vol. 68 No. 10, Oct. 1971, pp 795-98, 13 Ref

2A 214117

STANDARDIZATION AND TOLERANCES IN PRECAST CONCRETE CONSTRUCTION

FOR ANY COMPONENT, THE PRODUCTION PROCESS, THE NECESSARY DEGREE OF STANDARDIZATION AND THE SCALE OF ACTIVITY ARE INTERRELATED: THE DEGREE OF STANDARDIZATION RESTRICTS THE CHOICE OF PROCESS AND THE CAPITAL INVESTMENT REQUIRED, WHICH IN TURN DETERMINES THE MINIMUM SCALE OF OPERATION.

Griffiths, TJ
Building Research Station /UK/ 1967, 11 pp

NTIS AD 692032, 3P32222906

2A 214189

UNDER WATER CONCRETE CONSTRUCTION

UNDERWATER CONCRETE CONSTRUCTION IS CURRENTLY CARRIED OUT BY FOUR BASIC METHODS: TREMIE, BUCKET, GROUT-INTRUDED AGGREGATE, AND GROUTING. THIS ARTICLE SUMMARIZES THE PRESENT STATE OF THE ART, EVALUATES SIGNIFICANT NEW DEVELOPMENTS, AND INDICATES DIRECTIONS FOR FUTURE UTILIZATION TO OBTAIN MORE EFFECTIVE AND RELIABLE UNDERWATER CONSTRUCTION. /DOT/

Gerwick, BC *Mechanical Engineering* Vol. 94 No. 11, Nov. 1972, pp 29-34

2A 214192

CONCRETE SET CONTROL FOR VERTICAL SLIPFORMING

THE CONCRETE SETTING TIME CONTROL THAT CAN BE USED BY SET-CONTROLLING ADMIXTURES IS DESCRIBED. STUDIES WERE CONDUCTED ON SUCH PROJECTS AS THE GENTILLY NUCLEAR CENTER, GENTILLY, QUEBEC; THE INTERNATIONAL NICKEL STACK, SUDBURY, ONTARIO; THE HUSKY TOWER, CALGARY, ALBERTA; AND NUMEROUS CEMENT, WOOD CHIP AND FED SILOS IN THE UNITED STATES AND CANADA. THE CONCRETE SETTING TIME IS CORRELATED TO SLIPPING TIME AND RATE OF RISE OF THE SLIPFORM, WITH GUIDES TO ADMIXTURE TYPE AND DOSAGE, MIX PROPORTIONS, AND SUCH SUGGESTED PRACTICES.

Fisher, GH *Am Concrete Inst Journal & Proceedings* Vol. 69 No. 9, Sept. 1972, pp 556-61, 2 Fig, 2 Tab, 1 Phot

2A 214240

FIBROUS CONCRETE-CONSTRUCTION MATERIAL FOR THE SEVENTIES

PRACTICAL ASPECTS OF FIBROUS CONCRETE AS A CONSTRUCTION MATERIAL ARE EMPHASIZED. THE PAPERS COVERING THE STATE OF THE ART INCLUDE A REVIEW OF FIBROUS CONCRETE THEORY AND DISCUSSIONS OF THE VARIOUS CONSTITUENTS USED IN THE PRODUCTION OF THE MATERIAL. POTENTIAL APPLICATIONS OF FIBROUS CONCRETE IN THE PAVING FIELD ARE DISCUSSED AND ACTUAL FULL SCALE PLACEMENT OF PAVEMENT APPLICATIONS ARE REVIEWED. THIS CONFERENCE PROCEEDINGS CONTAINS MANY OF THE PAPERS PRESENTED AT THE MAY 1972 FIBROUS CONCRETE CONFERENCE SPONSORED BY THE U. S. ARMY CORPS OF ENGINEERS, CONSTRUCTION ENGINEERING RESEARCH LABORATORY (CERL). /HRIS/

Gray, BH Williamson, GR Batson, GB
Construction Eng Res Lab, Army Ce /US/ Conf Proc No. m-28, Dec. 1972, 246 pp

NTIS AD 756 384, 1P32229765

2A 214318

LABORATORY STUDY OF EFFECTS OF ENVIRONMENT AND CONSTRUCTION PROCEDURES ON CONCRETE PAVEMENT SURFACE

FINISHED PAVEMENT MUST NOT ONLY BE SMOOTH RIDING BUT MUST ALSO BE DURABLE, STRUCTURALLY SOUND, AND SAFE (PROVIDE AMPLE SKID RESISTANCE). TO THIS END, A STUDY WAS CONDUCTED TO DEVELOP IMPROVED CONSTRUCTION PRACTICES RELATED TO THE CONSOLIDATION, FINISHING, AND CURING OF CONTINUOUSLY REINFORCED CONCRETE PAVEMENTS (CRCP). A TOTAL OF 56 SIDEWALK SIZE SLABS WERE CAST IN CONTROLLED ENVIRONMENTAL ROOMS. PARAMETERS INVESTIGATED INCLUDED TYPES OF SUBBASE, METHOD OF CONSOLIDATION (VIBRATION), TYPE OF FINISH, TYPE OF CURING METHOD, AND CURING ENVIRONMENT. ALSO, THE SLABS WERE UTILIZED TO DETERMINE THE EFFECTS OF WIND ON THE EVAPORATION RATE OF WATER FROM THE SURFACE OF THE SLABS. THIS WAS ACCOMPLISHED BY GENERATING WIND OVER THE SURFACE OF THE SLABS. AFTER A 28-DAY CURING PERIOD THE SLABS WERE REMOVED FROM THEIR CURING ENVIRONMENT AND A MINIMUM OF THREE CORES WERE TAKEN FROM EACH. THE CORES WERE THE SUBJECT TO DIAGNOSTIC ANALYSES. AT THE CONCLUSION OF THE TESTS, THE DATA TAKEN FROM THE CORES ALONG WITH THE WATER LOSS MEASUREMENTS WERE REDUCED, TABULATED, ANALYZED, AND CURVES PLOTTED TO ILLUSTRATE THE RESULTS OBTAINED.

Wrbas, RO Ledbetter, WB Meyer, AH
Texas Transportation Institute Nov. 1972, 14 pp, 34 Fig, 15 Tab, 45 Ref

2A 214322

REHABILITATED AASHO TEST ROAD: PART 1--MATERIALS & CONSTRUCTION

THIS REPORT, WHICH IS THE FIRST OF A THREE-PART FINAL REPORT, GIVES A BRIEF RESUME OF THE AASHO ROAD TEST,

DESCRIBES THE RECONSTRUCTED TEST FACILITY, AND DISCUSSES THE MATERIALS AND THE CONSTRUCTION PROCEDURES THAT WERE USED TO REHABILITATE THE TEST FACILITY. NEW SUBBASE MATERIALS INTRODUCED UNDER RIGID PAVEMENT WERE CRUSHED STONE, GRAVEL, BITUMINOUS-AGGREGATE MIXTURE AND CEMENT-AGGREGATE MIXTURE, BUT THE ONLY NEW SUBBASE MATERIAL USED UNDER THE FLEXIBLE PAVEMENT WAS GRAVEL. EXCEPT FOR PORTLAND CEMENT CONCRETE, BASE MATERIALS SUCH AS SALVAGED CRUSHED STONE-SPECIAL, CRUSHED STONE, BITUMINOUS- AND CEMENT-AGGREGATE MIXTURES WERE SIMILAR TO THOSE USED IN THE ORIGINAL AASHO TEST ROAD. AS A SIDE STUDY, THE BITUMINOUS SURFACE WAS ALTERED IN SEVERAL TEST SECTIONS EITHER BY ADDING ASBESTOS TO OR BY SUBSTITUTING HYDRATED LIME AND KAOLIN CLAY FOR LIMESTONE DUST MINERAL FILLER.

Little, RJ Mckenzie, LJ Dierstein, PG
Illinois Dept of Transportation July 1973, 84 pp

**2A 214325
CRUSHED STONE SCREENINGS USED AS FINE AGGREGATE FOR CONCRETE**

BECAUSE OF THE SCARCITY OF NATURAL SAND DEPOSITS IN NORWAY, CRUSHED ROCK MATERIALS ARE USED AS AGGREGATES FOR CONCRETE ON SOME CONSTRUCTION SITES. TESTS ON CRUSHED STONE SCREENINGS EMPLOYED AS FINE AGGREGATE HAVE BEEN CARRIED OUT AT THE NORWEGIAN INSTITUTE OF TECHNOLOGY THE RESULTS OF WHICH ARE: 1) FOR A GIVEN WATER-CEMENT RATIO, CRUSHED STONE SCREENINGS REQUIRE A GREATER QUANTITY OF CEMENT PASTE THAN NATURAL SAND IN ORDER TO OBTAIN THE SAME CONCRETE CONSISTENCY; 2) CRUSHED STONE SCREENINGS CONTAIN A HIGHER PROPORTION OF FINES; 3) FOR CRUSHED STONE SCREENINGS THE FINE TO COARSE AGGREGATE RATIO SHOULD BE SLIGHTLY HIGHER THAN FOR NATURAL SAND; 4) WITH A HIGH WATER CEMENT RATIO CONCRETE CONTAINING CRUSHED STONE SCREENINGS IS COARSER AND MORE READILY SUBJECT TO BLEEDING THAN NATURAL SAND CONCRETE; 5) IF SUITABLE ROCK IS USED CRUSHED STONE CONCRETE STRENGTH CAN EXCEED THAT OF NATURAL SAND CONCRETE FOR A GIVEN WATER CEMENT RATIO. THIS APPLIES TO COMPRESSIVE AND TENSILE STRENGTH; AND, 6) IF WATER CEMENT RATIO IS HIGH AND THE PROPORTION OF AIR ENTRAINING AGENT SMALL, CRUSHED STONE CONCRETE HAS A LOWER RESISTANCE TO WEATHER THAN NATURAL SAND CONCRETE; IF THE WATER CEMENT RATIO IS LOW AND ENTRAINED AIR CONTENT IS BETWEEN 3 AND 6 PER CENT, NO DIFFERENCE IS OBSERVED.

Colbojensen, A *Nordisk Betong /Sweden/* Vol. 16 No. 2, 1972, pp 119-32, 9 Fig, 1 Tab, 4 Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/IRRD 202 670, 3C32235462

**2A 214327
RECOMMENDATIONS REGARDING ADDITIONS TO CONCRETE REGULATIONS TO EXTEND THEIR APPLICABILITY TO COVER STRUCTURAL LIGHTWEIGHT AGGREGATE CONCRETE COMPRISING EXPANDED CLAY**
THE RECOMMENDATIONS ARE INTENDED PURELY AS ADDITIONS TO CONCRETE REGULATIONS TO EXTEND THEIR APPLICABILITY TO COVER STRUCTURAL LIGHTWEIGHT AGGREGATE CONCRETE. THEY APPLY EXCLUSIVELY TO CONCRETE CONTAINING EXPANDED CLAY AS LIGHTWEIGHT AGGREGATE. THE RECOMMENDATIONS CONCERN THE MANUFACTURE AND HANDLING OF CONCRETE, DEFORMATION PROPERTIES, DESIGN OF STRUCTURES OF LIGHTWEIGHT AGGREGATE CONCRETE, AND COVER AGAINST AGGRESSIVE ENVIRONMENT.

Nordisk Betong /Sweden/ No. 4, 1971, pp 285-94, 3 Tab

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/IRRD 201 074, 3C32235467

**2A 214328
TEMPERATURE CHANGES AND THERMAL CRACKING IN CONCRETE PAVEMENTS AT EARLY AGES**

THE EFFECTS OF PAVEMENT DESIGN, CONCRETE MIX PARAMETERS AND ENVIRONMENTAL CONDITIONS UPON TEMPERATURE CHANGES AND UPON THE RISK OF THERMAL CRACKING IN CONCRETE PAVEMENTS AT EARLY AGES WERE EXAMINED. OF THE PARAMETERS CONSIDERED, THE ABSORPTIVITY OF THE CONCRETE SURFACE TO SOLAR RADIATION HAD THE MOST SIGNIFICANT EFFECT UPON TEMPERATURE CHANGES AT EARLY AGES. THE RISK OF THERMAL CRACKING DURING THE FIRST FEW DAYS WAS FOUND TO BE CLOSELY RELATED TO THE TIME OF DAY AND THE SEASON IN WHICH THE CONCRETE WAS PLACED, THE LENGTH OF THE PAVEMENT SLAB, AND THE COEFFICIENT OF THERMAL EXPANSION OF THE AGGREGATE USED IN THE CONCRETE MIX. /TRRL/

Hunt, JG
Cement & Concrete Assoc, London /UK/ R&d Rpt No. 424, Apr. 1972, 24 pp, 26 Fig, 2 Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/IRRD 203 015, 2C32235469

**2A 214337
SULFUR CONCRETE--A NEW CONSTRUCTION MATERIAL**
INVOLUNTARY LARGE SCALE PRODUCTION OF SULFUR AS A BYPRODUCT OF NATURAL GAS PRODUCTION HAS RESULTED IN RAPIDLY INCREASING CANADIAN INVESTORIES, THEY ARE EXPECTED TO REACH 22 MILLION TONS BY THE END OF 1975. WITH AN ASSURANCE OF LOW SULFUR PRICES DURING THE FORESEEABLE FUTURE IT IS NOW WORTHWHILE TO CONSIDER SULFUR CONCRETE FOR APPLICATIONS WHERE ITS UNIQUE PROPERTIES ARE ADVANTAGEOUS. THIS PAPER COMPARES THE PROPERTIES OF SULFUR CONCRETE WITH THOSE OF CONVENTIONAL CONCRETE AND DISCUSSES POSSIBLE ADVANTAGES AND DISADVANTAGES OF THIS NEW MATERIAL. SOME POSSIBLE AREAS OF APPLICATION ARE INDICATED. /AUTHOR/

Loov, RE Vroom, AH Ward, MA *Prestressed Concrete Institute Journal*
Vol. 19 No. 1, Jan. 1974, pp 86-95

**2A 214378
CALCRETE IN ROAD CONSTRUCTION**
THE COMPOSITION, DISTRIBUTION, ORIGIN, AND AGE OF SOUTH AFRICAN CALCRETES, ARE BRIEFLY REVIEWED AND A SIMPLE CLASSIFICATION SUITABLE FOR ENGINEERING USE DESCRIBED. METHODS OF SEARCHING FOR ECONOMIC CALCRETE DEPOSITS AND OF TESTING CALCRETES FOR ROAD-MAKING ARE CONSIDERED, AND IT IS CONCLUDED THAT SPECIAL METHODS OF LOCATING THESE MUST BE USED AND THAT PRECAUTIONS MUST BE TAKEN DURING TESTING IF THE BEST RESULTS ARE TO BE ACHIEVED. THE ENGINEERING PROPERTIES OF CALCRETES AND SPECIFICATIONS FOR CALCRETE ROADS ARE DEALT WITH IN SOME DETAIL. DEPENDING ON THEIR STAGE OF DEVELOPMENT, THESE MATERIALS RANGE IN PROPERTIES FROM THOSE OF AN ALMOST USELESS POWDER TO THOSE OF ROCK, AND THIS AND THEIR UNUSUAL COMPOSITION AND MODE OF FORMATION CAUSE THEM TO EXHIBIT UNUSUAL AND OFTEN BENEFICIAL PROPERTIES. DEPENDING ON THE ACTUAL STAGE OF DEVELOPMENT REACHED, CALCRETES CAN BE SUITABLE AND HAVE BEEN USED FOR ALL CLASSES OF ROAD MATERIAL, INCLUDING SURFACING CHIPS, BASE, SUBBASE, GRAVEL ROAD WEARING COURSES AND CONCRETE AGGREGATE. SOME OF THE USUAL SOIL CONSTANTS AND GRADING REQUIREMENTS CAN BE CONSIDERABLY RELAXED WHEN THESE MATERIALS ARE EMPLOYED AND SIGNIFICANT ECONOMIC BENEFIT CAN RESULT. /AUTHOR/

Also published in CSIR Reports, Number 286, 1971

Netterberg, F
National Institute for Road Research, South Africa 1971

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

2A 214394

CONCRETE FOR HIGHWAY PAVEMENTS

THIS PAPER IS PRESENTED IN TWO PARTS (PART 1, PROPERTIES OF HARDENED CONCRETE AND PART 2, AIR-ENTRAINED CONCRETE) AND DISCUSSES THE MIX DESIGN AND DURABILITY OF CONCRETE PAVEMENTS WITH SPECIAL REFERENCE TO THE EFFECTS OF DE-ICING SALTS. /TRRL/

Shacklock, BU

Surveyor-local Gov't Technology /UK/ Vol. 138 No. 4140, Oct. 1971, pp 48-50, 3 Phot, 11 Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

2A 214405

THE VALUE OF INSULATED FORMS FOR WINTER BRIDGE CONSTRUCTION

NEW YORK STATE IS INVESTIGATING THE USE OF INSULATED FORMS FOR THE PROTECTION OF CONCRETE DURING THE WINTER CONSTRUCTION OF BRIDGES. THE CONCRETE USED IN THIS COLD WEATHER CONSTRUCTION IS FOR FOOTINGS, ABUTMENTS AND PIER BEAMS. AFTER AN EVALUATION OF THE FIELD TESTS A SPECIFICATION IS BEING WRITTEN FOR COLD WEATHER CONCRETING.

Britton, HB *Highway Research Record, Hwy Res Board* 1963

2A 214412

ENGINEERING PROPERTIES AND APPLICATIONS OF NUCLEAR EXCAVATIONS

THE USE OF NUCLEAR EXCAVATION FOR ENGINEERING PROJECTS DEPENDS NOT ONLY ON THE SIZE OF THE EXCAVATION BUT ALSO ON THE PROPERTIES OF THE MATERIAL IN AND AROUND THE EXCAVATION. IN A NUCLEAR EXCAVATION SEVERAL GENERAL ZONES ARE EVIDENT, INCLUDING THE TRUE AND APPARENT CRATER, CRATER FALLBACK AND LIP THROWOUT MATERIAL, GROUND UPHEAVAL, AND THE RUPTURE AND PLASTIC ZONES. THE PROPERTIES OF THE MATERIAL IN THESE ZONES ARE DEPENDENT ON ORIGINAL MEDIUM CHARACTERISTICS AND THE EFFECTS OF THE DETONATION. THE HYPERBOLIC SHAPE OF A CRATER LENDS ITSELF TO GOOD SLOPE STABILITY. THE PROBLEM OF SLOPE STABILITY IN SOILS OR HIGHLY WEATHERED ROCK WILL BE MORE ACUTE THAN IN COMPETENT ROCK. THE CONDITION OF THE RUPTURE ZONE, THE AMOUNT OF SURCHARGE ON THE CRATER LIP, AND GROUND SHOCK FROM LATER DETONATIONS IMPOSE ADDITIONAL PROBLEMS TO SLOPE STABILITY EVALUATION. THE FALLBACK MATERIAL WILL OBTAIN A CERTAIN AMOUNT OF DYNAMIC COMPACTION AS A RESULT OF THE MATERIAL FALLING FROM HEIGHTS OF SEVERAL HUNDRED FEET. FURTHER FOUNDATION STABILITY, IF NECESSARY, CAN BE ACCOMPLISHED BY STANDARD TECHNIQUES. SEVERAL APPLICATIONS OF NUCLEAR EXPLOSIVES IN THE HIGHWAY ENGINEERING FIELD APPEAR FEASIBLE, INCLUDING EXCAVATION OF ROADWAY CUTS, AGGREGATE PRODUCTION BY OPEN PIT MINING, DRAINAGE DIVERSION OR INTERCEPTION BY CRATERS, AND LANDSLIDE REMOVAL, ENCOURAGEMENT, OR STABILIZATION. THE FEASIBILITY OF USING LARGE-YIELD EXPLOSIONS FOR ENGINEERING PROJECTS HAS BEEN DEMONSTRATED IN THE U.S.S.R. DURING THE LAST 20 YR, MANY LARGE-YIELD CONVENTIONAL EXPLOSIVES HAVE BEEN USED FOR EXCAVATION, MINING, AND DAM CONSTRUCTION. /AUTHOR/

Circeo, LJ *Highway Research Record, Hwy Res Board* 1964

2A 214431

CONSTRUCTION OF SECTIONAL PAVEMENTS

DESIGN AND CONSTRUCTION METHODS FOR THREE TYPES OF PRE-FABRICATED PRESTRESSED CONCRETE PAVEMENT WERE DESCRIBED AND ILLUSTRATED. DEVELOPED IN THE USSR, THE PAVEMENTS HAVE SAND AND BITUMEN OR CEMENT STABILIZED BASES. THE PREFABRICATED CONSTRUCTION

METHOD WAS FOUND ECONOMICAL AND EFFECTIVE. IMPROVEMENTS SUGGESTED WERE DEVELOPMENT OF LIGHTWEIGHT SLABS HIGH PRESSURE GROUTING, ROTARY GRADERS, VACUUM-GRIP LAYING PLANT, AND MULTIPOINT WELDING EQUIPMENT.

Stepuro, NT *Automobil Nye Dorogi /Ussr/*

ACKNOWLEDGMENT: Highway Res Abstracts Hwy Res Board, Am Concrete Inst Journal & Proceedings

2A 214432

COMPACTION OF ASPHALTIC CONCRETE PAVEMENT WITH HIGH INTENSITY PNEUMATIC ROLLER-PART 2-DENSIFICATION DUE TO TRAFFIC

PART II OF THIS STUDY ENTITLED DENSIFICATION DUE TO TRAFFIC CORRELATES DENSITY OF BITUMINOUS PAVEMENTS AFTER CONSTRUCTION WITH PERFORMANCE AS EVIDENCED BY PROGRESSIVE DENSIFICATION AND DEPTH OF LONGITUDINAL GROOVES OR RUTS CAUSED BY TRAFFIC UP TO 36 MONTHS AFTER CONSTRUCTION. TEST SECTIONS, CONSISTING OF BITUMINOUS BINDER COURSE ONLY AND A SYSTEM OF BINDER AND WEARING COURSE WERE CONSTRUCTED ON FLEXIBLE AND RIGID BASES. THE TEST SECTIONS WERE COMPACTED TO VARIOUS INITIAL DENSITIES BY VARYING THE COMPACTIVE EFFORT, I.E., TIRE CONTACT PRESSURES AND NUMBER OF PASSES OF A PNEUMATIC ROLLER. PERIODIC SURVEYS MADE OF THE PAVEMENT DENSITY SHOW THAT REGARDLESS OF THE INITIAL DENSITY THE RATE OF DENSITY INCREASE IS GREATEST DURING THE FIRST SIX MONTHS THE PAVEMENT IS OPEN TO TRAFFIC AND THEN TENDS TO TAPER OFF AND STABILIZE. IT WAS ALSO FOUND THAT THE LEAST AMOUNT OF PROGRESSIVE DENSIFICATION TOOK PLACE IN TEST SECTIONS THAT HAD HIGH INITIAL DENSITIES. MEASUREMENTS OF DEPTH OF RUTTING IN THE TEST SECTIONS WERE MADE AFTER 36 MONTHS OF TRAFFIC. IN GENERAL, THE GREATEST AMOUNT OF WHEEL PATH RUTTING WAS NOTED IN SECTIONS COMPACTED AT LOW TIRE CONTACT PRESSURES AND THE LEAST AMOUNT WHEN COMPACTED AT HIGH CONTACT PRESSURES AND OPTIMUM NUMBER OF PASSES OF THE ROLLER. THE MAJORITY OF THE TEST SECTIONS, AFTER BEING OPENED TO TRAFFIC FOR 36 MONTHS, HAVE EQUALLED OR EXCEEDED THE LABORATORY DESIGN DENSITY AS DETERMINED BY THE 75 BLOW MARSHALL PROCEDURE, HOWEVER, NO SECTION HAS SHOWN EVIDENCE OF FLUSHING. RECOMMENDATIONS ARE MADE IN THE REPORT CONCERNING CONTACT PRESSURES TO BE USED FOR PNEUMATIC ROLLERS AND THE NUMBER OF PASSES TO BE REQUIRED FOR BITUMINOUS WEARING AND BINDER COURSE CONSTRUCTION. /BPR/

Adam, V

Louisiana Department Highways

ACKNOWLEDGMENT:

2A 214439

DETERMINATION OF STATISTICAL PARAMETERS FOR HIGHWAY CONSTRUCTION

THIS WAS A 2 YEAR PROJECT TO DETERMINE THE RANGE AND MAGNITUDE OF VARIATIONS OF MEASURED CHARACTERISTICS OF AGGREGATE, AGGREGATE BASE COURSES, PORTLAND CEMENT CONCRETE AND BITUMINOUS MIXTURES USED IN HIGHWAY CONSTRUCTION IN WEST. VA. DATA WAS OBTAINED FROM /1/ HISTORICAL RECORDS OF SATISFACTORILY CONSTRUCTED PROJECTS AND /2/ FROM STATISTICALLY DESIGNED EXPERIMENTAL PROJECTS OF CURRENT NORMAL CONSTRUCTION. THE AUTHORS ANALYZED THE DATA BY USE OF COMPUTERS AND CONCLUDED THAT /1/ THE AMOUNT OF SAMPLING AND TESTING COULD BE REDUCED IN SEVERAL INSTANCES, /2/ IMPROVED SAMPLING METHODS WOULD MATERIALLY DECREASE VARIATIONS OF MEASURED VALUES FOR SEVERAL CHARACTERISTICS, /3/ ANALYSIS OF STANDARD DEVIATIONS INDICATED CLOSE COMPLIANCE WITH CURRENT SPEC-

IFICATIONS, AND /4/ STATISTICAL TYPE SPECIFICATIONS MIGHT PERMIT ACCEPTANCE OF BORDERLINE MATERIAL AT A REDUCED PRICE. /AUTHOR/

Materials, RES & DEV INC
Miller-warden Associates, West Virginia State Road Commission July 1966

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4721343 66)PB 173 820, 1C33020586

2A 214442
QUALITY CONTROL ANALYSIS, PART III, CONCRETE AND CONCRETE AGGREGATES

THIS IS THE THIRD AND LAST REPORT ON THE QUALITY CONTROL ANALYSIS OF HIGHWAY CONSTRUCTION MATERIALS. IT DEALS WITH THE STATISTICAL EVALUATION OF DATA FROM SEVERAL CONSTRUCTION PROJECTS TO DETERMINE VARIABILITY OF SLUMP AND OF AGGREGATES. THE ANALYSIS INDICATED /1/ THAT THE FREQUENCY DISTRIBUTION OF MOST OF THE DATA TEND TO FOLLOW NORMAL DISTRIBUTION, /2/ THAT THERE IS CONSIDERABLE VARIATION IN CONCRETE PRODUCTION FROM BATCH TO BATCH, /3/ THAT FOR FINE AGGREGATE, THE STOCKPILE COMPONENT OF VARIANCE CONTRIBUTES MORE TO THE OVERALL VARIANCE THAN SAMPLES WITHIN STOCKPILE COMPONENT, AND /4/ THAT IN THE CASE OF COARSE AGGREGATES THE SAMPLE WITHIN STOCKPILE COMPONENTS SHOW LARGER VARIANCE THAN BETWEEN STOCKPILE COMPONENTS. THE STUDY REVEALED HOW CONTROL CHARTS CAN BE USED FOR CONTROL AND ACCEPTANCE OF P.C. CONCRETE. THE REPORT INCLUDES AN ANALYSIS OF THICKNESS OF PAVEMENT AND ANALYSIS OF BITUMINOUS HOT MIX DENSITY AND DISCHARGE TEMPERATURE. /BPR/

Louisiana Department Highways Sept. 1966

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4721183 66)PB 173 822, 1C62020484, 3C33083225, 1C33020631, 3C33021718

2A 214444
THE COMPACTION OF SOIL AND ROCK MATERIALS FOR HIGHWAY PURPOSES

THE MANY FACTORS RELATED TO THE PHENOMENON OF SOIL AND SOIL-AGGREGATE COMPACTION IN THE PRESENCE OF MOISTURE AND THE BEHAVIOR OF THE SOIL-MOISTURE MASS WHEN SUBJECTED TO STRESS ARE REVIEWED. THE REPORT PROVIDES A REVIEW OF CURRENT KNOWLEDGE OF THE EQUIPMENT AND PROCESSES THAT INFLUENCE THE COMPACTION OPERATION AND THE PROPERTIES OF THE RESULTANT MASS BOTH IN THE LABORATORY AND IN THE FIELD. NO ORIGINAL RESEARCH WAS DONE IN THIS PHASE. THE AUTHORS COMPILED AND ANALYZED CURRENT STATE HIGHWAY DEPARTMENT COMPACTION SPECIFICATIONS AND FIELD PRACTICES, AND REVIEWED COMPACTION CONTROL PROCEDURES. METHODS WERE OFFERED TO DETERMINE THE VARIABILITY AND CONTROL OF QUALITY OF COMPACTED MASSES BY STATISTICAL QUALITY CONTROL DISCIPLINES. ON THE BASIS OF KNOWLEDGE OF THE STATE OF THE ART OF SOIL COMPACTION, THE AUTHORS OFFER RECOMMENDATIONS FOR CURRENT PRACTICES AND SPECIFICATIONS AS WELL AS FOR FUTURE RESEARCH. /BPR/

Wahls, HE Fisher, CP Langfelder, LJ
North Carolina State University Final Rpt. FHWA-RD-73-8, Aug. 1966, 457 pp
RESPONSIBLE INDIVIDUAL: McMahon, TF

Contract CPR-11-0954

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (3723993 66)
PB-227913/AS

2A 214466
APPLICATION OF STATISTICAL SPECIFICATIONS FOR HIGHWAY CONSTRUCTION

A BRIEF SUMMARY IS PRESENTED OF THE STUDY TITLED APPLICATION OF STATISTICAL QUALITY CONTROL METHODS IN THE FORM OF A PAPER FOR PRESENTATION AT A TECHNICAL CONFERENCE, OUTLINING THE APPLICATION OF STATISTICAL QUALITY CONTROL METHODS FOR ANALYSIS OF DATA ON DETERMINATION OF PENETRATION TESTS OF ASPHALT, GRADATION OF AGGREGATE, COMPACTION OF EMBANKMENTS AND THE USE OF CONTROL CHARTS OF MOVING AVERAGES. THE REPORT DOES NOT ATTEMPT TO SPECIFY FREQUENCY OF SAMPLING NOR DEFINE THE LOT OF MATERIAL. THE STATE IS WORKING TOWARDS THE GOAL OF DEVELOPING MORE ENFORCEABLE SPECIFICATIONS. /BPR/

Watkins, RO
California Division Highways, Bureau of Public Roads /US/ 1968

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4601413 68)

2A 214471
THE STATISTICAL APPROACH TO QUALITY CONTROL IN HIGHWAY CONSTRUCTION, PHASE I, MEASURING THE VARIABILITY, PART B, ASPHALT CONSTRUCTION

MEASUREMENTS ARE REPORTED OF VARIABILITY OF BITUMINOUS CONCRETE CONSTRUCTION ON 3 JOBS. TEST MEASUREMENTS VARIATIONS REPORTED ON INCLUDE: HOT BIN GRADATION, EXTRACTED GRADATION, ASPHALT CONTENT, ACTUAL ASPHALT USED, MIX TEMPERATURE AT PLANT AND PAVER, STABILITY FROM LAB MIXES AND PAVEMENT CORES, CONVENTIONAL AND FLUSH AND AIR GAP NUCLEAR DENSITY, PAVEMENT THICKNESS, VOLUME OF VOIDS. TEST RESULTS INCLUDE: TESTING, SAMPLING AND MATERIAL VARIANCE. /BPR/

Jorgenson, JL
North Dakota State University, North Dakota State Highway Dept, Bureau of Public Roads /US/

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4601483 68)PB 182 286, 1C33021315, 1C33021947, 1C33021344

2A 214474
STATISTICAL QUALITY CONTROL OF HIGHWAY CONSTRUCTION MATERIAL

A SUMMARY OF THE FINDINGS OF SEVERAL INTERIM REPORTS ON STATISTICAL QUALITY CONTROL OF HIGHWAY CONSTRUCTION MATERIAL IS PRESENTED. THE ADVANTAGES AND LIMITATIONS OF THE PRESENT CONTROL PROCEDURES ARE DISCUSSED. THE WORK DONE TO DATE INDICATES THAT STATISTICAL SPECIFICATION CAN BE USED TO THE ADVANTAGE OF THE HIGHWAY ENGINEER. DURING THE STUDY SOME OF THE PROBLEMS IDENTIFIED THAT NEED ADDITIONAL ATTENTION WERE: PERSONNEL TRAINING, REPRODUCIBILITY OF TESTS, PRESERVATION OF ENGINEERING JUDGMENT, AND COST OF ADMINISTRATION. POSSIBLE SOLUTIONS TO THESE PROBLEMS ARE DISCUSSED INCLUDING DETERMINING THE PRECISION OF TEST METHOD AND PROCEDURES FOR ASSURING THAT A LABORATORY IS IN OPERATIONAL CONTROL. ONE SPECIFIC PROCEDURE, QUALITY CONTROL BY THE MOVING AVERAGE USING CONTROL CHARTS, IS PROPOSED. IT IS ANTICIPATED THAT THIS PROCEDURE WILL PROVIDE CONTROL WITHOUT INCREASING COST WHILE AT THE SAME TIME SUPPLYING MANAGEMENT INFORMATION IN THE FORM OF CHARTS AND GRAPHS. /AUTHOR/

Sherman, GB Watkins, RO
California Division Highways, Bureau of Public Roads /US/ 1968

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4601123 68)PB 180260, 3C33021382

2A 214477

DETERMINATION OF STATISTICAL PARAMETERS FOR HIGHWAY CONSTRUCTION

RESULTS OF TESTS ON PORTLAND CEMENT CONCRETE PAVEMENT INDICATE THAT THE LEVEL AND OVERALL COEFFICIENT OF VARIATION WAS SATISFACTORY ON MOST PROJECTS, BUT THE TESTING ERROR WAS SOMEWHAT HIGH. MEASUREMENTS OF BITUMINOUS PAVING MIXTURES SHOW EXCESSIVE VARIATION IN THE DETERMINATION OF BITUMIN CONTENT, THUS THE STATE DEVELOPED A NEWER METHOD OF TEST, THE PYCONOMETER METHOD, WHICH SHOWED PROMISE AS A BETTER TEST. DENSITY OF BITUMINOUS PAVEMENT MATERIAL WAS DETERMINED BY THE NUCLEAR METER WHICH QUICKLY DISCLOSED THE VARIATION TRANSVERSELY AND LONGITUDINALLY ON THE ROADWAY. PERHAPS THE MOST IMPORTANT PHASE OF THE STUDY WAS THE SIMULATION OF STATISTICALLY DERIVED ACCEPTANCE PLANS WHICH PROVED THAT THE PLAN IS PRACTICAL IN WELL CONTROLLED CONCRETE PAVEMENT MATERIAL, AND CONCRETE OF INFERIOR QUALITY WILL BE PAID FOR AT A PROPORTIONAL REDUCED PRICE. /AUTHOR/

Materials Research & Development, Inc, West Virginia State Road Commission, Bureau of Public Roads /US/ State No 18, July 1968

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4601463 68)PB 182 328, 1C33021426

2A 214480

STATISTICAL CORRELATION AND VARIANCE PROJECT RELATED TO THE QUALITY CONTROL OF HIGHWAY MATERIALS

TWENTY-EIGHT DAY STRUCTURAL AND PRESTRESSED CONCRETE HISTORICAL COMPRESSIVE STRENGTH DATA FROM 8000 CYLINDERS PREPARED IN 1964 BY CENTRAL LABORATORY PERSONNEL AT THE JOB SITE WAS STATISTICALLY ANALYZED TO ESTIMATE CONFORMANCE TO EXISTING CRITERIA. DATA FROM 10,000 CYLINDERS PREPARED BY PROJECT BASED PERSONNEL WAS NOT USED IN THE ANALYSIS. TESTING, SAMPLING, MATERIAL AND TOTAL VARIANCE, ST'D DEV., MEAN COEFFICIENT OF VARIATION WAS DETERMINED FOR EACH PROJECT SUB LOT. ACCEPTANCE PLANS FOLLOWING PRINCIPLES OF MIL, STD 414, ST'D DEVIATION UNKNOWN, WAS PROPOSED FOR USE ON A TRIAL BASIS. ACCEPTABLE QUALITY LEVELS (AGE) OF 2.5% FOR PRESTRESSED CONCRETE (5000 PSI MINIMUM) AND 6.5% FOR OTHER STRUCTURAL CONCRETE (3000 PSI MINIMUM) WERE SELECTED TO BEST APPROXIMATE COMPUTED TEST VALUES. FOR CONCRETE USED IN BRIDGE SUPERSTRUCTURES AN AQL OF 1.5% (5.5% ESTIMATE OF PERCENT DEFECTIVE) WAS USED TO REDUCE THE RISK OF ACCEPTING POOR QUALITY CONCRETE. AN ATTEMPT WAS MADE TO HOLD ALPHA AND BETA RISKS TO A COMMON 15% DEFECTIVE COMMENSURATE WITH SAMPLE SIZE, LOT SIZE, AND CRITICALNESS OF USE. AN ACTION AND REDUCED PAYMENT PLAN WAS SUGGESTED FOR NONCONFORMING CONCRETE. COMPARISONS WERE MADE WITH ACI 214 SUGGESTED MAXIMUM 10 PERCENT DEFECTIVE. SUGGESTIONS WERE MADE TO REVISE STATES EXISTING PRESTRESSED CONCRETE SPECIFICATION TO REDUCE THE RISK OF ACCEPTING EXCESSIVELY POOR QUALITY MATERIALS. /BPR/

New Jersey Dept Transportation, Bureau of Public Roads /US/ Sept. 1968

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4601283 69)

2A 214495

INVESTIGATION INTO THE USES OF STATISTICAL PROCEDURES IN SPECIFICATION WRITING AND QUALITY CONTROL

THE APPLICATION OF SEVERAL METHODS AND TECHNIQUES OF STATISTICAL ANALYSIS TO ACCEPTED TESTS OF HIGHWAY CONSTRUCTION MATERIALS WAS DEMONSTRATED. THE RESULTS VARY RATHER WIDELY IN NUMERICAL VALUES. SOME

TECHNIQUES COULD AND HAVE BEEN PUT IN ROUTINE USE AS A RESULT OF THE STUDY. OTHER TECHNIQUES ON CERTAIN MATERIALS YIELDED SUCH EXTREME VALUES THAT THE AUTHORS QUESTIONED THEM AS BEING IN ERROR OR THE METHOD BEING INAPPROPRIATE. THE AUTHORS CONCLUDED THAT THERE ARE AREAS WHERE STATISTICAL CONTROL TECHNIQUES ARE SUITABLE FOR USE AND OTHER AREAS EXIST WHERE THERE IS A NEED FOR CHANGE IN STATISTICAL CONCEPTS OR TEST METHODS, OR BOTH BEFORE THE S.R.C. PROCEEDS WITH WRITING AND ENFORCEMENT OF STATISTICALLY ORIENTED SPECIFICATIONS. /AUTHOR/

Smith, NL Parrish, AS

Maryland State Roads Commission, Bureau of Public Roads /US/ Apr. 1969

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4601203 69)

2A 214504

DEVELOPING AND TRIAL USE OF ACCEPTANCE SAMPLING PLANS FOR ASPHALT CONSTRUCTION

PREVIOUS RESEARCH INDICATED THAT PRESENT ACCEPTED BITUMINOUS PAVEMENT CONSTRUCTION DOES NOT MEET SPECIFIED REQUIREMENTS. ALSO ON PROJECTS RESEARCHED EACH CONTRACTOR WAS PAID 100 PERCENT OF BID PRICE EVEN THOUGH THERE WAS A WIDE RANGE OF BELOW SPECIFICATION CONSTRUCTION BETWEEN JOBS. A SPECIFICATION DEVELOPED WILL ACCEPT CONSTRUCTION ON THE BASIS OF THE AVERAGE OF 5 TEST RESULTS PER LOT FOR (1) NOMINAL LARGEST SIEVE, #4 SIEVE, #30 SIEVE, #200 SIEVE, AC CONTENT, COMPACTION AND THICKNESS. ADJUSTMENT PRICE SCHEDULES ARE PROVIDED FOR THE ACCEPTANCE OF BELOW STANDARD CONSTRUCTION. A NUCLEAR GAGE CORRELATION WITH DENSITIES OBTAINED FROM CORES IS INCLUDED. /BPR/

Jorgenson, JL

North Dakota State University, North Dakota State Highway Dept, Bureau of Public Roads /US/

ACKNOWLEDGMENT: Bureau of Public Roads /US/REPORT PENDING, 1C33021315, 1C33021344, 1C33021947

2A 214520

AN INVESTIGATION OF BITUMINOUS HIGHWAY MATERIALS & METHODS OF PRODUCTION AND CONSTRUCTION CONTROL BASED ON STATISTICAL PROCEDURES

A SYSTEMATIC MEANS OF COLLECTING INFORMATION USING VARIOUS TEST METHODS OF BOTH COMPACTED AND UNCOMPACTED SAMPLES OF BITUMINOUS MIXES FROM FOUR DIFFERENT CONSTRUCTION PROJECTS IS DESCRIBED. THE RESULTS ARE REPORTED TO SHOW THE DEGREE OF VARIABILITY OF THE MATERIAL THAT CAN BE EXPECTED AND A COMPARISON OF THE LABORATORY AND FIELD TEST METHODS EMPLOYED. STATISTICAL CONCEPTS WERE USED TO SAMPLE, TEST, AND ANALYZE QUALITY CONTROL OF HIGHWAY CONSTRUCTION MATERIALS. /AUTHOR/

Elkin, BL

Federal Highway Administration /US/, Indiana State Highway Commission Study No V-1-388

ACKNOWLEDGMENT: Federal Highway Administration (4601033 71)REPORT PENDING, 2C33022679

2A 214524

ECONOMIC FEASIBILITY OF APPLICATION OF STATISTICAL CONCEPTS AND METHODS TO THE CONTROL AND ACCEPTANCE OF HIGHWAY MATERIALS AND CONSTRUCTION

THE PROBABLE COST OF A STATISTICAL QUALITY CONTROL SYSTEM WAS ESTIMATED BY PROJECTION OF CURRENT COSTS OF CONTRACTORS AND PRODUCERS WHO ARE CURRENTLY MAINTAINING VOLUNTARY TESTING PROGRAMS. ESTIMATES BASED ON DATA OBTAINED INDICATE THAT THE COST OF AN ACCEPTABLE DEGREE OF QUALITY CONTROL OF

HIGHWAY MATERIALS OR CONSTRUCTION BY THE CONTRACTOR OR PRODUCER WOULD AVERAGE ABOUT 4 PERCENT OF CONTRACT PRICE. COMPARISONS OF RELATIVE COSTS INDICATE THAT THE OPTIMUM QUALITY ASSURANCE SYSTEM WOULD BE QUALITY CONTROL BY THE CONTRACTOR WITH ACCEPTANCE TESTING BY THE STATE AGENCY. THE DOLLAR COST OF SUCH A SYSTEM IS ESTIMATED TO BE ABOUT 20 PERCENT LESS THAN THAT OF CURRENT PROCEDURES. THE ECONOMIC BENEFITS IN TERMS OF THE DEGREE OF QUALITY ASSURANCE OBTAINED BY THIS SYSTEM AS COMPARED TO THE EXISTING SYSTEM ARE ESTIMATED TO BE EVEN MORE FAVORABLE. A STUDY OF THE SIZE OF BUYER'S AND SELLER'S RISKS WAS COMPARED TO THOSE WHICH WOULD BE ASSOCIATED WITH REVISED SPECIFICATIONS AND STATISTICAL SAMPLING PLANS. THE LOWEST RISKS FOR THE SAME LEVEL OF TESTING EFFORT WOULD BE REALIZED WHEN A STATE OF STATISTICAL CONTROL OF PRODUCTION AND CONSTRUCTION PROCESSES WAS OBTAINED. /AUTHOR/

Hudson, SB Bowery, FJ
Materials Research & Development, Federal Highway Administration
/US/ Fh-11-7272

ACKNOWLEDGMENT: Federal Highway Administration (3601143
72)REPORT PENDING, 3C33022772

2A 214543

HANDBOOK OF APPLICATIONS OF STATISTICAL CONCEPTS TO THE HIGHWAY INDUSTRY, PART I-INITIAL COMPUTATIONS & APPLICATIONS

THIS IS PART I OF A THREE-PART HANDBOOK DEALING WITH PRACTICAL CONCEPTS IN THE FIELD OF STATISTICS AND WITH THEIR APPLICATIONS IN THE CONTROL OF MATERIALS AND PROCEDURES IN HIGHWAY CONSTRUCTION. THIS FIRST PART PRESENTS INTRODUCTORY EXPLANATIONS RELATING TO GENERAL PRINCIPLES OF STATISTICS THAT WILL BE USEFUL TO TECHNICIANS IN HIGHWAY ENGINEERING AND TO PRODUCERS OF MATERIALS. THE PRACTICAL APPLICATIONS OF THESE PRINCIPLES ARE SHOWN BY NUMERICAL EXAMPLES THAT ARE WORKED OUT FULLY. THE TERMS AND UNITS OF MEASUREMENTS ARE THOSE IN COMMON USE IN HIGHWAY WORK AND THE VALUES USED IN THE EXAMPLES ARE APPROXIMATELY THE SAME AS WOULD BE OBTAINED DURING CONSTRUCTION OPERATIONS. THE IMPORTANCE OF OBTAINING SAMPLES FOR TESTING BY THE USE OF UNBIASED METHODS IS STRESSED, AND THE USE OF CONTROL CHARTS IS ILLUSTRATED. /FHWA/

Hudson, SB
Materials Research & Dev, Rockville, Federal Highway Administration
/US/ Handbook June 1971, 182 pp

ACKNOWLEDGMENT: Federal Highway Administration FHWA P-0013, REPORT PENDING, 2C33023218

2A 214561

RECORDATION OF QUANTITIES OF MATERIALS INCORPORATED IN BASE AND PAVEMENT PLANT MIXTURES (FINAL REPORT OF SECOND PHASE)

THIS IS THE SECOND PHASE OF RESEARCH TO DEVELOP AN INDEPENDENT MONITORING AND RECORDING SYSTEM. A SYSTEM THAT WILL PROVIDE A RECORD OF THE WEIGHTS OF EACH INGREDIENT FOR EACH BATCH PRODUCED IN WEIGHT PROPORTIONING BATCH PLANTS, COMPLETELY INDEPENDENTLY FROM THE PLANT OPERATING SYSTEM. IN THIS PHASE A PROTOTYPE SYSTEM INCLUDING FOUR LOAD CELLS SUPPORTING EACH WEIGHT HOPPER, ACTING INDEPENDENTLY FROM THE PLANT LEVER SYSTEM, WAS INSTALLED ON A COMMERCIALY OPERATED, FULLY AUTOMATED TRANSLATED THROUGH PROCESSING INSTRUMENTATION INTO BOTH A PRINTED TABULATION AND PUNCHED TAPE RECORD FOR EACH BATCH. THE SYSTEM WAS OPERATED FOR A THIRTEEN MONTH PERIOD DURING WHICH NUMEROUS OBSERVATIONS AND COMPARATIVE WEIGHING TESTS WERE MADE. THE PROTOTYPE SYSTEM, REFERRED TO AS THE

"MONITOR" WAS NEVER IN ERROR COMPARED TO DEAD WEIGHTS AND IS AT LEAST AS RELIABLE AS PRESENT PLANT SCALES. THE MECHANICAL PROBLEMS, CONSIDERING THAT IT WAS A PROTOTYPE, WERE NEGLIGIBLE AND CORRECTABLE. THE RECORDED WEIGHTS ACCURATELY REPRESENTED THE AMOUNT OF MATERIAL ACTUALLY DELIVERED TO THE WEIGH HOPPER REGARDLESS OF PLANT SCALE SETTINGS OR BEHAVIOR AND CANNOT BE INFLUENCED BY THE OPERATOR. THE MONITOR IS A RELATIVELY INEXPENSIVE, EASILY INSTALLED, ACCURATE WEIGHTING AND RECORDING SYSTEM WHICH CAN GIVE VITAL SURVEY INFORMATION OF THE PLANT OPERATION AND COULD FURNISH AN ALTERNATIVE METHOD OF DETERMINING CONTRACT PAY QUANTITIES.

Pitt, N Racheli, U Obermuller, JC Spickelmire, LS
Pitt, Norman, Incorporated, California Department Transportation Final
Rept June 1972, 95 pp

ACKNOWLEDGMENT: Federal Highway Administration, California Department Transportation FHWA P-0038, NTIS PB 228656/AS, 3C33023590

2A 214566

FOR A STATISTICAL CONTROL OF CRUSHER RUN MATERIAL FOR DENSE GRADED MIX

IMPROVEMENTS IN THE QUALITY OF ROAD MATERIALS CAN ONLY BE ACHIEVED BY THE USE OF STATISTICAL CONTROL METHODS. IN THE COURSE OF AN ACCEPTANCE CONTROL OF 0-12.5 MILLIMETER CRUSHER -RUN MATERIAL, THE AUTHOR HAS TRIED THROUGH STATISTICAL ANALYSIS TO ESTABLISH 1/ THAT THERE WAS A CORRELATION BETWEEN DRY AND WET SIEVINGS AND THAT THE SIGNIFICANT DIFFERENCE WAS SMALL UP TO THE 2 MILLIMETER SIEVE, 2/ THAT A GOOD APPROXIMATION OF THE SAMPLES AVERAGE GRADING CURVE COULD BE OBTAINED BY MIXING AND THEN QUARTERING THROUGH A REDUCING SAMPLER, 3/ THAT THE SIZE OF THE CONTROLLED MATERIAL UNIT BEING TAKEN AS A CUBIC METER, ONE COULD OBTAIN ITS AVERAGE GRADING WITH A GOOD DEGREE OF APPROXIMATION BY TAKING 5 SAMPLES OF ABOUT 4 POUNDS EACH AND DETERMINING THEIR AVERAGE GRADING, 4/ THAT THERE IS A CORRELATION BETWEEN THE 2 MILLIMETER DRY SIEVING AND THE FILLER CONTENT /WET/ AND THAT A POSSIBILITY OF INDIRECT CONTROL OF THE GREATEST VARIATIONS OF THE FINES CONTENT CAN BE INFERRED. THESE CONCLUSIONS COULD LEAD TO STANDARDS FOR A SIMPLE SPECIFICATION OF /OR ACCEPTANCE/ STATISTICAL CONTROL FOUNDED ON THE KNOWLEDGE OF A SIMPLIFIED GRADING /3 OR 4 SIEVES/ THROUGH DRY SIEVING AND ON THE CREATION OF CONTROL CARDS.

Lefebvre, JP *Bull Liaison Labs Routiers /France/* Jan. 1965

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 214567

WIDER USE SHOULD BE MADE OF LOCAL MATERIALS IN THE CONSTRUCTION OF LOCAL ROADS
CEMENT, LIME, BITUMEN AND TAR ARE USED FOR THE STABILIZATION OF LIMESTONE AND SLAG AGGREGATE IN U.S.S.R. ROAD CONSTRUCTION. RECOMMENDATIONS ARE MADE BASED ON THE RESULTS OF LABORATORY TESTS. /LCPC/RRL/

Dolgov, AN Samodurov, SI *Avtomobil Nye Dorogi /Ussr/* Jan. 1965

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 214582

PAVING OF PUBLIC ROADS IN FINLAND
PAVING OF HIGHWAYS WAS STARTED ON A LARGER SCALE AT THE BEGINNING OF THE 1960S. IN 1964 THE USE OF OIL GRAVEL DECREASED, AND THE LENGTH OF ASPHALT CONCRETE PAVEMENTS WAS AT THE SHORTEST IN THE DECADE. THE USE OF BITUMINOUS GRAVEL AND CUT-BACK ASPHALTIC BITUMEN, HOWEVER, INCREASED. THERE HAVE BEEN NO

ESSENTIAL CHANGES CONCERNING THE ACTUAL ASPHALT PAVEMENTS, ALTHOUGH OVER 100 TEST ROAD SECTIONS HAVE BEEN CONSTRUCTED FOR ANALYSIS OF DIFFERENT BINDER MATERIALS, ADHESIVE AGENTS, WORKING METHODS, AND THE ECONOMY OF PAVING. THE LENGTH OF PAVED PUBLIC ROADS IN 1964 WAS 1,701 KM, WHICH CAN BE DIVIDED BY PAVEMENT TYPE AS FOLLOWS: ASPHALT CONCRETE 170, BITUMINOUS GRAVEL 329, CUT-BACK ASPHALTIC BITUMEN 169, AND OIL GRAVEL 1,033 KM, OF WHICH 712 KM ARE OLD ROADS /RRL/

Niemi, B
Tielehti, Helsinki Apr. 1965

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 214583

RESEARCH ON CONCRETE ROAD CONSTRUCTION, RRL AND MINISTRY TESTS WITH SLIP-FORM PAVER
THE CAPABILITIES OF A SLIP-FORM PAVER FOR CONSTRUCTING CONCRETE ROADS TO BRITISH DESIGN REQUIREMENTS ARE TO BE INVESTIGATED BY THE ROAD RESEARCH LABORATORY, IN CONJUNCTION WITH THE HIGHWAYS ENGINEERING DIVISION OF THE MINISTRY OF TRANSPORT. THE CROMWELL BY-PASS ON THE A1 IN NOTTINGHAMSHIRE WILL BE USED FOR THE FIRST FULL-WIDTH CONSTRUCTION BY THIS METHOD IN THE U. K. THE MAIN OBJECTS OF THE EXPERIMENT ARE /1/ TO DETERMINE SUITABLE FORMS OF EXPANSION AND CONTRACTION JOINTS FOR USE WITH EITHER REINFORCED OR UNREINFORCED CONCRETE, /2/ TO DETERMINE SUITABLE WAYS OF REINFORCING CONCRETE SLABS LAID BY SLIP-FORM PAVER, AND /3/ TO COMPARE THE COST OF REINFORCED AND UNREINFORCED CONCRETE DESIGNED TO HAVE EQUIVALENT PERFORMANCE USING THE BEST METHODS DEVELOPED FOR EACH TYPE OF CONSTRUCTION. ILLUSTRATIONS ARE INCLUDED OF THE DESIGN OF THE SECTIONS UNDER TEST. THIS EXPERIMENT IS ALSO BRIEFLY MENTIONED IN CONTRACT JOURNAL 1965, 205 /4480/, 36; ENGINEERING, LONDON, 1965, 200 /5183/, 232. /SEE ALSO ABSTRACT NO. 3292./ /RRL/

Municipal Engineering /UK/ May 1965

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 214588

FARM ROAD CONSTRUCTION. THIRD REVISED EDITION
DETAILS ARE GIVEN OF THE MATERIALS, EQUIPMENT AND PROCEDURE INVOLVED IN CONCRETE, FARM-ROAD CONSTRUCTION. IT IS CONSIDERED THAT FOR GENERAL PURPOSES THE ROAD SHOULD NOT BE LESS THAN 8 FT WIDE AND, UNLESS IT IS AT LEAST 16 FT WIDE PASSING BAYS SHOULD BE PROVIDED. THE SLAB SHOULD BE 6 IN THICK OR 5 INCHES ON A GOOD SUBGRADE. JOINTS ARE REQUIRED, BUT REINFORCEMENT IS NECESSARY ONLY UNDER CONDITIONS OF HEAVY TRAFFIC OR ON A WEAK SUBGRADE. /RRL/

Cement & Concrete Assoc, London /UK/ June 1965

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 214589

SURFACE IRREGULARITY DATA FOR RECENT MAJOR ROAD WORKS' SPECIFICATIONS AND TOLERANCES
MEASUREMENTS WERE MADE WITH A MULTI-WHEELED PROFILOMETER OR A BUMP INTEGRATOR ON A CONSIDERABLE NUMBER OF RECENT MAJOR ROAD WORKS, IN ORDER THAT THE STANDARDS OF SURFACE FINISH AND THE VARIABILITY BETWEEN AND WITHIN INDIVIDUAL PROJECTS COULD BE ASCERTAINED AND COMPARED WITH THE CURRENT REQUIREMENTS OF SPECIFICATIONS. STANDARDS WERE FOUND TO VARY WIDELY BUT ON NEARLY ALL THE ROADS AN APPRECIABLE PROPORTION OF THE WHOLE SURFACE HAD A FINISH BETTER THAN THE 1/8-INCH STANDARD. IT IS CONSIDERED THAT SUPERVISING ENGINEERS SHOULD AIM PRIMARILY AT MINIMIZING THE VARIABILITY OF SURFACE FINISH IN

ORDER TO IMPROVE OVERALL RESULTS. THIS IN TURN IMPLIES EFFICIENT AND ADEQUATE CONTROL OF ALL MATERIALS AND PROCESSES IN CONSTRUCTION. /RRL/

Road Research Laboratory Notes /UK/ June 1965

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 214597

INVESTIGATIONS INTO ROAD BUILDING PRACTICE IN THE TROPICS. SIX STUDIES OF SOME ROAD BUILDING OPERATIONS ON A ROAD CONSTRUCTION SCHEME IN TORTOLA, BRITISH VIRGIN ISLANDS
AS PART OF A STUDY OF ASPECTS OF NORMAL ROAD-BUILDING PRACTICE IN THE TROPICS, MEASUREMENTS WERE MADE DURING THE CONSTRUCTION OF A CEMENT-STABILIZED BASE IN TORTOLA. THE BASE IS BEING CONSTRUCTED WITH A SINGLE-PASS STABILIZING TRAIN BY ADDING A SMALL PROPORTION OF CEMENT TO A GRANULAR MATERIAL KNOWN LOCALLY AS TARRAS. THE DATA OBTAINED SHOWED THAT WITH THE CONSTRUCTION METHODS USED ADEQUATE STATES OF COMPACTION AND THICKNESSES OF STABILIZED BASE WERE BEING PRODUCED BUT SHAPING BY BULLDOZERS WAS UNABLE TO PRODUCE A SURFACE OF ACCEPTABLE REGULARITY. /RRL/

Tanner, JS *Road Research Laboratory Notes /UK/ Sept. 1965*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 214599

IMMERSED TUBE METHOD. WORLDS FIRST SIX-LANE TUNNEL IN SWEDEN

THE TINGSTAD TUNNEL UNDER THE GOTA RIVER AT GÖTEBORG IS CONSTRUCTED ON THE SUNK TUNNEL PRINCIPLE, AND COMPRISES AN ENCLOSED COFFERDAM STRETCH OF 455 M WITH A 60 M LONG APPROACH RAMP AT EITHER END. THE TUNNEL CONSISTS OF 5 SECTIONS, EACH APPROX. 93 M LONG, WHICH ARE PRECONSTRUCTED, CLOSED, TOWED OUT AND SUNK INTO POSITION ON THE FOOTINGS PREPARED BEFOREHAND. HEADROOM IN THE CARRIAGEWAYS IS 4.55 M. THE THICKNESS OF THE STRUCTURAL CONCRETE IS 100 CM FOR OUTER WALLS AND BOTTOM, 82 CM FOR THE ROOF AND 50 CM FOR INBOARD DIVIDING WALLS. DETAILS ARE GIVEN OF ADDITIONAL WATER INSULATION, CONSTRUCTING THE UNITS IN THE BUILDING DOCK, SINKING OF UNITS, DIMENSIONING, VENTILATION, SOIL EXPLORATION AND EXPERIMENTATION. /RRL/

Gustafson, T *Contract Journal /UK/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 214615

PEAT BLASTING IN IN SCHLESWIG-HOLSTEIN AND BAVARIA 1958- 1963

IN THE CONSTRUCTION OF THE E3 FROM HAMBURG THROUGH RENDSBURG, SCHLESWIG AND FLENSBURG, A NUMBER OF PEAT BOGS WEST OF RENDSBURG AND SOUTH OF SCHLESWIG, UP TO 360 METERS IN LENGTH AND WITH DEPTHS UP TO 17 METRES WERE DISCOVERED. SOUTH OF RENDSBURG ON THE B202, PEAT BOGS WITH 70 AND 110 METRES LENGTH AND DEPTHS UP TO 12 METRES WERE DISCOVERED. ON A RELIEVING BYPASS NEAR FLENSBURG, A STRETCH OF BOG 140 METRES LONG WITH A MAXIMUM DEPTH OF 24 METRES WAS DISCOVERED. THE AUTHOR REPORTS ON THESE STRETCHES, WHICH HAVE BEEN IN TRAFFIC USE FOR BETWEEN TWO AND FOUR YEARS, AND FOR WHICH PEAT-BLASTING WAS USED, SINCE, OWING TO THE EXCESSIVE DEPTH, HIGH WATER CONTENT AND SOFT CONSISTENCY OF THE PEAT, NEITHER COMPLETE STRIPPING NOR SAND-DRAINAGE COULD BE USED. THE PEAT-BLASTING METHODS USED IN THE INDIVIDUAL CONSTRUCTION SECTIONS ARE DESCRIBED IN DETAIL, MENTIONING THE SOIL CLASSIFICATION, PEAT AND SLUDGE BEDS, CONSUMPTION OF EXPLOSIVES AND COSTS AND WITH MANY SECTIONAL AND BLASTING DIAGRAMS. /RRL/FGL

Garras, A *Strassen Und Tiefbau /Germany/* July 1965

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 214617

SOFT-GROUND TUNNELLING' DESIGN AND CONSTRUCTION
THIS PAPER DEALS WITH VARIOUS DESIGN AND CONSTRUCTION TECHNIQUES EMPLOYED IN SOFT-GROUND TUNNELLING. THE PAST DEVELOPMENT, AS WELL AS THE LATEST TRENDS, ARE DISCUSSED. THE FIRST PART OF THE PAPER DEALS WITH SHIELD-DRIVEN TUNNELS AND REVIEWS THE TUNNELLING SHIELD, COMPRESSED AIR AND GROUND TREATMENT, TUNNEL LINING, VEHICULAR TUNNELS. SUNKEN-TUBE TUNNELS ARE DESCRIBED IN THE SECOND PART OF THE PAPER. A GENERAL DESCRIPTION OF THE METHOD IS GIVEN. REVIEWING VARIOUS TYPES OF VEHICULAR TUNNELS. CONDITIONS WHICH AFFECT THE FEASIBILITY OF THIS METHOD ARE SUMMARIZED AND THE MORE IMPORTANT DETAILS OF THE CONSTRUCTION PROCEDURES ARE DISCUSSED. THE PAPER IS CONFINED TO A BROAD REVIEW OF SOFT-GROUND TUNNELLING. /CGRA/

Noskiewicz, TM Ramsay, JA *Canadian Good Roads Association Proc* Oct. 1964

2A 214621

QUALITY CONTROL OF ASPHALT PAVEMENT CONSTRUCTION

BECAUSE OF THE LIMITED INFORMATION AVAILABLE IN THE FIELD OF QUALITY CONTROL OF ASPHALT PAVEMENTS, AN INTENSIVE STUDY WAS MADE OF HUNDREDS OF TEST RESULTS FROM ACTUAL PAVING PROJECTS TO DETERMINE THE ACTUAL VARIATIONS WHICH DO OCCUR IN CONTROL TESTS. THE MEAN VALUES AND STANDARD DEVIATION VALUES WERE CALCULATED AND HISTOGRAMS SHOWING VARIATION WERE PLOTTED FOR ASPHALT PENETRATION, ASPHALT CONTENT, AGGREGATE GRADATION, SURFACE DENSITY, AIR VOIDS, MARSHALL STABILITY AND FLOW, ASPHALT SURFACE THICKNESS VARIATION. THE TEST RESULTS WERE COMPARED TO DESIGN VALUES AND SPECIFICATIONS. THE RESULTS INDICATE THE PERCENTAGE OF TEST RESULTS WHICH CAN BE EXPECTED TO FALL OUTSIDE OF SPECIFICATION LIMITS AND INDICATE THE USEFULNESS OF QUALITY CONTROL CHARTS IN INTERPRETING DATA. /CGRA/

Huculak, NA *Canadian Good Roads Association Proc* Oct. 1964

2A 214627

CONSTRUCTION OF A FULL-SCALE ROAD EXPERIMENT AS PART OF A UNIT-PRICE CONTRACT

AN EXPERIMENTAL PAVEMENT COMPRISING 36 TEST SECTIONS WAS CONSTRUCTED, AS PART OF A UNIT-PRICE HIGHWAY CONTRACT, BETWEEN MAY AND SEPTEMBER, 1965. SPECIAL PROVISIONS WERE INTRODUCED INTO THE CONTRACT DOCUMENTS DEALING WITH THE SPECIAL CONSTRUCTION SEQUENCES, TOLERANCES, TESTING, AND THE CONTROL OF TRAFFIC DURING CONSTRUCTION. CONSTRUCTION CONTROL AND CONTRACT SPECIFICATIONS ARE DESCRIBED AND THE DEGREE OF UNIFORMITY OF MATERIALS, COMPACTION, MOISTURE CONTENTS, LAYER THICKNESSES, ETC., ACHIEVED WITHIN THE FRAMEWORK OF THE CONTRACT IS REPORTED. THE SPECIAL PROVISIONS ARE MENTIONED IN THIS REPORT AND THE DEGREE OF COMPLIANCE, AS MEASURED BY A COMPREHENSIVE SERIES OF TESTS DURING CONSTRUCTION, IS DESCRIBED. IT IS CONCLUDED THAT A GENERALLY ACCEPTABLE STANDARD OF CONTROL WAS ACHIEVED AND THE EXPERIMENTAL PAVEMENT WAS CONSTRUCTED IN A VERY SHORT TIME. /AUTHOR/

Schonfeld, R *Canadian Good Roads Association Proc* 1967

ACKNOWLEDGMENT: Canadian Good Roads Association

2A 214628

SPEEDY COMPACT CONCRETE PUMPING UNITS PRODUCE SAVINGS AND A NEW CONTRACTOR

COMPACT AND MOBILE CONCRETE PUMPING RIGS ARE COMPETITIVE IN COST AND SPEED-AND OFTEN MORE EASY TO HANDLE THAN CONVENTIONAL CRANE AND BUCKET OR TRUCK AND BUGGY COMBINATIONS. HERE ARE THE BENEFITS OF PUMPING' /1/ CONCRETE PLACEMENT TENDS TO BE A MORE STEADY, UNINTERRUPTED OPERATION AND IS GENERALLY FASTER THAN CONVENTIONAL METHODS, /2/ FORM PRESSURES AND WEAR ARE REDUCED BECAUSE OF ELIMINATION OF SURGES, /3/ CONCRETE CAN BE CAST IN LOCATIONS OTHERWISE COMPLETELY INACCESSIBLE TO CRANE OR BUGGIES, /4/ COSTS ARE USUALLY COMPARATIVE WITH, OR BETTER THAN MOVING CONCRETE BY OTHER METHODS. LABOR REQUIREMENTS ARE ALSO REDUCED, /5/ THE QUALITY CONTROL OF THE MIX BUILT RIGHT INTO THE PUMP MEANS BETTER AND STRONGER FINAL PRODUCT, /6/ CRANES ARE FREED FROM BUCKET-SWINGING DUTY TO BE MORE PRODUCTIVELY DEPLOYED. CONVEYOR SYSTEMS ARE OFTEN TEAMED UP WITH PUMPS FOR LONG DISTANCE OR HIGH VOLUME POURS, AND /7/ THE PIPELINES DELIVER THE MIX RIGHT TO THE FINAL LOCATION, AND IN SUCH A MANNER THAT OTHER TRADES OR OPERATIONS ARE NOT INTERRUPTED DURING THE POUR. BUGGY RUNWAYS ARE ELIMINATED. /CGRA/

Rooke, W *Heavy Construction News /Canada/* Apr. 1967

ACKNOWLEDGMENT: Canadian Good Roads Association

2A 214638

DEVELOPMENTS IN ASPHALT COMPACTION BY VARIABLE TIRE PRESSURE ROLLERS

PAVEMENTS ARE CURRENTLY COMPACTED IN THE FIELD IN TWO STAGES. THE FIRST STAGE CONSISTS OF ROLLING AT HIGH TEMPERATURES DURING CONSTRUCTION, AND IT MAY BE CONTINUED FOR AN HOUR OR TWO AFTER THE MIX LEAVES THE SPREADER. THE SECOND STAGE IS COMPACTION BY TRAFFIC, WHICH TAKES PLACE AT NORMAL SERVICE TEMPERATURES, AND IT ORDINARILY CONTINUES FROM TWO TO FOUR YEARS TO ACHIEVE ULTIMATE DENSITY, WHICH CORRESPONDS TO 100% OF LABORATORY COMPACTED DENSITY. POOR COMPACTION BY ROLLING DURING CONSTRUCTION LEAVES A PAVEMENT WITH A HIGH AIR VOIDS CONTENT. THE HIGHER THIS CONTENT, THE FASTER THE ASPHALT CEMENT IN THE PAVEMENT HARDENS, AND THE SHORTER IS THE PAVEMENT'S SERVICE LIFE. CONSEQUENTLY, THERE IS A NEED TO COMBINE THIS TWO-STAGE PAVEMENT COMPACTION INTO A SINGLE STAGE. THIS MEANS THAT PAVEMENTS SHOULD BE ROLLED DURING CONSTRUCTION TO 100% OF LABORATORY COMPACTED DENSITY. EXPERIENCE SHOWS THAT ROLLING TO 100% OF LABORATORY COMPACTED DENSITY CANNOT BE ACHIEVED BY STEEL WHEEL ROLLERS. IT COULD PROBABLY BE ATTAINED BY THE PROPER USE OF PNEUMATIC-TIRE ROLLERS EQUIPPED FOR RAPID CHANGE OF TIRE INFLATION PRESSURE. SOME IMPROVEMENTS IN THE LATTER TYPE THAT ARE NEEDED TO ACCELERATE THIS DEVELOPMENT ARE REVIEWED. COMPACTION PAVEMENTS DURING CONSTRUCTION TO 100% OF LABORATORY COMPACTED DENSITY WOULD RETARD THE RATE OF HARDENING OF THE ASPHALT CEMENT IN THE PAVEMENT, THEREBY SUBSTANTIALLY LENGTHENING PAVEMENT SERVICE LIFE, AND IT WOULD GREATLY INCREASE THE LOAD CARRYING CAPACITY OF BINDER AND SURFACE COURSES, AND PARTICULARLY OF ASPHALT BASE COURSES, PER INCH OF THICKNESS. LOW VISCOSITY ASPHALT CEMENTS, BECAUSE OF THEIR LOW VISCOSITIES AT HIGH TEMPERATURE, PROVIDE PAVING MIXTURES WITH MUCH LESS RESISTANCE TO COMPACTION BY ROLLING, AND THIS WOULD BE HIGHLY ADVANTAGEOUS FOR: (1) ASSISTING PROPERLY OPERATED PNEUMATIC-TIRE ROLLERS WITH RAPIDLY ADJUSTABLE TIRE PRESSURE TO ATTAIN 100% OF LABORATORY COMPACTED DENSITY BY ROLLING DURING CONSTRUCTION,

(2) ACHIEVING MUCH FASTER COMPACTION BY TRAFFIC TO 100% OF LABORATORY COMPACTED DENSITY, WHERE THIS IS NOT ATTAINED BY ROLLING, AND (3) ACHIEVING COMPACTION TO MUCH HIGHER DENSITY BY ROLLING DURING COLD WEATHER CONSTRUCTION. /AUTHOR/

McLeod, NW *Canadian Good Roads Association Proc* Sept. 1967

ACKNOWLEDGMENT: Canadian Good Roads Association

2A 214640

CANADIAN CONSTRUCTION ASSOCIATION PROCEEDINGS OF THE 49TH ANNUAL MEETING

CONTENTS: BENEFITS OF EQUITABLE STANDARD FORMS OF CONSTRUCTION CONTRACTS: OWNER-CONTRACTOR CONTRACT FORMS, R. E. BRIGGS, CONTRACTOR-SUBCONTRACTOR FORMS, R. G. CURRY. USE OF COMPUTERS IN CONSTRUCTION: THE CRITICAL PATH METHOD, S. BROWN, GENERAL APPLICATIONS, KEITH PROSSER, SPECIFICATION PREPARATION, PETER PENNINGTON, PROGRESS REPORTS: D.P.W. RE-ORGANIZATION, LUCIEN LALONDE, CONSTRUCTION LABOUR RELATIONS ENQUIRY, JOHN CRISPO. EXPANDED CONSTRUCTION PROGRAMMES THROUGH URBAN RE-DEVELOPMENT, ELLIOTT N. YARMON. GENERAL CONTRACTORS: PLANNING FOR PROFITS, C. G. MCKENZIE, WATERLOO'S APPROACH TO ENGINEERING EDUCATION, A. N. SHERBOURNE. ROAD BUILDERS AND HEAVY CONSTRUCTION: PLANNING FOR PROGRESS, GEORGE GOMME. CANADIAN WATER UTILIZATION, E. KUIPER, THE GRAND CANAL CONCEPT, T. W. KIERANS, WHOSE RESPONSIBILITY IS SAFETY?, D. A. CAMPBELL, REPORTS OF THE PROVINCIAL AFFILIATES, NOVA SCOTIA, PRINCE EDWARD ISLAND, NEW BRUNSWICK, ONTARIO, MANITOBA, SASKATCHEWAN, AND ALBERTA. MANUFACTURERS AND SUPPLIERS: THE BEAM PROGRAM, R. B. HINDSON, THE CANADIAN JOINT COMMITTEE ON CONSTRUCTION MATERIALS, E. L. MAHONEY, THE M&S SECTION AS A TOOL IN SOLVING ITS MEMBERS' PROBLEMS, PANEL DISCUSSION, A. W. PURDY, J. R. FAULDS AND J. F. SADLER.

Canadian Construction Association Proc Jan. 1967

ACKNOWLEDGMENT: Canadian Good Roads Association

2A 214652

INTERRELATION BETWEEN PAVEMENT DESIGN, CONSTRUCTION AND MATERIALS SPECIFICATIONS AND THEIR ENFORCEMENT IN CANADA

AN EXTENSIVE REVIEW OF THE SPECIFICATIONS AND THE TESTS USED DURING CONSTRUCTION IN EACH OF CANADA'S PROVINCES AND IN THREE FEDERAL DEPARTMENTS IS PRESENTED. THE MATERIALS EXAMINED ARE ASPHALT, ASPHALT CONCRETE, PORTLAND CEMENT CONCRETE, BASE COURSE, SUB-BASE, AND SUBGRADES. THE IMPLICATIONS OF THESE SPECIFICATIONS AND THEIR ENFORCEMENT DURING CONSTRUCTION ARE TRACED BY REFERENCE TO THE PAVEMENT MANAGEMENT SYSTEM OF THE CANADIAN GOOD ROADS ASSOCIATION. IN ORDER TO EVALUATE THE PAVEMENT DESIGN METHODS USED BY THESE AGENCIES IT IS SUGGESTED THAT ADEQUATE HISTORIES OF THE MATERIALS USED BE MAINTAINED. PROBLEM AREAS DEFINED BY THIS STUDY ARE LISTED AND SUGGESTIONS REGARDING SPECIFICATIONS AND QUALITY CONTROL ARE PRESENTED. /CGRA/

Sebastian, GY

Canadian Department Transport, Ottawa Sept. 1969

ACKNOWLEDGMENT: Canadian Good Roads Association

2A 214665

POTENTIAL USES OF SONIC AND ULTRASONIC DEVICES IN HIGHWAY CONSTRUCTION

RESEARCH WAS INITIATED TO EVALUATE: /1/ THE PRESENT USAGE OF HIGH-FREQUENCY VIBRATIONS IN VARIOUS INDUSTRIAL AND SCIENTIFIC FIELDS, AND /2/ THE FEASIBILITY OF POSSIBLE APPLICATIONS OF SONIC AND ULTRASONIC MECHANICAL VIBRATIONAL ENERGY IN HIGHWAY ENGI-

NEERING AND CONSTRUCTION. THE STUDY WAS DIRECTED SPECIFICALLY TOWARD EVALUATION OF POTENTIAL APPLICATIONS OF SONIC ENERGY /60 CPS TO 25 MC/. A STUDY WAS MADE OF TECHNICAL LITERATURE AND RESEARCH REPORTS ON PRESENT USAGE OF SONIC AND ULTRASONIC ENERGY. APPLICATIONS OF SONIC ENERGY TO PREPARATION AND EVALUATION OF HIGHWAY MATERIALS WERE STUDIED EXPERIMENTALLY. THE INVESTIGATION RESULTED IN: /1/ COMPLETION OF AN EXTENSIVE LITERATURE SURVEY, /2/ THE VIBRATORY COMPACTION OF HIGHWAY MATERIALS, ESPECIALLY SOILS, WAS STUDIED AS THE FIRST POTENTIAL AREA OF APPLICATION, /3/ PRELIMINARY APPLICATION TESTS WERE MADE WITH PIEZO-ELECTRIC AND AIR DRIVEN ROTATING BALL TRANSDUCERS, AND /4/ LIMITED TESTS WERE CONDUCTED ON MIXING AND COMPACTION OF OTHER HIGHWAY MATERIALS SUCH AS ASPHALTIC MIXTURES AND GRANULAR MATERIALS. IT WAS CONCLUDED THAT: /1/ SONIC ENERGY CAN PROVIDE POTENTIAL BENEFIT IN HIGHWAY CONSTRUCTION AND ENGINEERING, /2/ MORE FUNDAMENTAL KNOWLEDGE IS NEEDED ON THE DYNAMIC BEHAVIOR OF HIGHWAY MATERIALS AT LOW AND HIGH FREQUENCIES AND THEORETICAL AND EXPERIMENTAL WORK NEEDED IN AREAS OF VIBRATION OF NON-HOMOGENEOUS MEDIA LIKE SOILS AND CONCRETE, /3/ BASIC EFFORT SHOULD BE DEVOTED TO THE LOWER /AUDIO/ FREQUENCY RANGE FOR PROBLEMS SUCH AS COMPACTION OF COHESIVE MATERIALS, EXCAVATION AND CUTTING IN COHESIVE SOILS DRILLING, AND SIMILAR APPLICATIONS, /4/ DEVELOPMENT IS NEEDED OF RUGGEDIZED TRANSDUCERS, FEEDBACK-CONTROLLED POWER SUPPLIES, AND TRANSDUCER SYSTEMS OPERABLE FROM FIXED FREQUENCY ROTATING MOTOR-GENERATOR SETS.

Moavenzadeh, F McMaster, RC *Highway Research Board Nchrp Reports* 1966

2A 214666

CONSTRUCTION PRACTICES-FLEXIBLE PAVEMENTS

THIS BIBLIOGRAPHY IS CONCERNED WITH CONSTRUCTION REQUIREMENTS, EQUIPMENT, MATERIALS FOR VARIOUS LAYERS, AND PROCESSING. IN ADDITION TO THE ITEMS CONCERNING CONSTRUCTION PRACTICES OF FLEXIBLE PAVEMENTS THERE ARE ITEMS ON SUBGRADES, BASES AND SUBBASES PERTINENT TO THIS TYPE OF CONSTRUCTION. THE BIBLIOGRAPHY IS PRESENTED IN THREE PARTS, A TECHNICAL LITERATURE SURVEY WITH LISTING OF COVERAGE, PUBLICATION COVERAGE OF ENGINEERING NEWS-RECORD AND OF ROADS & STREETS, BOTH FROM 1955 THROUGH 1964. KEY WORDS ARE INDICATED FOR EACH ARTICLE. ARTICLES ARE LISTED FOR EACH KEY WORD.

Highway Research Board Bibliography 1966

2A 214675

PRACTICAL APPLICATIONS OF THE AREA CONCEPT TO COMPACTION CONTROL USING NUCLEAR GAGES

THE RATE OF PLACEMENT OF EARTHWORK IN HIGHWAY CONSTRUCTION HAS GREATLY EXPANDED SINCE WORLD WAR II; HOWEVER, THE ACCEPTANCE OR REJECTION OF THIS EARTHWORK COMPACTION HAS BEEN BASED ON PREWAR METHODS THAT ARE GEARED TO LOWER PRODUCTION RATES. THE CALIFORNIA DIVISION OF HIGHWAYS HAS BEEN DEVELOPING A NEW TEST METHOD FOR ACCEPTING OR REJECTING EARTHWORK COMPACTION. THIS METHOD HAS THREE IMPORTANT FACETS: /1/ A MODIFIED STATISTICAL APPROACH, /2/ THE USE OF NUCLEAR SOIL GAGES, AND /3/ AN AREA CONCEPT. THE STATISTICAL APPROACH CONSISTS OF OBTAINING SEVERAL IN PLACE DENSITIES OF THE COMPACTED EARTHWORK IN AN AREA TO BE TESTED. THE ACCEPTANCE OR REJECTION IS BASED ON THE AVERAGE RELATIVE COMPACTION AND THE PERCENTAGE FALLING BELOW THE REQUIRED RELATIVE COMPACTION VALUE. THE TEST SITES ARE SOMEWHAT RANDOMLY SELECTED IN AN AREA READY FOR TESTING. THE AREA IS PASSED OR FAILED

ACCORDING TO THE TEST RESULTS. THE DENSITY OF THE COMPACTED MATERIAL IS DETERMINED BY USE OF NUCLEAR SOIL MOISTURE AND DENSITY GAGES. THIS NEW TEST METHOD WAS USED EXPERIMENTALLY ON A PROJECT DURING 1964 AND THE RESULTS WERE SATISFACTORY. AFTER SOME MODIFICATION OF THE TEST PROCEDURE IT WAS USED ON SEVERAL PROJECTS IN THE 1965 AND 1966 CONSTRUCTION SEASONS. THIS COMPACTION CONTROL CONCEPT WAS SUCCESSFUL FROM BOTH THE STATE AND CONTRACTORS POINTS OF VIEW. /AUTHOR/

Weber, WG Smith, TW *Highway Research Record, Hwy Res Board* 1967

2A 214677

DENSITY CONTROL: ITS BENEFITS AND COMPLEXITIES

TEXAS EMPLOYS THE COMPACTION RATIO (THE RATION OF THE DIFFERENCE BETWEEN ROADWAY AS COMPACTED DENSITY (D SUB A) AND THE LOOSE DRY WEIGHT OF THE SOIL (D SUB L) DETERMINED BY THE TEXAS METHOD TO THE DIFFERENCE BETWEEN THE MAX. LABORATORY DENSITY (D SUB D) UNDER A COMPACTIVE EFFORT OF 30 FT-LB/CU IN.). THE METHOD RESULTS IN HIGH DENSITY REQUIREMENTS FOR NON-SWELLING SOILS AND LOWER, MORE SUITABLE DENSITIES FOR SWELLING SOILS. SOILS AND BASE MATERIALS ARE PLACED IN THREE GROUPS: UNIFORM, NONUNIFORM AND ERRATIC DEPENDING ON THE RELATION OF THEIR RESPECTIVE VALUES TO THE D SUB A DENSITY. PLOTS ARE MADE OF THE DEVIATION FROM AVERAGE D SUB A VS PERCENT OF AVERAGE D SUB A REPRESENTING THE THREE TYPES OF MATERIAL. REASONABLE COMPACTION RANGES ARE ESTABLISHED FOR EACH GROUP FOR USE AS A BASIS FOR CONTROL. DESIGN AND CONSTRUCTION RECOMMENDATIONS HAVE BEEN PREPARED FOR DIFFERENT TYPES OF SOIL AND FOR SOME SOILS CONTAINING ADMIXTURES OF STABILIZING AGENTS. USE IS MADE OF THE TEXAS GYRATORY METHOD FOR ERRATIC MATERIALS. DATA HAVE SHOWN THAT INCREASING COMPACTIVE EFFORT FROM 4 TO 30 FT-LB/ CU IN. INCREASED DENSITY OF A SANDY SOIL BY 9 PCF AND INCREASED THE SHEARING RESISTANCE FROM 19 TO 30 PSI (FOR 20 PSI NORMAL STRESS). THE PAPER CONCLUDES THAT THE COMPACTION RATIO METHOD ESTABLISHES THE DEGREE OF DENSITY THAT IS REQUIRED AND THAT IS PRACTICAL, THAT THE RESULTS OF HIGH COMPACTIVE EFFORT TESTS ARE MORE NEARLY REPRODUCIBLE THAN THOSE FOR LOWER EFFECTS, THAT DENSITY CONTROL OF ERRATIC MATERIALS IS WISFUL THINKING AND THAT THE TEXAS GYRATORY COMPACTOR OFFERS GOOD PROMISE FOR MEASURING DENSITY PROPERTIES. /AUTHOR/

Mcdowell, C *Highway Research Record, Hwy Res Board* 1967

2A 214682

QUALITY CONTROL FOR PRECAST CONCRETE CONSTRUCTION

QUALITY CONTROL FOR PRECAST CONCRETE CONSTRUCTION SHOULD BE BASED ON THE ASSUMPTIONS THAT /1/ EACH MEMBER WILL BE ACCURATELY CAST TO DESIGN DIMENSIONS, /2/ THE MEMBERS WILL FIT WHEN JOINED TOGETHER, /3/ THE STRUCTURE WILL POSSESS AN ADEQUATE FACTOR OF SAFETY, AND /4/ MATERIAL EXPOSED TO VIEW WILL HAVE THE FINISHED APPEARANCE INTENDED BY THE DESIGNER. INADEQUATE PLANNING AND THE NEED FOR UNIFORM QUALITY-CONTROL PRACTICES LEAVES ROOM FOR IMPROVEMENT. SUBSTANTIAL ECONOMY CAN BE OBTAINED IN PRECAST CONCRETE CONSTRUCTION IF THE PLANNING AND DESIGN EFFORTS ARE INCREASED. CONTRACTORS MUST BE REQUIRED TO PLAN, COORDINATE AND CHECK THE SHOP DRAWINGS BEFORE FABRICATION.

Anderson, AR *Civil Engineering Asce* Mar. 1966

2A 214684

QUALITY CONTROL FOR PRECAST CONCRETE CONSTRUCTION SLIPPING ON ROAD JOB

THE UTAH STATE HIGHWAY DEPARTMENT IS TRYING TO SOLVE THE MANCOS SHALE PROBLEM IN THE GREEN RIVER

AREA. A NEW AND RELATIVELY UNTESTED PROCEDURE IS BEING TRIED. THE BASE COURSE OF THE ROAD, 12 INCHES THICK, WILL BE CONSTRUCTED IN THE USUAL MANNER. THEN THE TOP EIGHT INCHES OF THE COMPACTED COURSE WILL BE SCARIFIED WITH A SPECIAL MACHINE AND LIME WILL BE ADDED AT THE RATE OF 4 PERCENT. AFTER NORMAL COMPACTION PROCEDURES, THE AREAS WILL BE COVERED WITH AN EXTRA-HEAVY ASPHALT MEMBRANE. IT IS HOPED THAT THE LIME WILL INCREASE THE FRICTION IN THE SHALE WHILE THE OIL WILL PREVENT FROM REACHING IT. /AUTHOR/

Thomas, DA

Rocky Mountain Construction Aug. 1966

ACKNOWLEDGMENT: Highway Res Abstracts Hwy Res Board

2A 214687

AN INSPECTION RATIONALE

INSPECTION OF CONCRETE CONSTRUCTION SUGGESTS A NUMBER OF FUNCTIONS THAT SHOULD BE COVERED BY CONCRETE INSPECTION' /1/ INSPECTION AND APPROVAL OF BATCHING AND MIXING FACILITIES, /2/ CONTROL OF THE PROPORTIONING OF CONCRETE MIXES, /3/ INSPECTING IN THE BATCH PLANT WHERE SIZE OF JOB OR TYPE OF CONCRETE WARRANTS IT, /4/ INSPECTION, TESTING, AND APPROVAL OF MATERIALS, /5/ INSPECTION OF FORMS AND FALSEWORK, EMBEDDED ITEMS, REINFORCING STEEL, AND OTHER ITEMS RELATED TO THE PRELIMINARIES BEFORE ACTUAL PLACEMENT OF THE CONCRETE, /6/ INSPECTION OF CONCRETE HANDLING AND PLACING EQUIPMENT SUCH AS BUCKETS, CHUTES, HOPPERS, VIBRATORS, AND PUMPS, /7/ INSPECTION OF THE ACTUAL PLACING AND HANDLING OF THE CONCRETE, INCLUDING CONSOLIDATION, FINISHING, CURING, PROTECTION, AND REPAIR, /8/ INSPECTION OF REMOVAL OF FORMS AND SHORING, /9/ PREPARING AND TESTING CONCRETE STRENGTH SPECIMENS, /10/ INSPECTION AT PRECASTING PLANTS FOR PRESTRESSED CONCRETE AND SPECIAL PRECAST UNITS, AND /11/ PREPARING REPORTS COVERING ALL OF THESE INSPECTIONS AND TESTS. THE ARRANGEMENT OF THESE INSPECTION PROCEDURES IS A VERY COMPLICATED AND DIFFICULT TIMING PROBLEM. GOOD, REALISTIC INSPECTION SPECIFICATIONS MUST BE DEFINED PROPERLY AND JUSTLY ADMINISTERED. REFERENCES' RECOMMENDED PRACTICE FOR CONCRETE INSPECTION, ACT COMMITTEE 311 REPORT.

Waddell, JJ *Concrete Construction* Oct. 1966

2A 214696

COMPUTER EVALUATION OF CONCRETE QUALITY

PROBLEMS AND PITFALLS OF PRESENT SPECIFICATIONS AND PROCEDURES FOR CONTROL TESTING OF CONCRETE ARE DISCUSSED AND IT IS SUGGESTED THAT THESE ARE IN NEED OF REVIEW TO PLACE THEM ON A SOUNDER STATISTICAL BASIS USING ACCELERATED TESTS, ESPECIALLY FOR CONCRETE STRENGTH WHEREVER POSSIBLE. MODERN METHODS OF DATA PROCESSING, STORAGE AND RETRIEVAL ARE SHOWN TO OFFER POTENTIAL FOR FASTER HANDLING OF INFORMATION. NEW REPORTING SYSTEMS HAVE BEEN ESTABLISHED TO FEED CONCRETE DATA TO A COMPUTER. THE DATA ARE THEN PROCESSED, STORED, RETRIEVED AND EVALUATED AS NEEDED FOR THE CONTROL OF QUALITY AT THE TIME OF CONSTRUCTION, THE SELECTION OF CONCRETE BEST SUITED TO A PARTICULAR STRUCTURAL DESIGN OR FOR THE STUDY OF PERFORMANCE. THE SHORT TERM BENEFIT IS IN BETTER CONTROL OF CONCRETE QUALITY AT THE TIME OF CONSTRUCTION. THE LONG TERM, AND PERHAPS EVEN MORE IMPORTANT BENEFIT, SHOULD BE THAT THE PROPERTIES OF CONCRETE WHICH INFLUENCE PERFORMANCE CAN BE IDENTIFIED AND BETTER SPECIFICATIONS PREPARED FOR FUTURE WORK. /AUTHOR/

Smith, P

Ontario Dept Hwys, Downsview /Canada/ Jan. 1967

ACKNOWLEDGMENT: Highway Res Abstracts Hwy Res Board

2A 214697

JOB-RIGGED SPREAD PAVES 35-DEGREE SLOPES

A SPECIAL THREE-RIG PAVING TRAIN THAT CAN POUR AND FINISH CONCRETE TO TOLERANCES WITHIN 1/8 IN. WHILE TILTED 35 DEG WAS DEvised BY A BRUSSELS CONTRACTOR TO PLACE THE STEEP BANKS OF AN AUTOMOBILE TEST TRACK IN LOMMEL, BELGIUM. THE BANKED CURVES ARE 36 FT WIDE IN PLAN, BUT VARY 11 FT 4 IN. IN HEIGHT. THIS MEANS THAT ALTHOUGH EACH OF THE SIX LANES IS 6 FT WIDE IN THE STRAIGHTWAYS, THEY RANGE FROM 6 TO 6.95 FT IN WIDTH ON THE BANKS. ALL THREE PAVING MACHINES ADJUST IN WIDTH AND ARE SELF-PROPELLED ON RAILS. THE FIRST IS AN AUGER THAT SPREADS A 5-IN LIFT OF CRANE-DUMPED CONCRETE. AFTER WIRE MESH REINFORCING HAS BEEN PLACED BY HAND, THE SECOND MACHINE CONSOLIDATES THIS LIFT WITH FIVE VIBRATORS ACROSS ITS FRONT END. THE SECOND MACHINE ALSO POURS AND VIBRATES THE UPPER 2.8-IN. LIFT, SMOOTHING THE SURFACE WITH AN EXTRUDING PLATE. THE THIRD RIG IN THE TRAIN, A STANDARD FINISHER, CARRIES MOVING SCREEDS THAT WORK AT A 30-DEG ANGLE TO THE DIRECTION OF TRAVEL, WORKING CONCRETE TOWARD THE LANES UPPER EDGE. IT BRINGS THE CONCRETE WELL WITHIN THE 1/8 IN. TOLERANCE CALLED FOR IN SPECS. THE 2 2/3-MI TRACK IS MADE UP OF TWO 1,970-FT-LONG STRAIGHT STRETCHES LINKED BY THE SUPER ELEVATED CURVES. /AUTHOR/

Construction Methods & Equipment Mar. 1966

ACKNOWLEDGMENT: Highway Res Abstracts Hwy Res Board

2A 214700

SUBWAY TUNNEL CONSTRUCTION IN NEW YORK CITY

SUBWAY TUNNEL CONSTRUCTION PROVIDES A VARIETY OF CONDITIONS REQUIRING SPECIAL EQUIPMENT AND METHODS. TUNNEL SECTIONS VARY AS TO SHAPE, HEIGHT AND PROXIMITY TO EXISTING STRUCTURES. PROVEN AND NEW EQUIPMENT AND METHODS ARE USED FOR EXCAVATION AND CONCRETE OPERATIONS. A COMBINATION OF ROOF BOLT, TIMBER AND STRUCTURAL STEEL IS USED TO SUPPORT THE EXCAVATED TUNNEL. RUBBER-TIRED HAULING EQUIPMENT PROVED TO BE MANEUVERABLE AND ADAPTABLE TO A VARIETY OF TUNNEL OPERATIONS. CRAWLER-MOUNTED EQUIPMENT FOR LOADING IS SELECTED BECAUSE OF ITS SUCCESS DOING SIMILAR WORK. CONCRETE EQUIPMENT IS SELECTED AND ADAPTED TO BE MANEUVERABLE AND FLEXIBLE BECAUSE OF THE VARIETY PLACING REQUIREMENTS. ROCK FALL STOPS ADVANCE OF TUNNEL EXCAVATION. TUNNEL AND VOID ARE FILLED WITH CONCRETE TO FORM SUPPORT FOR FALLING ROCK. ROCK EXCAVATION IS CARRIED OUT DIRECTLY UNDER OPERATING RAILROAD AND PASSENGER STATION. SUPPORT OF OVERHEAD STRUCTURE IS DONE AS EXCAVATION IS ADVANCED. BLASTING IN THIS AREA IS LIMITED TO AVOID DAMAGE TO EXISTING STRUCTURE.

Knight, GB *Am Soc Civil Engr J Construction Div* Sept. 1964

2A 214706

ASPHALT PAVING WORKSHOP-2

THE EFFECT OF A SILICONE MIX ADDITIVE ON PAVEMENT COMPACTION IS DISCUSSED. A REVIEW WAS MADE OF STUDY RESULTS ON ASPHALT TREATED WITH DIFFERENT RATES OF SILICONE. COMMENTS WERE MADE ON THICK-LIFT PAVING PROCEDURES, PARTICULARLY AS TO PROPER TIRE PRESSURE FOR BREAK-DOWN AND ON CONTROL SPREAD OF LOOSE MIX TO SECURE UNIFORM MAT THICKNESS. THERE WERE SUGGESTIONS ON HOW TO GET RESURFACING OPERATIONS STARTED QUICKLY AFTER A RAIN. WEAR COST WAS EXPERIENCED TO RUN ABOUT DOUBLE WITH MIXES USING GRAVEL OR GRANITES. COMPARED WITH LIMESTONE OR CERTAIN EASILY FRACTURED TRAPROCKS. COMMENTS WERE MADE ON PRODUCTIVITY VS QUALITY, AND MIX HAULING AND

COSTS. RECOMMENDATION WAS MADE THAT THE STABILITY TEST TEMPERATURE OF ASPHALT MIXES USED IN HIGHWAY COURSES BE LOWERED FROM 140 F TO 100 F.

Roads and Streets June 1966

2A 214714

QUALITY ASSURANCE THROUGH PROCESS CONTROL AND ACCEPTANCE SAMPLING

QUALITY ASSURANCE FOR HIGHWAYS INCLUDE PROPER ORDERING OF THE THINGS NECESSARY TO PERFORM THE SERVICES AND ASSURANCE THAT WHAT WAS ORDERED WILL BE RECEIVED. THE SPECIFIC CHARACTERISTICS THAT MUST BE CONTROLLED AND THEIR QUANTITATIVE LEVEL OR UNIFORMITY OF DIMENSIONS OR PERFORMANCE ARE INVESTIGATED. BECAUSE OF THE VOLUME, SPEED, LEGAL AND FINANCIAL REQUIREMENTS OF HIGHWAY CONSTRUCTION, IMPROVED QUALITY ASSURANCE METHODS ARE NEEDED. STATISTICAL DEFINITIONS AND CONCEPTS NEEDED FOR APPLICATION IN SPECIFICATION WRITING ARE GIVEN.

Bureau of Public Roads /US/ 79 pp, Apr. 1967

ACKNOWLEDGMENT: Highway Res Abstracts Hwy Res Board 1C33021088, 3C33084583

2A 214726

WHAT CONTRACTORS SHOULD KNOW ABOUT STATISTICAL SPECIFICATIONS

STATISTICAL SPECIFICATIONS DEFINE THE QUALITY OF THE MATERIALS AND OF THE CONSTRUCTION REQUIRED. PRESENT CONSTRUCTION IS BEING MEASURED IN TERMS OF QUALITY LEVEL, OR AVERAGE QUALITY, AND THE DEVIATION OF QUALITY MEASUREMENT ABOVE AND BELOW THIS AVERAGE. THIS KNOWLEDGE AND THE USE OF STATISTICAL CONCEPTS IN WRITING SPECIFICATIONS WILL TAKE INTO ACCOUNT THESE FOUR IMPORTANT FACTS' /1/ VARIATIONS EXIST IN WHATEVER PROPERTY MEASURED, /2/ IT IS IMPRACTICAL TO TEST ALL OF THE MATERIAL OR ALL OF THE END PRODUCT ON ANY PROJECT, /3/ RANDOM SAMPLING ENABLES DESCRIPTION OF THE PROBABILITY THAT THE PROPERTIES OF THE MATERIALS WHICH HAVE BEEN INCORPORATED ARE WITHIN SOME RANGE, AND /4/ THE MORE NEARLY UNIFORM A PRODUCT IS SPECIFIED, THE MORE THE COST WILL BE. SPECIFICATIONS MUST, THEREFORE, BE DEVELOPED ON A PROBABLISTIC RATHER THAN ON AN ABSOLUTE BASIS. METHODS OF WRITING SPECIFICATIONS BASED ON STATISTICAL PARAMETERS ARE REVIEWED. DEFINITIVE TESTING AND BETTER QUALITY DEFINITION OF MATERIALS AND CONSTRUCTION ARE NEEDED. THE CONCEPTS AND METHODS PRESENTED WILL IMPROVE CONSTRUCTION QUALITY AND, BECAUSE OF THE ELIMINATION OF UNCERTAINTIES IN BIDDING, WILL EVENTUALLY LOWER THE COST.

Roads and Streets Apr. 1967

2A 214731

EVALUATION OF CONSTRUCTION CONTROL PROCEDURES-INTERIM REPORT

VARIATIONS INHERENT IN AGGREGATE GRADATIONS IN WIDELY DIFFERENT GEOGRAPHICAL LOCATIONS WERE EVALUATED. STATISTICAL TECHNIQUES WERE USED FOR DETERMINING THE RELATIVE EFFECT OF TESTING ACCURACY, SAMPLING METHODS, AND SEGREGATION, WITH RELATION TO THE EVALUATION AND ACCEPTANCE OF COARSE AGGREGATE USED FOR HIGHWAY CONSTRUCTION. A PRECISION STATEMENT WAS DEVELOPED FOR THE AGGREGATE GRADATION TEST, AND A METHOD OF DRAFTING A REALISTIC AND ADEQUATE ACCEPTANCE GRADATION SPECIFICATION FOR COARSE AGGREGATES. THE STANDARD DEVIATION FOR THE REPEATABILITY OF THE GRADATION TEST ON COARSE AGGREGATE, UNDER ROUTINE CONDITIONS, IS APPROXIMATELY 4 PERCENT. RECOMMENDED METHODS OF INCORPORATING THE RESULTS OF THIS STUDY INTO HIGHWAY CONSTRUCTION SPECIFICATIONS AND PRO-

CEDURES ARE PRESENTED IN THE FORM OF A COMPLETE MODEL SPECIFICATION FOR GRADED COARSE AGGREGATE.

Highway Research Board Nchrp Reports 1967

**2A 214735
EXPERIENCES WITH THE USE OF WEDGES AGAINST FROST HEAVING**

OBSERVATIONS OF THE FROST HEAVINGS IN THE ROAD CONSTRUCTION USING WEDGES FOR PREVENTION OF THE INFLUENCE OF FROST WERE CONDUCTED. OBSERVATIONS WERE MADE ON FROST-SUSCEPTIBLE GROUND ON ROAD PARTS SITUATED ON BOTH SIDES OF CULVERTS. THE FOLLOWING CASES WERE OBSERVED: /1/ CULVERTS WITHOUT ANY TRANSITION WEDGES, /2/ CULVERTS WITH SHORT IRREGULAR WEDGES, FILLED WITH SAND, /3/ CULVERTS WITH LONG REGULAR SAND WEDGES, AND /4/ WEDGE FILLED WITH INSULATING LIGHTWEIGHT AGGREGATE. THE INVESTIGATION RESULTED IN A PROPOSAL FOR THE SHAPE AND DIMENSIONS OF THE FROST DISPLACEMENT WEDGE OF THE CULVERT TO PREVENT FROST HEAVING.

Taivainen, CA *Intl Conf Struct Design Asphalt Pvmnts Jan. 1967*

**2A 214737
RESPONSIBILITY FOR QUALITY IN HIGHWAY CONSTRUCTION**

THE PROBLEMS OF RESPONSIBLE CONTROL FOR QUALITY IN HIGHWAY CONSTRUCTION ARE DISCUSSED. PERFORMANCE DEPENDS ON THE DESIGN OF THE PAVEMENT STRUCTURE AT LEAST AS MUCH AS ON THE QUALITY OF MATERIALS AND CONSTRUCTION USED. THE ULTIMATE CONCEPT IN RESPONSIBILITY WOULD BE HAVING THE CONTRACTOR OR GOVERNMENT AGENCY REQUIRED TO DESIGN, BUILD AND GUARANTEE THE PERFORMANCE OF THE HIGHWAY. HOWEVER, INITIATIVE IN USING NEW CONSTRUCTION METHODS MUST NOT BE HAMPERED. CONSTRUCTION CONTROL TOLERANCES AND THE RESPONSIBILITY FOR QUALITY CONTROL TESTING ARE DISCUSSED.

Smith, P *Highway Research News, Hwy Res Board 1967*

**2A 214740
RECOMMENDED PRACTICE FOR CONCRETE FORMWORK**
PRESENTS BRIEF INTRODUCTORY STATEMENT ON THE NEED FOR FORMWORK STANDARDS BASED ON THE FACT THAT 35 TO 60 PERCENT OF THE TOTAL COST OF THE CONCRETE WORK IN A PROJECT IN THE UNITED STATES IS IN THE FORMWORK. A SECTION IS GIVEN ON ENGINEER-ARCHITECT SPECIFICATIONS NOTING THE KIND AND AMOUNT OF SPECIFICATION THE ENGINEER OR ARCHITECT SHOULD PROVIDE THE CONTRACTOR. SINCE THE COMMITTEE CONCLUDES THAT FORMWORK DESIGN AND ENGINEERING, AS WELL AS CONSTRUCTION, MUST BE THE RESPONSIBILITY OF THE CONTRACTOR, THE RECOMMENDATIONS CONTAINED IN THE REPORT ARE DIRECTED TO THAT GROUP. HOWEVER, AN UNDERSTANDING OF THE RECOMMENDATIONS BY ENGINEERS AND ARCHITECTS WILL AID THESE GROUPS IN THEIR SPECIFICATION FUNCTIONS. THE REPORT IS DIVIDED INTO FIVE CHAPTERS: 1. DESIGN, 2. CONSTRUCTION, 3. MATERIALS FOR FORMWORK, 4. FORMS FOR SPECIAL STRUCTURES, AND 5. FORMWORK FOR SPECIAL METHODS OF CONSTRUCTION. /AUTHOR/

Am Concrete Inst Journal & Proceedings July 1967

**2A 214752
FEASIBILITY OF COLD WEATHER EARTHWORK IN INDIANA**
THE EFFECTS OF COLD AND INCLEMENT WEATHER ON MEN, MACHINES, AND MATERIALS INVOLVED IN HIGHWAY EARTHWORK WERE REVIEWED. THE COLD WEATHER EARTHWORK EXPERIENCE OF THE NORTHERN STATES OF THE UNITED STATES, THE PROVINCES OF CANADA, AND THE SCANDINAVIAN COUNTRIES HAS BEEN REVIEWED WITH THE AIM OF DETERMINING, (1) HOW WEATHER AND SOIL CONDI-

TIONS TEND TO RESTRICT THE LENGTH OF THE CONSTRUCTION SEASON, AND (2) WHAT COLD WEATHER CONSTRUCTION PRACTICES MIGHT BE APPLICABLE IN INDIANA. THE SEASONAL VARIATIONS OF WEATHER AND CERTAIN SOIL CONDITIONS IN INDIANA HAVE BEEN STUDIED. THE INCREASED COSTS OF VARIOUS EARTHWORK OPERATIONS IN INDIANA DURING COLD WEATHER HAVE BEEN ESTIMATED. THE PROBABLE BENEFITS OF (1) REDUCED INTEREST AND INFLATION COSTS, (2) REDUCED ACCIDENT AND INCONVENIENCE COSTS, AND (3) BETTER UTILIZATION OF THE RESOURCES OF LABOR, CONTRACTORS, AND THE STATE HIGHWAY COMMISSION HAVE BEEN WEIGHED AGAINST HEIGHTENED TECHNOLOGICAL DEMANDS. A HYPOTHETICAL EXAMPLE HAS BEEN DEVELOPED WHICH SHOWS THAT COLD WEATHER EARTHWORK IS FEASIBLE ON AN INTERSTATE HIGHWAY CONSTRUCTION PROJECT IN NORTHERN INDIANA AND THAT YEAR-ROUND CONSTRUCTION SCHEDULING CAN PRODUCE AN ECONOMIC BENEFIT. /AUTHOR/

Osborne, AM
Purdue & Ind State Hwy Comm Jhrp June 1967

**2A 214766
CRUSHED BRICK IN ROAD CONSTRUCTION**

THERE ARE LARGE AREAS IN PAKISTAN WHERE STONE AGGREGATE IS NOT AVAILABLE IN THE VICINITY OF ROAD CONSTRUCTION. LONG HAULAGE OF STONE MAKES THE ROAD CONSTRUCTION EXPENSIVE. SIMILAR CONDITIONS EXIST ELSEWHERE IN MANY PARTS OF THE WORLD. WORK HAS BEEN DONE AT THE ROAD RESEARCH INSTITUTE LAHORE TO INVESTIGATE THE USE OF AGGREGATE OBTAINED FROM CRUSHING BURNT BRICK IN SUCH AREAS FOR USE IN ROAD CONSTRUCTION. THIS STUDY HAS BEEN DIRECTED TOWARDS THE DISCUSSION ON THE EXISTING PRACTICES RELATING TO USE OF BRICKS IN ROAD CONSTRUCTION, USE OF CRUSHED BRICK IN SUBSTITUTION OF WHOLE BRICKS, AND REPLACEMENT OF STONE AGGREGATE WITH CRUSHED BRICK WHEREVER ECONOMICALLY FEASIBLE. BRICK AGGREGATE MADE BY CRUSHING BUILDING BRICKS HAS BEEN CHECKED FOR ITS USE IN SUBBASE, BASE AND ASPHALTIC CONCRETE MIX. EXPERIMENTAL ROADS WERE BUILT ON THE BASIS OF RESULTS OBTAINED IN THE LABORATORY. RESULTS OF THE BOTH LABORATORY AND FIELD EXPERIMENTS HAVE BEEN DETAILED, WHICH INDICATE THAT BRICK AGGREGATE OFFERS GOOD PROSPECTS OF REPLACING CRUSHED STONE IN THE AREAS OF STONE SCARCITY AND IS A BETTER STRUCTURAL SUBSTITUTE FOR WHOLE BRICK IN CONVENTIONAL ROAD CONSTRUCTION. /AUTHOR/

Ahmad, MS
Roads Maintenance Circle /Pakistan/

**2A 214767
SWISS ROAD BUILDERS SEEK WAYS TO REDUCE BAD WEATHER RISKS**

SOME OF THE LARGER SWISS ROAD BUILDING CONSTRUCTION JOBS REQUIRE 400 MEN ON THE JOB. THE INVESTED VALUE OF EQUIPMENT AVERAGES OUT TO 62,500 SWISS FRANCS PER MAN WHICH MEANS THAT EVERY HOUR OF WORK LOST BECAUSE OF RAIN RESULTS IN A CONSIDERABLE LOSS OF RETURN ON INVESTMENT. SOME MEANS OF REDUCING WEATHER RISK USED ARE: USE OF SCRAPEDOZERS WHICH WORK SUCCESSFULLY UNDER ALL KINDS OF CONDITIONS AND ARE MORE EFFICIENT THAN RUBBER TIRE SCRAPPERS WHERE SHORT DISTANCES ARE INVOLVED. LAYING LIME FOR SOIL STABILIZATION OFFERS ONE MEANS OF COMPACTING WATERLOGGED MORAINES AFTER FIVE DAYS OF RAIN.

Mojen, H *World Construction Oct. 1967*

2A 214768

NATIONAL CONFERENCE ON STATISTICAL QUALITY CONTROL METHODOLOGY IN HIGHWAY AND AIRFIELD CONSTRUCTION

SESSION I-CONCEPTS OF STATISTICS CONCEPTS OF DISTRIBUTION AND SAMPLING, A. J. DUNCAN CONCEPTS OF DECISION CRITERIA, PAUL IRICK CONCEPTS OF CONTROL CHARTS, N. L. ENRICK CONCEPTS OF ACCEPTANCE SAMPLING, H. WEINGARTEN SESSION II-GENERAL SESSION SEVERAL INDUSTRIAL APPROACHES TO STATISTICAL QUALITY CONTROL, M. E. WESCOTT CONTRACTUAL RELATIONSHIPS BETWEEN GOVERNMENT AND CONTRACTORS IN QUALITY ASSURANCE, J. J. RIORDAN THE NEED FOR CHANGE IN CONSTRUCTION CONTROL PROCEDURES, W. N. CAREY, JR. AND J. F. SHOOK EXPERIENCE IN THE APPLICATION OF STATISTICAL METHODS IN ROAD CONSTRUCTION AND MATERIALS, J. HODE KEYSER SELECTING APPROPRIATE LEVELS OF QUALITY, B. MATHER SESSION III-VARIABILITY VARIABILITY OF COMPACTED SOILS, E. T. SELIG STOCKPILING OF AGGREGATE FOR GRADATION UNIFORMITY, H. F. WALLER, JR. VARIABILITY IN BITUMINOUS CONSTRUCTION, J. F. SHOOK VARIABILITY OF PORTLAND CEMENT CONCRETE, H. H. NEWLON A COMPARISON OF SOIL CLASSIFICATION SYSTEMS BY ANALYSIS OF VARIANCE, H. E. WAHLS AND G. E. FUTRELL APPLICATION OF STATISTICAL EVALUATION TECHNIQUES FOR QUALITY CONTROL OF STEAM CURED CONCRETE, H. E. BROWN VARIABILITY OF SOME SELECTED LABORATORY SOIL TESTS, T. K. LIU AND M. R. THOMPSON AN ANALYSIS OF VARIATIONS ENCOUNTERED IN NUCLEAR DENSITY TESTING, C. S. HUGHES AND M. C. ANDAY SESSION IV-APPLICATIONS OF STATISTICAL METHODS ACCEPTANCE SAMPLING FOR ATTRIBUTES, HARRY WEINGARTEN ACCEPTANCE SAMPLING BY VARIABLES, A. GRANDAGE THE USE OF STATISTICAL TECHNIQUES IN JUDGING COMPLIANCE WITH SPECIFICATION AND IN THE CONTROL OF THE MANUFACTURE OF BITUMINOUS MATERIALS, D. H. MATHEWS AND R. HARDMAN APPLICATIONS OF CONTROL CHARTS, P. F. WADE, M. KUSHNER, AND J. HODE KEYSER ADAPTING STATISTICAL METHODS TO CONCRETE PRODUCTION, E. A. ABDUN-NUR INTERPRETING THE ANALYSIS OF VARIANCE (FOR PHYSICAL SCIENTISTS), R. E. WHEELER SUMMARY OF BUREAU OF RECLAMATION EXPERIENCE IN STATISTICAL CONTROL OF EARTH DAM EMBANKMENT CONSTRUCTION, F. J. DAVIS APPLICATION OF SEQUENTIAL ANALYSIS TO COMPACTION CONTROL, C. P. FISHER AND A. SANVER SOME BASIC CONSIDERATIONS IN THE APPLICATION OF STATISTICAL METHODS TO HIGHWAY PROBLEMS, R. L. DAVIS SESSION V-IMPLICATIONS OF STATISTICAL METHODS BROAD ASPECTS OF STATISTICAL QUALITY CONTROL, R. F. BAKER IMPLICATIONS OF STATISTICAL QUALITY CONTROL TO AN AUDITOR, D. A. SCHRAHEK IMPLICATIONS OF STATISTICAL QUALITY CONTROL TO A HIGHWAY ENGINEER, G. W. MCALPIN IMPLICATIONS OF STATISTICAL QUALITY CONTROL TO A MATERIALS SUPPLIER, R. S. REIGELUTH THE EQUIPMENT MANUFACTURER AND THE PHILOSOPHY OF STATISTICAL QUALITY CONTROL, J. J. BENSON IMPLICATIONS OF STATISTICAL QUALITY CONTROL FROM THE CONTRACTOR'S VIEWPOINT, C. R. FOSTER AND R. R. STANDER IMPLICATIONS OF STATISTICAL QUALITY CONTROL AFTER SEVERAL YEARS EXPERIENCE, J. W. G. KERR AND D. R. PARKES.

Virginia University Proceedings 664 pp, Nov. 1966

2A 214772

THE STATISTICAL APPROACH TO REALISTIC HIGHWAY SPECIFICATIONS

THE STEP-BY-STEP PROCEDURE IS PRESENTED WHERE STATISTICAL CONCEPTS ARE EMPLOYED TO INCORPORATE STATISTICAL PARAMETERS BASED ON WEST VIRGINIA RESEARCH DATA INTO SPECIFICATION TEXT. NUMEROUS FIGURES, FLOW CHARTS, AND TABLES ARE USED TO ILLUSTRATE THE PROCEDURES AND TO DEMONSTRATE THAT ONLY A KNOWLEDGE OF ARITHMETIC IS NEEDED TO DESIGN AN ACCEPTANCE PLAN. THE STATISTICAL APPROACH IS EXTENDED TO THE DERIVATION OF A PENALTY SYSTEM THAT WILL PERMIT

ACCEPTANCE OF MARGINAL MATERIAL AT A REDUCED PRICE ON A FORMAL CONTRACT BASIS. /AUTHOR/

Steele, GW Hudson, SB Van, TIL CJ
Sasho Annual Meeting

2A 214780

ESTIMATING CONCRETE WORK-VI

MATERIAL REQUIREMENTS FOR FORMING COLUMN AND WALL FOOTINGS ARE REVIEWED. THE LABOR COST FOR INSTALLING THESE FORMS ARE CALCULATED. FORMS FOR FOUNDATION WALLS, PIERS BELOW GRADE, EXTERIOR-INTERIOR COLUMNS, EXTERIOR AND INTERIOR BEAMS, SHORED FLAT SLABS, AND SHORED PAN SLABS ARE DESCRIBED.

Le, JEUNE EG *Concrete Construction* Nov. 1967

2A 214782

ESTIMATING CONCRETE WORK-V

TECHNIQUES ARE DESCRIBED FOR REMOVING ITEMS FOR PRICING FROM THE QUANTITY TAKEOFF SHEETS TO THE RECAP SHEET. A LABOR OUTPUT TABLE IS PRESENTED FOR USE IN PRICING LABOR FOR FORM WORK ERECTION. THREE ITEMS ARE LISTED IN THE LABOR OUTPUT TABLE FOR FORM WORK: MATERIAL COST, ERECTION LABOR PER DAY AND STRIPPING LABOR PER DAY. THE ERECTION TIME INCLUDES A CARPENTER AND ONE-HALF LABORER PER DAY. THE STRIPPING TIME INCLUDES ONE LABORER PER DAY.

Lejeune, EG *Concrete Construction* Oct. 1967

2A 214783

ESTIMATING CONCRETE WORK-IV

ESTIMATING TECHNIQUES AND PROCEDURES ARE DESCRIBED FOR ESTIMATING THE FOLLOWING: SLABS ON CORRUGATED METAL FORMS, STAIRS ON FILL, SHORED STAIRS, STAIR LANDINGS, PAN-FILL STAIRS, EXTERIOR SIDEWALKS, EXTERIOR PAVING, EXTERIOR STRAIGHT CURBS, EXTERIOR CURB AND GUTTER, AND MISCELLANEOUS CONCRETE IN BUILDING. CORRUGATED FORMWORK IS USED SINCE IT PROVIDES BETTER, CHEAPER, CONCRETE PLACING CONDITIONS. CORRUGATED FORMWORK AS DESCRIBED IS A CORRUGATED METAL FORM LEFT IN POSITION AFTER CONCRETE IS PLACED.

Lejeune, EG *Concrete Construction* Sept. 1967

2A 214785

ESTIMATING CONCRETE WORK-III

PROCEDURES AND TECHNIQUES ARE PRESENTED FOR ESTIMATING CONCRETE WORK FOR INTERIOR AND EXTERIOR COLUMNS, INTERIOR AND EXTERIOR BEAMS, SHORED FLAT SLABS, AND METAL OR FIBERGLASS PAN SLABS.

Le, JEUNE EG *Concrete Construction* Apr. 1967

2A 214794

SLURRY-TRENCH TECHNIQUES FOR DIAPHRAGM WALLS IN DEEP FOUNDATION CONSTRUCTION

BENTONITE SLURRY IS BEING SUCCESSFULLY USED IN TRENCH EXCAVATION AROUND THE WORLD. THE CONSTRUCTION OF UNDERGROUND CONCRETE DIAPHRAGM WALLS BY USE OF BENTONITE SLURRY-TRENCH TECHNIQUES OFFERS MANY ADVANTAGES FOR FOUNDATION AND UNDERGROUND CONSTRUCTION. THEIR USE PROVIDES A RIGID, WATERTIGHT WALL THAT PERMITS SUBSEQUENT DEWATERING AND EXCAVATION WITHOUT CAUSING SETTLEMENTS AND GROUND WATER DRAWDOWN THAT MIGHT DAMAGE ADJOINING STRUCTURES. THUS, UNDERPINNING IS ELIMINATED OR MINIMIZED AND DEEP EXCAVATIONS ARE FACILITATED. SHORT LENGTHS OF WALL ARE EXCAVATED BY CLAMSHELL BUCKET OR OTHER MEANS AND ARE HELD FROM CAVING BY SLURRY UNTIL EXCAVATION IS COMPLETE AND CONCRETE CAN BE PLACED BY TREMIE METHODS. A

NEW DEVELOPMENT IS USE OF VERTICAL (SOLDIER) BEAMS TO ESTABLISH WORK AREAS AND THEN SERVE AS STRUCTURAL REINFORCEMENT. BUILDING FOUNDATION WALLS IN THIS WAY ALLEVIATES MOVEMENT OF SOIL AND OF GROUND WATER.

Gerwick, BC *Civil Engineering Asce* Dec. 1967

2A 214798

THE ART OF TUNNELLING

THE AUTHOR, WHO HOLDS THE CHAIR OF FOUNDATION ENGINEERING AND TUNNELLING AT THE UNIVERSITY OF BUDAPEST, PUBLISHED A BOOK ON TUNNELLING IN HUNGARIAN IN 1961, WHICH HAS NOW BEEN TRANSLATED INTO ENGLISH WITH MINOR REVISIONS. AFTER DISCUSSING THE VARIOUS TYPES OF TUNNELS AND THE HISTORICAL DEVELOPMENT OF TUNNEL CONSTRUCTION, THE AUTHOR TREATS THE PRELIMINARY STUDIES AND GENERAL DESIGN CONSIDERATIONS RELATING TO THE ECONOMIC, GEOLOGICAL, HYDROLOGICAL, AND VARIOUS OTHER FACTORS INFLUENCING THE TUNNEL LOCATION AND CROSS-SECTION. THE CHAPTER ON THE ANALYSIS OF LOADS ON TUNNELS AND UNDERGROUND STRUCTURES CONTAINS A DETAILED ACCOUNT OF THE CAUSE AND TYPES OF ROCK PRESSURES, DIFFERENT THEORETICAL METHODS OF ESTIMATING ROCK AND SOIL PRESSURES ON TUNNELS, AND THEIR EXPERIMENTAL VERIFICATION. THE STRUCTURAL DESIGN OF RIGID AND FLEXIBLE HORSESHOE-SHAPED, CIRCULAR, AND RECTANGULAR TUNNELS IS DISCUSSED IN DETAIL ON THE BASIS OF VARIOUS THEORIES, INCLUDING THE EFFECT OF ROCK OR SOIL AND STRUCTURE INTERACTION. NUMERICAL DESIGN EXAMPLES ARE WORKED OUT IN FULL FOR ILLUSTRATION. THE IMPORTANT EFFECTS OF FISSURES, JOINTS, AND OTHER ROCK DEFECTS, AS WELL AS THE INFLUENCES OF ANISOTROPY AND STRATIFICATION OF ROCK AND SOIL MASSES ON THE LOADING AND BEHAVIOR OF TUNNELS IN PRACTICE COULD, PERHAPS, HAVE BEEN INCLUDED IN THIS CHAPTER. AFTER TREATING ANCILLARY WORKS AND TUNNEL SURVEYING, THE AUTHOR COVERS THE CONSTRUCTION OF TUNNELS IN ROCK AND SOILS AND THE SERVICE, OPERATION, AND MAINTENANCE OF TUNNELS. /AUTHOR/

Szechy, K
Akademiai Kaido /Hungary/ 891 pp, 1966

2A 214800

QUALITY CONTROLS FOR STEEL CONSTRUCTION

DEVELOPMENTS IN THE STEEL INDUSTRY PERMITTING THE USE OF A WIDE VARIETY OF STRUCTURAL STEELS, THE EVER-INCREASING USE OF WELDED DESIGNS, AND THE RAPID PACE OF TODAY'S CONSTRUCTION ARE PLACING GREAT RESPONSIBILITY ON THE INSPECTION PHASE OF STRUCTURAL-STEEL PRODUCTION, FABRICATION AND ERECTION. BETTER AND MORE CLOSELY SUPERVISED INSPECTION OF STEEL IS REQUIRED FROM ROLLING MILL THROUGH FABRICATION PLANT TO ERECTION AND FINAL PAINTING. THE SUPPLIER FACES THE CONFLICTING INTERESTS OF LOWERED COST VS. A QUALITY PRODUCT-WITH THE FIRST OF MAJOR IMPORTANCE TO HIS PRODUCTION STAFF. THE OWNER MUST BE CONVINCED THAT HE CAN ECONOMICALLY AFFORD THE BEST INSPECTION AND THAT THE INSPECTION AGENCY SHOULD BE SELECTED BY NEGOTIATION RATHER THAN COMPETITIVE BIDDING. THE ENGINEER MUST KEEP IN CLOSE CONTACT WITH THE INSPECTOR AND MUST BACK HIM UP FULLY IN THE MILL, IN THE FABRICATION SHOP AND AT THE ERECTION SITE. PROPER APPLICATION OF PAINT IS MOST IMPORTANT IN REDUCING MAINTENANCE. THE CURRENT PRACTICE OF ARCHITECTS HAVING FIELD INSPECTION OF BUILDINGS PERFORMED ON THE BASIS OF INFREQUENT VISITS TO THE SITE BY THE DESIGNING ENGINEER IS SUBJECT TO CRITICISM. BECAUSE OF A LACK OF UNDERSTANDING BY THOSE ON THE JOB AS TO THE BASIC DESIGN REQUIREMENTS AND BEHAVIOR OF MATERIALS, THIS PRACTICE OFTEN LEADS TO COSTLY CORRECTIVE ACTION OR INFERIOR WORK.

IT IS STRONGLY RECOMMENDED THAT THIS PRACTICE BE GIVEN CLOSE SCRUTINY BY THE ENGINEERING PROFESSION.

Brumer, M Stahl, F *Civil Engineering Asce* Oct. 1965

2A 214806

THE SEARCH FOR BETTER QUALITY ASSURANCE FOR ASPHALT PAVEMENTS

CONTENTS: THE BASIC PROBLEMS OF QUALITY ASSURANCE QUALITY ASSURANCE REQUIREMENTS FOR BITUMINOUS CONSTRUCTION SUGGESTED TOLERANCES BASIS FOR TOLERANCES.

Halstead, WJ
Transportation Department /US/ 1968

2A 214812

QUALITY CONTROL OF ASPHALT PAVEMENT CONSTRUCTION

DATA WERE COLLECTED FROM NINE ASPHALT PAVEMENT CONSTRUCTION PROJECTS TO DETERMINE THE VARIATIONS IN GRADATION, ROAD DENSITIES, AIR VOIDS, MARSHALL STABILITY AND FLOW VALUES, PAVEMENT THICKNESS, AND ASPHALT CEMENT PENETRATION. STANDARD DEVIATIONS FOR EACH ARE PRESENTED IN GRAPHS. THE DESIGN OF A QUALITY CONTROL CHART IS PRESENTED AS THE ESTABLISHMENT OF THE PROBABLE LIMITS OF RANDOM FLUCTUATION AND THE NUMBER OF DEFECTIVES FOUND PER UNIT VOLUME REPRESENTED BY A SERIES OF SAMPLES. THE TECHNIQUE IS INTRODUCED AS A NATURAL FOLLOW-THROUGH IN THE STUDY VARIATION IN PHYSICAL PROPERTIES USED TO DESCRIBE THE QUALITY OF PAVEMENT MIXTURES. THE USE OF QUALITY CONTROL CHARTS SHOULD PROVE TO BE A VALUABLE TOOL IN PAVEMENT PRODUCTION BESIDES AN INVALUABLE HISTORICAL ACCOUNT OF QUALITY-CHARACTERISTICS.

Huculak, NA
Canadian Department Public Works Feb. 1968

2A 214815

INVESTIGATIONS INTO ROAD BUILDING PRACTICE IN THE TROPICS. A STUDY OF THE COMPACTION OF EARTHWORKS AT THE NEW INTERNATIONAL AIRPORT FOR KUALA LUMPUR, MALAYSIA

AS PART OF A STUDY OF ASPECTS OF NORMAL ROAD-BUILDING PRACTICE IN TROPICAL COUNTRIES THE LEVELS OF COMPACTION ACHIEVED ON EARTHWORKS AT THE NEW INTERNATIONAL AIRPORT AT KUALA LUMPUR, MAYAYSIA, WERE INVESTIGATED. THE STUDY SHOWS THAT GIVEN EFFICIENT SITE MANAGEMENT, WITH PARTICULAR EMPHASIS ON THE MINIMIZING OF THE EFFECTS OF ADVERSE WEATHER CONDITIONS, HIGH STATES OF COMPACTION CAN BE CONSISTENTLY OBTAINED IN A WET TROPICAL CLIMATE ON RESIDUAL SANDY CLAY SOILS. /AUTHOR/

Bulman, JN *Rrl Reports, Road Research Lab /UK/* 1967

2A 214818

STATISTICAL QUALITY CONTROL IN HIGHWAY CONSTRUCTION

CALIFORNIA'S EXPERIENCE IN MAKING A STATISTICAL STUDY OF ITS QUALITY SPECIFICATIONS FOR HIGHWAY AND BRIDGE CONSTRUCTION MATERIALS IS DESCRIBED. FOUR YEARS OF RESEARCH ON SAMPLING AND TESTING OF MATERIALS SUCH AS COMPACTED EMBANKMENT, PLASTIC CONCRETE, CEMENT TREATED BASE, STRUCTURAL CONCRETE AGGREGATE, UNTREATED BASE MATERIAL AND AGGREGATE SUBBASE MATERIAL ARE BEGINNING TO PROVIDE INFORMATION CONCERNING VARIATIONS DUE TO SAMPLING, TESTING, AND THOSE INHERENT IN THE MATERIALS ITSELF. SUGGESTED IN PLACE OF TRADITIONAL METHODS IS STATISTICAL QUALITY CONTROL (SQC). THE USE OF SQC COULD SHIFT THE QUALITY CONTROL RESPONSIBILITY TO THE CONTRACTOR WITH THE BUYER BASING HIS PURCHASE

ON A STATISTICALLY SOUND END POINT EVALUATION. PROBLEMS ARISING IN THE USE OF SQC MAY BE MET BY TRAINING IN THE TECHNOLOGY OF STATISTICAL CONTROL, RECOGNITION OF THE FACT THAT THERE IS NO NEED TO SUPPLY STATISTICAL SPECIFICATIONS TO EVERY CONSTRUCTION ITEM, THE ESTABLISHMENT OF NEW SPECIFICATION LIMITS, AND A REVISION OF TESTING PROCEDURES. /AUTHOR/

Beaton, JL *Am Soc Civil Engr J Construction Div* Jan. 1968

2A 214824

EFFECT OF CEMENT HYDRATION OF CONCRETE FORM PRESSURE

THE PRESSURE OF CONCRETE ON FORMS AS AFFECTED BY CEMENT HYDRATION AND INDIVIDUAL CONCRETE INGREDIENTS AT 70 F (21 C) WAS STUDIED. THE EFFECT OF CEMENT HYDRATION WAS INVESTIGATED BY COMPARING THE BEHAVIOR OF CONCRETE WITH AND WITHOUT A WATER-REDUCING, SET RETARDING AGENT TO THE NONHYDRATING MIXTURE CONTAINING FLY ASH WHICH HAD ABOUT THE SAME PLASTIC PROPERTIES AS CONCRETE. OIL FILLED PRESSURE CELLS WERE ADAPTED TO MEASURE PRESSURE IN A FORM 10 FT. (3.05M) HIGH X 3 FT. (0.91 M) WIDE X 1 FT. (0.30 M) THICK. RESULTS INDICATE THAT UNDER THESE CONDITIONS, A WORKABLE CONCRETE HAVING A 2 TO 4 IN. (76 TO 102 MM) SLUMP DOES NOT BEHAVE AS FLUID FOR ANY APPRECIABLE TIME WITHOUT SOME OUTSIDE ENERGIZING FORCE SUCH AS VIBRATION. THE ARCHING ACTION OF THE AGGREGATE IS THE EARLIEST FACTOR TO LIMIT THE LATERAL PRESSURE TO 5 TO 6 PSI (0.35 TO 0.42 KG/CM²) EQUIVALENT TO 5 TO 6 FT. (1.52 TO 1.83 M) OF HEAD, WITH THE METHOD OF PLACEMENT AND VIBRATION USED. HYDRATION OF THE CEMENT TENDED TO LIMIT FORM PRESSURE UNDER THE NORMAL VIBRATION USED, BUT DID NOT PREVENT AN INCREASE IN PRESSURE BROUGHT ABOUT BY REVIBRATION UNTIL AFTER 4 HOURS. THE EFFECT OF SET RETARDING AGENT ON CEMENT HYDRATION DID NOT SIGNIFICANTLY ALTER THE PRESSURE. /AUTHOR/

Ore, EL Straughan, JJ *Am Concrete Inst Journal & Proceedings* Feb. 1968

2A 214832

P.C. CANTILEVER ERECTION METHOD USING PRECAST UNITS

THE P. C. CANTILEVER ERECTION METHOD USING PRECAST BOX- TYPE GIRDERS AND EPOXY RESIN INTO JOINTS IS CONSIDERED FOR THE ENGINEERING OF PRESTRESSED CONCRETE. THIS METHOD WAS USED IN JAPAN FOR THE CONTINUOUS EXPRESSWAY VIADUCT WORK WHERE THE TOKYO METROPOLITAN EXPRESSWAY CROSSES OVER RADIAL ROUTE 3. RESULTS ARE DESCRIBED OF TESTS CARRIED OUT ON SPECIMEN TO OBTAIN NEEDED DESIGN DATA, AND THE RESULTS OF EXPERIMENTS EXECUTED ON ACTUAL BRIDGE, AS WELL AS SEVERAL TECHNICAL PROBLEMS OF THE METHOD. THIS METHOD IS APPLIED SINCE: (1) THE ERECTION PERIOD CAN BE SHORTENED BECAUSE THE PRECAST BLOCKS ARE MANUFACTURED WHEN SUBSTRUCTURE WORKS ARE GOING ON, (2) THE QUALITY VARIANCE OF EACH UNIT IS LESS BECAUSE SUFFICIENT CONTROL CAN BE PERFORMED IN THE PRODUCING YARD, (3) ALMOST NO DEFORMATION, DUE TO DAY SHRINKAGE AND CREEP OF CONCRETE, IS OBSERVED BECAUSE THE CURING PERIOD BETWEEN PRECASTING AND PRESTRESSING IS LONG ENOUGH, AND (4) NO TIMBERING IS NEEDED BECAUSE OF SIMPLE ERECTING APPARATUS. /AUTHOR/

Miyauchi, N *Japan Road Association Annual Reports* 1967

2A 214835

QUALITY CONTROL OF CONSTRUCTION BY STATISTICAL TOLERANCES

TWO YEARS WORK AND STUDY ARE REPORTED IN THE FIELD OF STATISTICAL CONTROL OF CONSTRUCTION TOLERANCES BY THE ALABAMA HIGHWAY DEPARTMENT. THREE CON-

STRUCTION PROJECTS WERE EXAMINED IN DETAIL: (1) A GRADING PROJECT, (2) A BASE AND BITUMINOUS PAVEMENT PROJECT, AND (3) A BASE AND PORTLAND CEMENT CONCRETE PAVEMENT PROJECT. THE PROJECTS WERE EXAMINED IN DETAIL AND STRICT COMPLIANCE WITH THE RECOMMENDATIONS CONTAINED IN THE STATISTICAL APPROACH TO QUALITY CONTROL AND HIGHWAY CONSTRUCTION PUBLISHED AS A RESEARCH GUIDE BY THE BUREAU OF PUBLIC ROADS IN APRIL, 1965. THE COMPUTER PROGRAM FOR THE ANALYSIS OF VARIANCE USED IS BASED ON THE PROPOSITION THAT THE VARIANCE OF THE MATERIAL, PLUS THE VARIANCE OF THE SAMPLING, PLUS THE VARIANCE OF THE TESTING IS EQUAL TO THE OVERALL VARIANCE OF THE END RESULT. THE ASPHALT CONCRETE USED IN THE PROJECT INCLUDED IN THE STUDY WAS PLACED IN THREE LAYERS. TABLES ARE PRESENTED ON THE ANALYSIS OF VARIANCE OF A BLACK BASE, BINDER COURSE AND WEARING COURSE. AN EXAMINATION OF THESE THREE TABLES INDICATES THAT THE VARIANCE DUE TO THE THREE COMPONENTS IS REASONABLE AND THERE IS NO INDICATION OF PARTICULAR CORRECTIVE ACTION WHICH SHOULD BE TAKEN. IT IS NOTED THAT WHERE THE VARIANCE TENDS TO BECOME LARGE THE QUANTITIES ARE SMALL. THE MATERIAL PERFORMED VERY WELL WITH THE CONSTRUCTION SPECIFICATIONS. COMPRESSIVE STRENGTH TESTS RESULTS WERE NOTED TO VARY SCANDALOUSLY IN THE ANALYSIS OF VARIANCE OF PORTLAND CEMENT CONCRETE PAVING. AGGREGATES ARE USED FROM APPROVED SOURCES. THE AVERAGE, OR ARITHMETIC MEAN, TAKEN AND TEST MADE, GENERALLY COME VERY CLOSE TO THE SPECIFICATION REQUIREMENTS. RESEARCH SAMPLING AND TESTING AND ACCEPTANCE SAMPLING AND TESTING WERE PERFORMED USING THE SAME SAMPLING AND TESTING TECHNIQUES AND OFTEN BOTH PROCEDURES WERE PERFORMED BY THE SAME PERSONNEL. STATISTICAL RESULTS DO SHOW A TENDENCY FOR A SMALL NUMBER OF RESULTS TO FALL OUTSIDE OF THE CONTRACT SPECIFICATIONS.

David, JH
Alabama State Highway Department May 1967

2A 214841

AN ANALYSIS OF FACTORS INFLUENCING CONCRETE PAVEMENT COST

THE BASIC ELEMENTS OF CONCRETE PAVEMENT CONSTRUCTION COSTS ARE BRIEFLY DISCUSSED AND EVALUATED. A COST ANALYSIS FOR AN ASSUMED PROJECT IN A MIDWESTERN LOCATION IS GIVEN TO ILLUSTRATE THE EFFECTS OF VARIATIONS IN DESIGN AND CONSTRUCTION PRACTICES ON CONSTRUCTION COSTS. SOME OF THE COST FACTORS DISCUSSED ARE (1) DISTRIBUTED STEEL AND PLAIN CONCRETE PAVEMENT DESIGNS, (2) PAVING EQUIPMENT AND CONSTRUCTION PROCEDURES, (3) DIFFERENCES IN MODULI OF SUBGRADE REACTIONS, AND (4) SINGLE-LANE AND DUAL-LANE CONSTRUCTION. A PRINCIPAL OBJECTIVE IS TO SHOW THAT DETAILED ANALYSIS OF INDIVIDUAL PROJECTS USING LOCAL MATERIAL AND LABOR PRICES WILL REVEAL THE MOST ECONOMICAL DESIGN FOR THE ANTICIPATED TRAFFIC, SUBGRADE, AND CLIMATIC CONDITIONS OF THE PAVEMENT. SUCH AN ANALYSIS WILL RESULT IN REDUCED PAVEMENT COSTS AT NO SACRIFICE IN PAVEMENT QUALITY. /AUTHOR/

Halm, HJ *Highway Research Board Bulletin* Jan. 1962

2A 214853

RETAINING WALLS

RETAINING WALLS ARE TREATED AS TO THEIR DESIGN, CONSTRUCTION, STABILITY, DISPLACEMENT, AND EARTH PRESSURES AGAINST THEM. SOIL PRESSURE CELLS ARE DISCUSSED.

Highway Research Information Service Feb. 1969

2A 214854

EXPERIMENTAL BASES DESIGNED TO MEET BUDGETARY LIMITATIONS

EXPERIMENTAL WORK WAS CONDUCTED ON CONSTRUCTING TWO AND THREE-COURSE COMBINATION BASES USING LOCALLY AVAILABLE MATERIALS FOR BITUMINOUS SURFACES ON SECONDARY ROADS. ANOTHER PROMISING DEVELOPMENT IN SECONDARY BASE CONSTRUCTION IS THE EMPLOYMENT OF COMPOSITE BASES, USING TWO OR MORE MATERIALS, WITH OR WITHOUT STABILIZING AGENTS, BUT GENERALLY WITH A BITUMINOUS SURFACE. THE STABILIZATION OF NON-COMMERCIAL AND LOCAL BASE MATERIAL HAS BEEN ACCOMPLISHED THROUGH THE USE OF SUCH AGENTS AS CEMENT, ASPHALT, LIME, SALT AND CALCIUM CHLORIDE, TO PRODUCE A DENSE, WATER-REPELLANT BASE AT A COST WITHIN BUDGET BOUNDARIES APPLICABLE TO SECONDARY FARM-TO-MARKET ROADS. THE COMPOSITE BASES CONSISTING OF LOW-COST LOCAL MATERIAL FOR THE SUBBASE, COVERED WITH A HIGHER-CLASS AND MORE EXPENSIVE UPPER BASE MATERIAL, APPRECIABLY REDUCE COSTS. THE TWO-COURSE BASES HAVE ADVANTAGES BECAUSE THE FIRST COURSE GRANULAR MATERIAL GIVES BETTER VERTICAL AND HORIZONTAL DRAINAGE. THE TOP COURSE OF GRADED CRUSHED AGGREGATE GIVES A SURFACE WITH GOOD RIDING QUALITIES AND A GOOD SURFACE FOR THE APPLICATION OF A LOW-COST BITUMINOUS TREATMENT. THIS TYPE OF CONSTRUCTION IS AN ADAPTATION OF THE MULTI-LAYER BASES INCORPORATING DIFFERENT MATERIALS USED IN THE CONSTRUCTION OF TOLL ROADS.

Cooney, JG *Better Roads* May 1954

2A 214857

MOISTURE REQUIREMENTS FOR SOIL-CEMENT CONSTRUCTION

LABORATORY RESEARCH SHOWS THAT THE OPTIMUM MOISTURE CONTENT (POINT AT WHICH MAXIMUM DENSITY IS OBTAINED) AS DETERMINED BY THE STANDARD MOISTURE-DENSITY TEST IS REASONABLY IN AGREEMENT WITH THE OPTIMUM MOISTURE CONTENTS AT WHICH MAXIMUM DURABILITY AND MAXIMUM STRENGTH ARE OBTAINED.

Catton, MD *Portland Cement Assoc Soil Cement Serv* Sept. 1943

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 214863

ROLLED CONCRETE ROADS, SOIL-CEMENT EXPERIMENTS
SIX SECTIONS OF SOIL-CEMENT ROAD HAVE BEEN CONSTRUCTED. ATTEMPTS TO SLIGHTLY INCREASE THE PROPORTION OF CEMENT AT THE SURFACE BY ADDING CEMENT SLURRY WERE NOT SUCCESSFUL, AS THE LAYER SO FORMED QUICKLY SCALED OFF.

Darwin, DV *Roads & Road Construction, London /UK/* July 1943

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 214869

OCRACOCKE'S BEACH SAND ROADS

THE CONSTRUCTION OF A ROAD ON OCRACOCKE ISLAND, N.C., IN WHICH SURFACING CONSISTS OF BEACH SAND STABILIZED WITH CEMENT, IS DESCRIBED. THE SAND CONTAINS A HIGH PROPORTION OF SHELLS. CEMENT AND SAND WERE USED IN THE PROPORTION OF APPROXIMATELY 1:3 BY WEIGHT. NO REINFORCEMENT AND NO EXPANSION JOINTS WERE USED.

Morrison, JL *Public Works, Road Abstracts /UK/* 1951

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 214870

CONSTRUCTION OF CONCRETE ROADS

OXTON EXPERIMENTAL ROAD IN NOTTINGHAMSHIRE CONSISTS OF PLAIN AND REINFORCED SLABS OF VARYING THICKNESS LAID ON VARYING THICKNESSES OF SOIL-CEMENT BASE

ON UNIFORM SUBGRADE. SIX IN. PLAIN SLABS FAILED AFTER 5 YEARS OF TRAFFIC, WHEREAS 3- AND 4-IN. REINFORCED CONCRETE SLABS WERE STILL SERVICEABLE. EXPERIENCES WITH PRESTRESSED ROADS AND JOINT SPACING ARE MENTIONED.

Collins, AR *Surveyor and Municipal Engineer /UK/, Engineering Index* Dec. 1953

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 214871

SOME PROBLEMS IN MIXING GRANULAR MATERIALS USED IN ROAD CONSTRUCTION, PART 1. MIXTURES OF SOIL AND CEMENT

A REPORT IS PRESENTED OF MIXING STUDIES UNDERTAKEN AT THE ROAD RESEARCH LABORATORIES USING MIXING MACHINES DESIGNED FOR SOIL STABILIZATION WORK. THE STUDIES ARE CONCERNED WITH DEFINING THE DEGREE OF MIXING REQUIRED AND WITH DEVELOPING METHODS OF EVALUATING, QUANTITATIVELY THE MIXING ACHIEVED BY MACHINES IN USE.

Clare, KE

Road Research Laboratory /UK/ 14 pp, Nov. 1954

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 214872

SUPERVISION OF CONTROL TESTS AT FERRY FRYSTON ESTATE, CASTLEFORD, U.D.C.

THIS REPORT GIVES AN ACCOUNT OF THE WORK UNDERTAKEN BY THE ASSOCIATION TO ASSIST WITH THE CONSTRUCTION OF SOIL-CEMENT BASES FOR HOUSING ESTATE ROADS AT FERRY FRYSTON, CASTLEFORD. DETAILS ARE GIVEN OF THE METHOD OF CONSTRUCTION EMPLOYED, TOGETHER WITH THE RESULTS OF FIELD TESTS ON A PRELIMINARY AREA OF APPROXIMATELY 1,350 SQ. YARDS. EXTRACTS FROM THE SPECIFICATION ARE INCLUDED.

Lilley, AA *Cement & Concrete Association Res Repts* Oct. 1954

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 214873

THE CONSTRUCTION OF A TEST TRACK FOR MOTOR VEHICLES (IN GERMAN)

A NEW TEST TRACK HAS BEEN CONSTRUCTED FOR THE VOLKSWAGEN FACTORY AT WOLFSBURG. THE DESIGN AND CONSTRUCTION OF THE PRESTRESSED CONCRETE RACING TRACK WHICH FORMS PART OF IT ARE DESCRIBED. IT IS 30 FT. WIDE, ROUGHLY OVAL IN PLAN, WITH A TOTAL LENGTH OF 5,900 FT., AND CONSISTS OF TWO CURVES OF 1,090 FT. (RADIUS 525 FT.) AND 847 FT. (RADIUS 482 FT.), TWO STRAIGHTS OF 755 FT., AND FOUR CLOTHOID TRANSITION CURVES WHICH ARE 587 OR 640 FT. LONG. THE SUPER-ELEVATION IN THE CURVES IS DESIGNED TO ALLOW A SPEED OF 93 MI. PER HR. WITHOUT THE VEHICLE'S BEING SUBJECT TO COMPONENT FORCES; THE MAXIMUM DEGREE OF INCLINATION IS 56 DEGREES. THE CONCRETE SLAB IS 6 IN. THICK OVER A SOIL-CEMENT STABILIZED BASE. THE HOLZMANN SYSTEM WAS EMPLOYED FOR THE PRESTRESSING.

Zerna, W *Beton Und Stahlbetonbau /Germany/, Road Abstracts /UK/* 1957

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 214875

STANDARD SPECIFICATIONS FOR CONSTRUCTION OF AIRPORTS

DIVISION II ON PAVING CONSTRUCTION DETAILS MENTIONS: SUBBASE COURSE, CRUSHED AGGREGATE BASE COURSE, SOIL CEMENT BASE COURSE, CEMENT TREATED BASE COURSE, PORTLAND CEMENT CONCRETE PAVEMENT.

Federal Aviation Administration /US/ 1964

ACKNOWLEDGMENT: Portland Cement Association

2A 214877

CONSTRUCTION PRACTICES-EARTHWORK

THESE REFERENCES ON EARTHWORK CONSTRUCTION PRACTICES INCLUDE CONSOLIDATION OF FINE-GRAINED SOIL BY DRAIN WELLS, BOG BLASTING FOR ROAD CONSTRUCTION, THEORIES FOR SAND DRAINS, VERTICAL SAND DRAIN INSTALLATIONS, SOIL MECHANICS IN THE DESIGN AND CONSTRUCTION OF AN AIRPORT, SETTLEMENT CORRECTION AT AN AIRPORT, TUNNEL ENGINEERING, AND PRE- WETTING EMBANKMENT SOILS.

Highway Research Information Service Feb. 1970

2A 214886

HIGHWAY CONCRETE MIXING PLANTS. CONTROL DURING AND AFTER PRODUCTION (IN FRENCH)

THE RESULTS ARE DESCRIBED OF CONTROLS AND MEASUREMENTS CARRIED OUT ON THE CONSTITUENTS AND ON THE PRODUCTION OF A HIGHWAY CONCRETE, AS PART OF A SERIES OF OBSERVATIONS ON A MOTORWAY CONCRETING SITE. THE CONTROLS RELATED TO THE CHARACTERISTICS OF THE CEMENT USED, NOTABLY IN RELATION TO THE CONTENT OF THE SECONDARY CONSTITUENTS, THE BLAINE FINENESS AND MECHANICAL STRENGTHS; THE CHARACTERISTICS OF THE VARIOUS AGGREGATES, IN PARTICULAR, GRAIN SIZE AND CLEANLINESS; THE CONCRETE PRODUCED; CONE SETTLEMENT, EASE OF HANDLING, OCCLUDED AIR CONTENT, MECHANICAL STRENGTHS. WHENEVER POSSIBLE, THE PRODUCTION OF CONCRETE WAS CONTROLLED BY MEANS OF CONTINUOUS RECORDING OF THE PARAMETERS OF PRODUCTION, INVOLVING WEIGHING OF THE VARIOUS CONSTITUENTS, ENERGY CONSUMED BY MIXING, TEMPERATURE OF CONSTITUENTS, AND RESISTIVITY OF SANDS. THE RESULTS OBTAINED MAKE IT POSSIBLE TO ASSESS THE VARIABILITY OF THE CHARACTERISTICS OF THE CONCRETES AND THEIR CONSTITUENTS. MOREOVER THE RECORDING OF THE PARAMETERS AND CONTINUOUS CONTROL DURING PRODUCTION CAN MAKE IT POSSIBLE:-(1) TO AVOID USING BATCHES WITH CHARACTERISTICS WHICH ARE INCOMPATIBLE WITH A PROPER SURFACING AND DURABILITY OF THE PAVEMENT, AND (2) TO DETECT AND LOCALIZE OPERATING FAULTS IN THE PRODUCTION EQUIPMENT SUFFICIENTLY IN TIME TO ENSURE THAT THE CONCRETE PRODUCED DOES NOT FALL BELOW STANDARD. TO SUM UP, IT SEEMS THAT THOUGH PROBLEMS OF THE BATCHING OF AGGREGATES AND CEMENT MAY BE FAIRLY SATISFACTORILY SOLVED, THE SAME IS NOT TRUE OF THE REGULARITY OF THE TOTAL WATER CONTENT OF THE CONCRETE, WHICH IS NEVERTHELESS A FACTOR OF PRIME IMPORTANCE FOR PROPER CONCRETING PROCEDURE AND ALSO FOR THE QUALITY AND DURABILITY OF THE CONCRETE. /LCPC/A/RRL/

Parey, C *Bull Liaison Labs Routiers /France/* Mar. 1968

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 214890

ADVANCEMENTS IN SUSPENSION BRIDGE CABLE CONSTRUCTION

IN THE EARLY 1960S, BETHLEHEM STEEL CORPORATION INITIATED A PROGRAM TO IMPROVE THE CONSTRUCTION OF SUSPENSION BRIDGE CABLES. AS A PART OF THIS EFFORT, RESEARCH AND DEVELOPMENT WERE CONDUCTED IN THE AREAS OF WEATHER PROTECTION OF BRIDGE CABLES, CABLE CONSTRUCTION TECHNIQUES, AND CABLE ANCHORAGE DESIGN. BETHLEHEM DEVELOPED JOINTLY WITH THE E.I. DU PONT DE NEMOURS & COMPANY A WEATHER-TIGHT, LONG-LIFE CABLE COVERING CONSISTING OF GLASS REINFORCED ACRYLIC RESIN. THIS PLASTIC COVERING WAS FIRST USED IN 1965 ON THE BIDWELL BAR BRIDGE IN CALIFORNIA, WHERE IT SUPPLANTED THE ORIGINALLY- SPECIFIED PAINTED WIRE WRAPPING. SINCE THE LATE 1920S, THERE HAVE BEEN TWO PRINCIPAL TYPES OF SUSPENSION BRIDGE CABLES WHICH ARE FIELD-CONSTRUCTED USING THE COM-

PLICATES "SPINNING" PROCEDURE, AND STRAND-TYPE CABLES, MADE UP OF SOCKETED HELICAL-WIRE STRANDS FABRICATED IN THE SHOP AND EASILY ERECTED IN THE FIELD. IT WAS BELIEVED THAT CABLES CONSTRUCTED OF SHOP-FABRICATED AND SOCKETED PARALLEL-WIRE STRANDS WOULD COMBINE ALL OF THE ADVANTAGES OF THESE TWO CABLE TYPES AND RENDER THEM BOTH OBSOLETE. PILOT WORK WAS UNDERTAKEN, AND CULMINATED IN A SUCCESSFUL DEVELOPMENT PROJECT CARRIED OUT DURING 1965 WITH THE CONSULTATION OF THE FIRM OF STEINMAN, BOYNTON, GRONQUIST & LONDON, WHICH REPORTED FAVOURABLY ON THE METHOD. STANDARD ANCHORAGE DESIGNS WERE NOT CONSIDERED TO BE ADVANTAGEOUS FOR USE WITH PARALLEL-WIRE-STRANDCABLES, AND BETHLEHEM, THEREFORE, DESIGNED A PIPE-TYPE ANCHORAGE WHEREIN THE USUAL COMPLICATED TENSION LINKAGES ARE ELIMINATED. THE DEVELOPMENT OF THE BETHLEHEM CABLE SYSTEM AND ITS APPLICATION TO THE NEWPORT BRIDGE IS DESCRIBED. /RRL/A/

Durkee, JL Asce, F Iabse, M *Suspension Bridges Symposium /Portugal/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 214891

COMPARATIVE METHODS OF SUSPENSION BRIDGE CONSTRUCTION

RECENT DEVELOPMENTS IN STRUCTURAL STEEL AND OTHER CONSTRUCTION MATERIALS AND FABRICATING AND ERECTION TECHNIQUES HAVE HAD IMPORTANT EFFECTS ON THE COSTS OF SUSPENSION BRIDGE CONSTRUCTION. SOME OF THESE DEVELOPMENTS ARE DESCRIBED FROM THE VIEWPOINT OF THE FABRICATOR AND ERECTOR SO THAT THE DESIGNER IS FULLY AWARE OF THE PRESENT DAY CAPABILITIES OF THE CONSTRUCTION INDUSTRY. SOME GUIDE LINES ARE OFFERED FOR COMPARISON OF COSTS FOR DIFFERENT GRADES OF STEEL AND FABRICATING PROCEDURES. THE FULL POTENTIAL OF SUSPENSION BRIDGE DESIGN CAN BE FULLY APPRECIATED ONLY BY TAKING ADVANTAGE OF ALL THE IMPROVEMENTS AVAILABLE TODAY IN THE CONSTRUCTION INDUSTRY. /RRL/A/

Maxwell, HM *Suspension Bridges Symposium /Portugal/* 1166

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 214906

CONCRETE PRODUCTION AND PROTECTION IN WINTER
MEASURES NECESSARY FOR THE CONTINUANCE OF CONCRETING IN INCLEMENT WEATHER CONDITIONS ARE CONSIDERED, INCLUDING HEATING OF THE MIXING WATER AND, POSSIBLY, THE AGGREGATES, AND THE PROTECTION OF AGGREGATE STOCK-PILES, FORMWORK AND CONCRETE AFTER PLACING. DETAILS ARE GIVEN OF THE USE OF ONE THIRD, ONE HALF AND THREE QUATER-CU. YD CONCRETE MIXING PLANTS AND THE COSTS OF PROVIDING AND OPERATING SUITABLE HEATING INSTALLATIONS FOR SUCH PLANTS. /RRL/A/

Tagg, JV *Concrete /UK/* Oct. 1967

ACKNOWLEDGMENT: Road Research Laboratory /UK/4C33128268, 3C33128267

2A 214909

BRITISH STANDARD CODE OF PRACTICE: COMPOSITE CONSTRUCTION IN STRUCTURAL STEEL AND CONCRETE. PART 2. BEAMS FOR BRIDGES

THIS PART DEALS WITH SIMPLY-SUPPORTED AND CONTINUOUS BRIDGE BEAMS, OTHER THAN FILLER BEAMS, COMPOSED OF EITHER ROLLED OR BUILT-UP STRUCTURAL STEEL SECTIONS, WITH OR WITHOUT CONCRETE ENCASEMENT, ACTING IN CONJUNCTION WITH AN IN-SITU REINFORCED CONCRETE SLAB, THE TWO ELEMENTS BEING INTERCONNECTED SO AS TO FORM A COMPOSITE SECTION ACTING AS A WHOLE. /TRRL/

British Standards Institution Sept. 1967

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

2A 214921

INSTRUCTIONS FOR THE CONSTRUCTION OF BITUMINOUS SURFACINGS USING THE HOT-LAID METHOD OF CONSTRUCTION /IN GERMAN/

INFORMATION IS PRESENTED ON THE BUILDING OF THE ROAD STRUCTURE, DEFINITIONS, CONSTRUCTION PRINCIPLES, DIMENSIONING, BUILDING MATERIALS, COMPOSITION AND PRODUCTION OF THE MIX, AND PLACING AND COMPACTION. THE DIMENSIONING IS BASED ON FOUR TYPES OF TRAFFIC. /FG/RRL/

Road Research Society /Austria/ 1966

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 214923

CHANGES IN TEMPERATURE OF BITUMINOUS MIXTURES DURING CONSTRUCTION /IN GERMAN/

THE PUBLICATION DEALS WITH THE TEMPERATURE CONDITIONS IN BITUMINOUS ROAD COURSES AFTER THEY HAVE BEEN PLACED ON THE SUBBASE. THE AIM IS TO DESCRIBE THE CHANGES IN TEMPERATURE BY MEANS OF THE PHYSICAL DIMENSIONS VALID FOR HEAT CONDUCTION AND HEAT TRANSFER. THE TEMPORAL COURSE OF TEMPERATURES IN BITUMINOUS MIXTURES HAS PREVIOUSLY ONLY BEEN EXAMINED THEORETICALLY DURING THE TRANSPORTING OF THE MIXTURE FROM THE MIXING SITE TO THE PLACE OF APPLICATION. CONSIDERATION OF THIS PART OF THE PROBLEM SHOWED THAT COOLING OF THE HOT MIXTURE, THE THICKNESS OF THE AMOUNT LOADED ONTO THE VEHICLE, AND IN PARTICULAR BY THE VARIOUS CONDITIONS OF HEAT TRANSFER, THE PRINCIPAL OF WHICH ARE AIR SPEED AND THE EFFECT OF INSULATING MATERIALS. STARTING FROM THESE FACTS THE CHANGE IN TEMPERATURE DURING THE PLACING OF BITUMINOUS MIXTURES WAS INVESTIGATED. THE RESULTING INFORMATION WAS PUT INTO A FORM SUITABLE FOR PRACTICAL USE, AND EXPLAINED BY EXAMPLES. /FG/RRL/

Bosseneyer, HR

Darmstadt Technical University /Ger/ 1966

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 214927

PREFABRICATION IN CARRIAGEWAY CONSTRUCTION /IN GERMAN/

FOR TEN YEARS PREFABRICATED SLABS HAVE BEEN USED FOR THE REPAIR OF MOTORWAYS; THEY SHORTEN THE ROAD CLOSURE TIMES, ARE ECONOMIC AND CAN BE USED PRACTICALLY WITHOUT LIMITATION. AT PRESENT SLABS OF 9.99 X 3.74 M. IN SIZE AND 18 CM. THICK WITH PRESTRESSED LONGITUDINAL AND TRANSVERSE REINFORCEMENT ARE MOSTLY USED; THEY ARE PLACED ON A BITUMINOUS SUBSTRUCTURE, PRESSED DOWN WITH CEMENT MORTAR TO THE DESIRED HEIGHT AND CONNECTED WITH SCREW DOWELS. ON THE BASIS OF RECENT TESTS LONGITUDINAL AND TRANSVERSE PRESTRESSED SLABS, JOINED WITH CEMENT OR PLASTIC MORTARS AND LAID ON A REINFORCED BASE ARE NOW PROPOSED. /FG/RRL/

Eisenmann, J *Strassen Und Tiefbau /Germany/* 1967

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 214933

MACHINE FOR THE TRANSVERSE ROUGHENING TREATMENT AND PULVERIZING A CURING COMPOUND ON FRESH CONCRETE /IN FRENCH/

DETAILS ARE GIVEN OF A PROTOTYPE MACHINE, DEVELOPED BY THE CENTRE DE RECHERCHES ROUTIERES, FOR TRANSVERSE ROUGHENING OF CONCRETE ROADS AND FOR PULVERIZING CURING COMPOUND ON FRESH CONCRETE.

THE MACHINE IS FULLY AUTOMATIC, AND THE ROUGHENING DEVICE CAN HAVE METAL BLADES OR TUFFS OF METAL, COCONUT FIBRE OR P.V.C. SPECIAL DEVICES CONTROL THE QUANTITY OF CURING COMPOUND APPLIED, PREVENT THE CLOGGING OF THE JETS, ENSURE A CONSTANT HOMOGENIZATION OF THE CURING COMPOUND AND PREVENT IT FROM BEING BLOWN AWAY BY THE WIND. THIS ROUGHENING FACILITATES THE RAPID DRAINAGE OF SURFACE WATER, AND GIVES A HIGH DEGREE OF ROUGHNESS IN WET WEATHER ENABLING VEHICLES TO TRAVEL AT HIGH SPEED. IT DOES NOT IMPAIR THE RIDING QUALITY OF THE PAVEMENT AND HAS THE ADVANTAGE OF REDUCING GLARE. /CRIC/FESR/LCPC/A/RRL/

Leyder, JP *Technique Routiere, Brussels /Belgium/* Mar. 1968

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 214952

TECHNOLOGY OF THE CONSTRUCTION OF PRESTRESSED CONCRETE SURFACINGS /IN RUSSIAN/

RESULTS ARE PRESENTED OF INVESTIGATIONS INTO CONDITIONS OF STRESS AND DEFORMATION AND TECHNOLOGICAL PROBLEMS CONCERNING THE CONSTRUCTION OF PRETENSIONED PRESTRESSED CONCRETE SURFACINGS. CHARACTERISTICS OF THIS TYPE OF SURFACING BUILT IN THE USSR ARE DESCRIBED. SPECIAL MENTION IS MADE OF METHODS USED FOR INCREASING THE RESISTANCE OF CONCRETE TO CRACKING DURING CONSTRUCTION AND UNDER TRAFFIC. EMPHASIS IS PLACED ON THE NEED FOR FURTHER STUDIES WITH A VIEW TO DETERMINING THE OPTIMUM PRESTRESS VALUE OF SURFACINGS. /LCPC/RRL/

Soyuzdornii /Ussr/ 1967

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 214954

THE CONSTRUCTION OF EARTH SUBGRADES UNDER DIFFICULT NATURAL CONDITIONS. WORK CARRIED OUT BY THE SOYUZZDORNII (FEDERAL STUDY AND RESEARCH INSTITUTE IN THE USSU) /IN RUSSIAN/

THE CONSTRUCTION IS STUDIES OF EARTH ROADS ON COMPRESSIBLE SOIL, PEAT, MUD, WET BRACKISH SOIL, ETC. THE HIGH COST OF THE CONVENTIONAL CONSTRUCTION METHOD, WHICH CONSISTS IN REMOVING THE EXISTING SOIL AND REPLACING IT WITH BORROW, LED TO RESEARCH INTO THE IMPROVEMENT OF CONSTRUCTION METHODS WHICH USE COMPRESSIBLE SOIL UNDER EMBANKMENTS. FINDINGS ARE PRESENTED AND RECOMMENDATIONS ARE OUTLINED FOR THE ESTABLISHMENT OF PROJECTS FOR BUILDING EARTH SUBGRADES ON COMPRESSIBLE SOIL. THE TITLES OF THE ARTICLES ARE AS FOLLOWS: (1) PROBLEMS CONCERNING PLANNING THE CONSTRUCTION OF EARTH SUBGRADES ON COMPRESSIBLE SOIL, (2) SPECIAL FEATURES OF PROJECTS AND CONSTRUCTION OF EARTH SUBGRADES IN THE MARSHES OF WESTERN SIBERIA, (3) THE USE OF RIGID SLABS IN THE CONSTRUCTION OF ROAD EMBANKMENTS ON MARSHLAND, (4) STABILITY OF SUBGRADES BUILT ON WET BRACKISH SOIL. (5) INFLUENCE OF HIGHLY SOLUBLE SALTS ON THE PHYSICAL AND MECHANICAL PROPERTIES OF SOIL WITH A HIGH SALT CONTENT, (6) STRUCTURAL AND MECHANICAL PROPERTIES OF SOIL WITH A HIGH SALT CONTENT, (7) PRINCIPLE FOR DRAWING UP SPECIFICATIONS RELATING TO THE COMPLEMENTARY WETTING OF THE SOIL DURING THE CONSTRUCTION OF EARTH IN KAZHASTAN, AND (8) WINTER CONSTRUCTION OF EMBANKMENTS USING POWDER AND COHESIVE SOIL. /LCPC/RRL/

Trudy Soyuzdornii /Ussr/ 1967

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 214959

REPORT ON CONCRETE. PART II. SITE SUPERVISION AND TESTING

THE REPORT IS DIVIDED INTO 2 SECTIONS: (1) SITE SUPERVISION; (2) THE TESTING OF CONCRETE AND CONCRETING MATERIALS. SECTION 1 CONTAINS ARTICLES ON MATERIALS FOR CONCRETE; CONCRETE MIXES; BATCHING; MIXING; TRANSPORTING, PLACING AND COMPACTING; CONCRETING IN COLD WEATHER; CURING, AIR-ENTRAINED CONCRETE; REINFORCEMENT; FORMWORK; FINISHING; PRECAST MEMBERS. SECTION 2 CONTAINS ARTICLES ON SAMPLING; TESTING CEMENTS; TESTING AGGREGATES; WATER; WORKABILITY OF FRESH CONCRETE; AIR CONTENT OF FRESH CONCRETE; TESTING OF HARDENED CONCRETE. /RRL/

Cement & Concrete Assoc, London /UK/ 1967

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 214960

PAVING MATERIALS

DURING THE PAST DECADE, NEW ENGINEERING PROCEDURES FOR THE CONSTRUCTION OF THE ASPHALT PAVEMENTS AND NEW METHODS FOR QUALITY CONTROL HAVE BEEN DEVELOPED. AMONG THE NEW METHODS WHICH ARE COMMANDING ATTENTION ARE: (1) AUTOMATION FOR CONTROL OF BITUMINOUS CONCRETE PLANTS, (2) ELECTRONIC SENSING DEVICES FOR GRADE CONTROL OF THE LAY-DOWN MACHINES, (3) NUCLEAR DEVICE FOR FAST ON-THE-SPOT MEASUREMENTS OF PAVEMENT DENSITY, (4) LOAD/DEFLECTION DEVICES FOR ON-THE- SPOT SURVEYS OF PAVEMENT STRUCTURAL STRENGTH, AND (5) FULL WIDTH AND DEEP LIFT PAVEMENT COURSES. EACH OF THESE NEW USES AND NEW METHODS OF APPLICATION IN THE USE OF ASPHALT IN PAVEMENT STRUCTURES IS DESCRIBED. /RRL/A/

Izatt, JE

World Petroleum Congress Proc 1967

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 215007

THE UTILIZATION OF CEMENT-STABILIZED WASTE MATERIALS IN ROAD CONSTRUCTION

IT IS IN THE NATIONAL INTEREST TO MAKE USE OF LOW-GRADE AND WASTE MATERIALS FOR ROAD CONSTRUCTION AS THIS CONSERVES THE SUPPLIES OF GOOD QUALITY ROAD MAKING MATERIALS AND ASSISTS IN PROBLEMS ARISING FROM THE DISPOSAL OF UNWANTED MATERIALS. IN ADDITION ECONOMIC CONSIDERATIONS MAKE IT LIKELY THAT THE COST OF AGGREGATES WILL INCREASE IN THOSE AREAS WHERE THEY ARE ALREADY IN SHORT SUPPLY WHEREAS LOW-GRADE AND WASTE MATERIALS ARE BY THEIR VERY NATURE AVAILABLE AT LOW COST. THIS PAPER THEREFORE CONSIDERS THE EXTENT TO WHICH THE ROAD CONSTRUCTION INDUSTRY CAN USE LOW-GRADE AND WASTE MATERIALS FOR BASE AND SUB-BASE CONSTRUCTION. THE ADVANTAGES AND DISADVANTAGES OF THE USE OF SUCH MATERIALS ON PRACTICAL, ECONOMIC AND AESTHETIC CONSIDERATIONS ARE DISCUSSED. FOUR GROUPS OF MATERIALS- CHALK, PULVERISED FUEL ASH, COLLIERY SHALE, AND QUARRY WASTES-ARE DEALT WITH IN DETAIL. THEY ALL OCCUR IN LARGE QUANTITIES AND WHEN STABILISED WITH CEMENT THEY CAN ALL BE MADE SUITABLE FOR USE IN ROAD PAVEMENT CONSTRUCTION. /RRL/AUTHOR/

Sherwood, PT Pocock, RG *Roads & Road Construction, London /UK/*
Feb. 1969

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 215014

INVESTIGATIONS INTO ROAD-BUILDING PRACTICE IN THE TROPICS. STUDIES OF THE MIXING AND COMPACTION OF CEMENT STABILIZED BASES ON TWO ROAD CONSTRUCTION SCHEMES IN SIERRA LEONE

INVESTIGATIONS WERE CARRIED OUT ON TWO ROAD-CONSTRUCTION SCHEMES IN SIERRA LEONE. TWO ASPECTS OF ROAD BUILDING WERE EXAMINED: (1) THE SPREADING AND MIXING PROCESSES IN THE CONSTRUCTION OF CEMENT-STABILIZED ROAD BASES, AND (2) THE COMPACTION OF CEMENT-STABILIZED ROAD BASES AND NATURAL SUBGRADES. THE INVESTIGATION SHOWED THAT THE RESULTS BEING ACHIEVED ON THESE TWO SCHEMES ARE SIMILAR TO THOSE FOUND PREVIOUSLY IN EAST AFRICA. IN PARTICULAR THE IMPORTANCE OF THE SPREADING OPERATION IN THE CONSTRUCTION OF STABILIZED-SOIL ROAD BASES IS AGAIN APPARENT. /A/RRL/

Oreilly, MP Hitch, LS Pollard, AE
Ministry of Transport, London /UK/ 1969

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 215016

THE EFFECT OF CONSTRUCTION TECHNIQUES ON THE DESIGN OF ROADS

THE DEVELOPMENT IS OUTLINED OF CONSTRUCTION TECHNIQUES WITH REFERENCE TO EXCAVATION AND EARTHWORKS, DRAINAGE, AND SUB-BASE, BASE AND SURFACING CONSTRUCTION. EXAMPLES ARE QUOTED FROM CONSTRUCTION WORK ON THE N.1 MOTORWAY. DEVELOPMENTS IN CONCRETE ROAD CONSTRUCTION, PARTICULARLY THE SLIP FORM PAVER, AND ITS STEEL AND CONCRETE BRIDGES ARE DESCRIBED. A DISCUSSION IS APPENDED. /RRL/

Oliver, FR *Inst Hwy Engineers Journal, London /UK/* Mar. 1969

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 215040

APPLICATION OF COMPUTERS TO ROADSTONE SUPPLY
THE APPLICATIONS OF COMPUTERS TO THE PROGRAMMING AND PLANNING OF DELIVERIES OF ALL CLASSES OF ROADSTONE TO ITS VARIOUS USERS ARE CONSIDERED. THE PROBLEMS OF PRODUCTION AND DISTRIBUTION ARE EXAMINED MAINLY FROM THE SUPPLIER'S POINT OF VIEW. /RRL/

Rhodes, FG
Surveyor, Longon /UK/ Sept. 1969

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 215044

MODERN TUNNELLING METHODS

MODERN TUNNELLING METHODS AND EQUIPMENT ARE REVIEWED. ASPECTS BRIEFLY TREATED INCLUDE, GROUND CONDITIONS, SETTLEMENT, SHAFTS AND LININGS, ECONOMICS OF SOFT GROUND TUNNELLING, WATERPROOFING AND WATER CONTROL, AND SURVEYING. REFERENCE IS MADE TO RECENT TUNNEL PROJECTS IN ENGLAND (POTTERS BAR, VICTORIA LINE, AND LONDON AIRPORT), AND A DISCUSSION IS APPENDED. /RRL/

Donovan, HJ
Pub Wks & Munic Serv Cong & Exhib Cncl 1968

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 215055

FREE-CANTILEVER CONSTRUCTION OF PRESTRESSED CONCRETE BRIDGES AND MUSHROOM-SHAPED BRIDGES
NEW CONSTRUCTION TECHNIQUES BASED ON RESEARCH, IN BOTH MATERIALS AND METHODS, ARE IMPROVING QUALITY AND SAVING COST IN THE CONSTRUCTION OF PRESTRESSED CONCRETE BRIDGES. FREE-CANTILEVER AND MOVABLE SCAFFOLD SYSTEMS SAVE TIME AND IMPROVE SAFETY BY

REPLACING CONVENTIONAL SCAFFOLDS AND FALSEWORK. THE FREE-CANTILEVER METHOD PERMITS SAFE AND EFFICIENT CONSTRUCTION OF LONG SPANS WITHOUT HIGH FORMWORK COSTS. MATERIALS AND METHODS DEVELOPMENT INCLUDE THREADED PRESTRESSING BARS FOR IMPROVED ANCHORAGE, STUDIES IN STRESS-CRACK CORROSION, DIAGONAL PRESTRESSING TO SAVE DEAD WEIGHT IN LONG SPANS, AND A MOVEABLE-JOINT DESIGN THAT PERMITS USE OF CONTINUOUS ASPHALT PAVEMENT WITHOUT RUPTURE. BRIDGE TYPES DESCRIBED INCLUDE MUSHROOM, STRESS-RIBBON, AND SUSPENSION, IN ADDITION TO MANY EXAMPLES OF FREE-CANTILEVER CONSTRUCTION. /RRL/A/

Finsterwalder, U
Intl Symp Concr Bridge Des Proc /Can/ 1969

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 215064
AN APPLICATION OF OPERATIONAL RESEARCH TO CONCRETE ROAD CONSTRUCTION

USES OF OPERATIONAL RESEARCH IN CONCRETE ROAD CONSTRUCTION, AND A METHOD OF REPRESENTING WORKING TIMES AND CONTINUOUS PROGRESS BY MATHEMATICAL MODEL OR DIAGRAM ARE EXAMINED. AS A RESULT OF THE ANALYSIS, THE FACTORS WHICH WILL LEAD TO GREATER PRODUCTIVITY IN TERMS OF LENGTH OF ROAD CONSTRUCTED PER DAY CAN EASILY BE LISTED. /RRL(A)/

Lilley, AA
Cement & Concrete Assoc, London /UK/ July 1969

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 215095
CONSTRUCTION PRACTICES ON CEMENT-TREATED SUBGRADES FOR CONCRETE PAVEMENTS

ALL CONCRETE PAVEMENTS CONSTRUCTED BY THE CALIFORNIA DIVISION OF HIGHWAYS HAVE BEEN PLACED ON SPECIALLY TREATED OR HARDENED SUBGRADES. IN THE MAJORITY OF CASES PORTLAND CEMENT HAS BEEN USED, ALTHOUGH IN SOME CASES SANDY SUBGRADES WERE TREATED WITH ASPHALTS. THE RESULTS ARE ENCOURAGING. FOR EXAMPLE, THE FIRST PROJECT AFTER 13 YEARS IS STILL IN EXCELLENT CONDITION. THE PROBLEMS ASSOCIATED WITH PUMPING JOINTS HAVE BEEN ELIMINATED. MOREOVER, THE ASPHALT TREATED SUBGRADES SEEM TO PERFORM EQUALLY WELL TO THE CEMENT-TREATED SUBGRADES. FURTHERMORE, EJECTION OF MATERIAL ALONG THE EDGES OF THE SLABS-KNOWN AS 'BLOWING'-IS VIRTUALLY UNKNOWN IN CALIFORNIA.

Hveem, FN *Highway Research Board Bulletin* 1960

2A 215098
CONSTRUCTION PRACTICES FOR MATERIALS CONTROL AND BATCHING OPERATIONS FOR RIGID PAVEMENT

THE TRAINING AND SPECIFIC DUTIES OF THE BATCH PLANT INSPECTOR ARE EXPLAINED IN DETAIL. TRAINING CAN TAKE PLACE DURING THE WINTER AND CLASSES SHOULD BE SMALL OF NOT MORE THAN TEN OR TWELVE MEN. THE LOGICAL SEQUENCE FOR INSPECTING IS DIVIDED INTO THREE PHASES: PRELIMINARY INSPECTION, OPERATIONAL CONTROL, AND REPORTS. PRELIMINARY INSPECTION INCLUDES APPROVAL OF PLANT LAYOUT AND STOCKPILING, INSPECTION OF EQUIPMENT, AND MATERIALS, AND MIX DESIGNS. OPERATIONAL CONTROL INVOLVES CHECKING AGGREGATE MOISTURE, SCALE CHECKING, PREPARATION OF TEST SPECIMENS, MAINTENANCE OF STOCKPILES, AND DAILY CEMENT CHECKS. UNIFORMITY IS THE GOAL IN REPORTING.

Stingley, WM *Highway Research Board Bulletin* 1960

2A 215102
REPORT OF THE TECHNICAL COMMITTEE ON LOW COST ROADS

CONTENTS: GENERAL ACTIVITY REPORT MANUAL AND MECHANICAL METHODS FOR HIGHWAY CONSTRUCTION AND MAINTENANCE REGIONAL AND NATIONAL SURVEYS OF ROADMAKING MATERIALS INFLUENCE OF ENVIRONMENT ON THE DESIGN OF ROADS VARIOUS QUESTIONS AND INFORMATION UNESCO MANUAL ON THE CONSTRUCTION AND MAINTENANCE OF ROADS IN DEVELOPING COUNTRIES CONCLUSIONS

Perm Intl Assoc Road Congresses Proc 1967

2A 215109
CONCRETE DOWN THE SPOUT

EQUIPMENT, CONSTRUCTION TECHNIQUES AND PRIMARY REQUIREMENTS FOR THE SUCCESSFUL PLACEMENT OF TREMIE CONCRETE ARE DESCRIBED. TREMIE CONCRETE IS A NAME GIVEN TO THE METHOD OF PLACING CONCRETE UNDER WATER BY MEANS OF A PIPE CALLED A TREMIE PIPE. CONCRETE OF HIGH SLUMP IS NECESSARY IN ORDER TO ACHIEVE HIGH-QUALITY CONCRETE WITH THIS METHOD. CONCRETE MUST BE POURED BELOW THE SURFACE OF THE WATER AND THEN INTRODUCED BELOW THE PREVIOUSLY PLACED FRESH CONCRETE IN A CONTINUOUS OPERATION, CAUSING AN OUTWARD AND UPWARD FLOW. ADVANTAGES OF TREMIE CONCRETE ARE: (1) IT IS UNNECESSARY TO DE-WATER THE CAISSON OR COFFERDAM, (2) IT IS POSSIBLE TO PLACE LARGE VOLUMES OF CONCRETE VERY QUICKLY AT GREAT DEPTHS, (3) THE CURING CONDITIONS ARE PERFECT, AND (4) VOIDS AND HONEYCOMBS ARE ELIMATED PROVIDED THE TREMIE SEAL IS NOT BROKEN.

Concrete Construction July 1968

2A 215110
HIGHWAY CONSTRUCTION PROBLEMS INVOLVING PLASTIC VOLCANIC ASH

ALONG THE EASTERN SHORES OF THE ISLAND OF HAWAII ARE SOILS DERIVED BY WEATHERING OF VOLCANIC ASH UNDER CONDITIONS OF CONTINUOUS MOISTURE. THIS HAS RESULTED IN A VERY PLASTIC TYPE OF SOIL WITH NATURAL MOISTURE CONTENT GENERALLY CLOSE TO 200 PERCENT. THE CONTAINED MOISTURE IS NOT FREE WATER AND HENCE CANNOT BE DRAINED. DUE TO THE ALMOST CONTINUOUS RAINFALL, THE DEEPER LAYERS MAINTAIN THEIR HIGH MOISTURE CONTENT. THE SURFACE LAYERS, MEASURING 6 TO 18 IN. THICK, ARE SUBJECT TO PARTIAL DRYING. DRYING EFFECTS AN IRREVERSIBLE CHANGE IN THE SOIL FROM PLASTIC TO RELATIVELY NON-PLASTIC. THUS PASSENGER CARS AND LIGHT TRUCKS CAN TRAVEL OVER THE TOPSOIL. ON THE OTHER HAND, THE UNDER SOIL, DUE TO ITS HIGH PLASTICITY, WILL NOT SUPPORT RUBBER-TIRED TRAFFIC. EQUIPMENT WITH CATERPILLAR TREAD, HOWEVER, CAN BE USED SUCCESSFULLY WITHIN CERTAIN LIMITATIONS. THESE LIMITATIONS STEM FROM THE FACT THAT THE UNDERSOIL IS THIXOTROPIC, SO ANY UNDUE WORKING OR MANIPULATION OF THE SOIL CAUSES IT TO LOSE ALL STABILITY WITH RESULTANT BOGGING DOWN OF EQUIPMENT AND SLIDING OF EMBANKMENT SLOPES. EXCAVATION CAN BE HANDLED EXPEDITIOUSLY BY USING EQUIPMENT SUCH AS A DRAG-LINE, TAKING THE MATERIAL OUT IN ONE LIFT AS CLOSE AS POSSIBLE TO REQUIRED GRADE. THE FRESHLY EXPOSED UNDERSOIL MUST BE QUICKLY COVERED WITH 18 IN. OF SELECT ROCKY MATERIAL TO FORM A TEMPORARY SURFACE (WHICH LATER BECOMES THE SUB-BASE) FOR TRUCKS HAULING AWAY THE EXCAVATED MATERIAL. CARRYALLS FITTED WITH ATHEE TRACKS HAVE ALSO PROVEN SUCCESSFUL UNDER CERTAIN CONDITIONS. EMBANKMENTS ARE BEST CONSTRUCTED IN ALTERNATE LAYERS OF 5 FT. OF ASH AND 18 IN. OF STABLE ROCKY MATERIAL. THE LATTER SERVES AS A TEMPORARY STABLE SURFACE OVER WHICH EQUIPMENT SUCH AS TRUCKS AND TRAC-FITTED CARRY-

ALLS CAN BRING UP MATERIAL. COMPACTION IS DEPENDENT UPON CONSTRUCTION TRAFFIC ENTIRELY. THIS LAYER METHOD ACHIEVES SATISFACTORY COMPACTION WITHOUT DANGER OF TOO INTENSIVE WORKING OF THE MATERIAL. END-DUMP METHODS CAN BE USED FOR RELATIVELY LOW AND SHORT EMBANKMENTS. FOR LONG EMBANKMENTS AND FOR HEIGHTS OVER 15 FT., END-DUMP METHODS RESULT IN TOO INTENSIVE WORKING OF THE MATERIAL WITH CONSEQUENT DANGER OF SLIDES. /AUTHOR/

Hirashima, KB *Highway Research Board Bulletin* 1951

2A 215111

INVESTIGATION OF STRENGTH, FROST-RESISTANCE AND IMPERMEABILITY OF CONCRETE CONSTRUCTION JOINTS
THE LIFE SPAN AND RELIABILITY OF MONOLITHIC CONCRETE STRUCTURES DEPENDS TO A GREAT DEGREE ON CORRECT METHODS OF PLACING CONCRETE DURING CONSTRUCTION. THE STRENGTH OF CONNECTION OF CONCRETE WITH CONSTRUCTION JOINTS AND INTERVAL BETWEEN CONCRETING UP TO 8 HOURS DECREASES UP TO 12%, IN THE CASE WITH NO SPECIAL TREATMENT OF THE JOINT SURFACE. THE STRENGTH OF CONNECTION OF CONCRETE WITH CONSTRUCTION JOINTS AND INTERVAL BETWEEN CONCRETING OF 16 HOURS TO 15 DAYS DECREASES BY 18 TO 29% BY COMPARISON WITH STRENGTH OF TEST PIECES WITHOUT JOINTS, IN THE CASE WITH CORRECT AND CAREFUL TREATMENT OF JOINT SURFACES. FOR EACH TYPE OF CEMENT ONE SHOULD CAREFULLY ASCERTAIN MAXIMUM ALLOWABLE TIME BETWEEN STAGES OF CONCRETING WITHOUT FORMATION OF CONSTRUCTION JOINTS, THAT IS, WITHOUT TREATMENT OF THE JOINT SURFACE. THE FROST-RESISTANCE OF CONCRETE WITH CONSTRUCTION JOINTS, IF PREPARED BY AN ACCEPTED METHOD ENSURES ADEQUATE LIFE-SPAN FOR MONOLITHIC REINFORCED-CONCRETE STRUCTURES. THE COMPOSITION OF THE CLINKER HAS NO REAL EFFECT ON STRENGTH OF CONNECTION OF CONCRETE JOINTS, NOR ON FROST-RESISTANCE (WHEN TESTED UP TO 300 CYCLES), NOR ON IMPERMEABILITY. HOWEVER, THE PRESENCE IN THE CEMENT OF A LARGE AMOUNT OF GYPSUM (IN THE FORM OF A SEMIHYDRATE) CAUSES RAPID STIFFENING AND LESS OF WORKABILITY OF CONCRETE MIXES, AND THIS MAKES FOR DIFFICULT CONCRETE PLACING AND MAY HARM THE STRUCTURE OF THE CONCRETE. /AUTHOR/

Trinker, BD *Hydrotechnical Construction* Sept. 1967

2A 215125

THE AASHO ROAD TEST: REPORT 2-MATERIALS AND CONSTRUCTION

CONTENTS: INTRODUCTION EMBANKMENT SUBBASE-FLEXIBLE AND RIGID PAVEMENTS BASE COURSE-FLEXIBLE PAVEMENT SURFACING-FLEXIBLE PAVEMENT SURFACING-RIGID PAVEMENT TEST BRIDGES APPENDIX A. STATISTICAL ANALYSIS OF COMPACTION DATA FOR CONSTRUCTION CONTROL APPENDIX B. ONE-POINT METHOD FOR DETERMINING MAXIMUM DRY DENSITY APPENDIX C. COOPERATIVE MATERIALS TESTING PROGRAM APPENDIX D. TESTS ON ROAD TEST MATERIALS BY THE BUREAU OF PUBLIC ROADS APPENDIX E. RESIDUAL STRESSES AND STATIC YIELD POINT OF STRUCTURAL STEEL FOR TEST BRIDGES APPENDIX F. COMMITTEES, ADVISORY PANELS, AND PROJECT PERSONNEL.

Highway Research Board Special Reports 1962

2A 215129

QUALITY CONCRETE FOR HIGHWAY CONSTRUCTION WITH CENTRAL MIXING PLANT

CENTRAL MIXED CONCRETE, DELIVERED TO JOB BY NEW AGITATED TRUCK BODIES, OFFERS GREAT OPPORTUNITY FOR FAST PLACEMENT, NEW METHODS OF QUALITY CONTROL. AND VERSATILITY IN RESPECT TO PLACING CONCRETE IN BRIDGES AND THE NUMEROUS OTHER STRUCTURES AS WELL AS THE SLAB ITSELF. THE METHOD IS FUNDAMEN-

TALLY OLD. FIGURES WILL SHOW WORK IN OHIO DURING 1921. THE FIRST LARGE SCALE OPERATION ALONG MODERN LINES WAS THE CONCRETING ON ONE SECTION OF THE OHIO TURNPIKE IN 1954. THERE WERE TWO LARGE SCALE OPERATIONS IN 1955 AND NUMEROUS SMALLER OPERATIONS WHERE ONLY PART OF THE CONCRETE WAS MIXED. IMPROVED PLANTS SUCH AS STATIONARY TRUCK MIXERS, AND STATIONARY PAVERS PERMITTED THE USE OF EQUIPMENT ALREADY AVAILABLE. THIS WAS AFFECTED ON THE GARDEN STATE PARKWAY WIDENING, JUNE 1955, AND ODD PARTS OF US 14 IN OHIO NEAR RAVENNA, SUCH AS BRIDGE APPROACHES, INTERSECTIONS, AND THE LIKE. THE NEED IS SHOWN FOR NEW EQUIPMENT INCLUDING A SPREADER TO CONVEY AND DEPOSIT THE CONCRETE EVENLY ACROSS A FULL 25 FOOT WIDTH OF PAVEMENT. PORTABLE, OR SEMI-PORTABLE, CONCRETE MIXING PLANTS ARE ALSO NEEDED WHICH CAN BE TRANSPORTED IN PARTS FOR RAPID TRAVEL AND ERECTION. THESE PLANTS SHOULD INCORPORATE COMPLETE FACILITIES FOR AUTOMATIC WEIGHING, RECORDING AND TESTING. IT IS PROPOSED THAT THE HEAVY MEDIA METHOD OF TESTING FOR CEMENT CONTENT BE ENLARGED TO TEST THE FIRST, MIDDLE, AND LAST PARTS OF THE CONCRETE AS DISCHARGED FROM THE CENTRAL MIXING PLANTS TO MEASURE UNIFORMITY OF MIXING. IN RESPECT TO PLACING CONCRETE IN THE SLAB A DEVICE SHOULD BE TRIED FOR CONSOLIDATING BY USING BOTH PRESSURE AND VIBRATION IN ORDER TO SUCCESSFULLY PLACE CONCRETE OF ONE INCH OR LESS SLUMP. WITH THE ADDED FLEXIBILITY AND SPEED, CENTRAL MIXED CONCRETE MAY WELL IMPROVE QUALITY AND REDUCE COST OF CONCRETE IN THE COUNTRY'S NEW HIGHWAY PROGRAM. /AUTHOR/

Maxon, G *Highway Research Board Bulletin* 1956

2A 215142

FEASIBILITY OF COLD-WEATHER EARTHWORK

MOST EARTHWORK OPERATIONS ARE MORE COSTLY IN THE COLD SEASON THAN IN THE WARM. HOWEVER, THE BENEFITS OF KEEPING CONSTRUCTION FORCES AND EQUIPMENT OPERATIVE MORE OF THE TIME, PLUS ADVANCING THE COMPLETION DATE OF A MODERN, SAFER FACILITY, MAY MORE THAN COMPENSATE FOR THE INCREASE IN UNIT COSTS. THE COLD-WEATHER EARTHWORK EXPERIENCES OF THE NORTHERN STATES OF THE UNITED STATES, THE PROVINCES OF CANADA, AND THE SCANDINAVIAN COUNTRIES HAVE BEEN STUDIED IN THE LITERATURE AND BY BRIEF QUESTIONNAIRES. THIS EFFORT HAS SERVED TO DEFINE (1) THE MANNER IN WHICH THE WINTER WEATHER AND SOIL CONDITIONS RESTRICT THE LENGTH OF THE CONSTRUCTION SEASON, (2) THE DESIGNS AND CONSTRUCTION PRACTICES EMPLOYED TO COPE WITH THE WINTER CONDITIONS, AND (3) AN ESTIMATE OF THE RELATIVE UNIT COSTS FOR VARIOUS WINTER OPERATIONS. THE ADVANTAGES OF COLD-WEATHER EARTHWORK HAVE BEEN DEFINED IN A SIMPLE LINEAR ECONOMIC MODEL. AN ASSESSMENT OF DETERMINANTS AND BENEFITS LEADS TO THE CONCLUSION THAT COLD-WEATHER EARTHWORK IS ECONOMICALLY AS WELL AS TECHNICALLY FEASIBLE ON MANY HIGHWAY PROJECTS IN THE FROST AREA OF NORTH AMERICA. /AUTHOR/

Lovell, CW Osborne, AM *Highway Research Record, Hwy Res Board* 1968

2A 215145

STATISTICAL EVALUATION OF HIGHWAY MATERIALS SPECIFICATIONS

A STATISTICAL EVALUATION OF SOME OF THE MAJOR HIGHWAY MATERIALS SPECIFICATIONS IS REPORTED. THE DATA FOR ANALYSIS AND EVALUATION WERE OBTAINED FROM HISTORICAL SOURCES, WITH LIMITED AMOUNTS FROM RESEARCH SOURCES FOR ASPHALTIC CONCRETE, BASE COURSE, AND CONCRETE CHARACTERISTICS. THE DATA WERE ANALYZED BY COMPUTER AND STANDARD STATISTICAL PROCES-

DURES. THE ANALYSIS INDICATES THAT (A) MOST OF THE HISTORICAL DATA TEND TO FOLLOW NORMAL DISTRIBUTION, (B) IN GENERAL, THERE IS CONSIDERABLE VARIATION IN PRODUCTION AND CONSTRUCTION CONTROL FOR DIFFERENT CONTRACTORS, AND (C) FURTHERMORE, THERE IS A LACK OF COMPATIBILITY BETWEEN CURRENTLY USED SPECIFICATION LIMITS AND STATISTICAL PARAMETERS. THE REPORT DESCRIBES THE VARIOUS SINGLE-SAMPLING PLANS FOR LOT ACCEPTANCE. THE USE OF CONTROL CHARTS FOR CONTROL AND ACCEPTANCE OF PORTLAND CEMENT AND ASPHALTIC CONCRETE IS ALSO DEMONSTRATED. /AUTHOR/

Shah, SC Adam, V *Highway Research Record, Hwy Res Board* 1968

2A 215162

CONCRETE CONSTRUCTION HANDBOOK

THE HANDBOOK IS A PRACTICAL, CONCISE VOLUME DESIGNED TO SERVE AS AN UP-TO-DATE REFERENCE BOOK. THE BOOK DISCUSSES THE USE OF PLASTICS IN FORMWORK, THE LATEST DEVELOPMENTS IN MACHINERY AND EQUIPMENT, AND SLIP FORM PAVERS AND PLASTICS USED IN THE REPAIR OF CONCRETE. ALSO IN DETAIL ARE GEOPHYSICAL AND AERIAL AGGREGATE SURVEYING METHODS, AGGREGATE BENEFICIATION, NEW ELASTOMERS FOR JOINT SEALANTS, THE USE OF ADHESIVES, NEW STUDIES IN CONCRETE TOUGHNESS AND CREEP, & THE APPLICATION OF STATISTICAL METHODS TO CONCRETE TESTING. OTHER TOPICS INCLUDE RESISTANCE WELDING OF REINFORCING STEEL, A DETAILED DISCUSSION OF THE PROPERTIES OF CONCRETE AS RELATED TO MATERIALS AND PERFORMANCE, SAMPLING AND TESTING MATERIALS, METHODS OF COMPUTING SIZE AND NUMBER OF BATCHERS, MIXERS, AND BATCH TRUCKS, AND COMPUTATIONS ON HEATING AND COOLING REQUIREMENTS FOR MAINTAINING CONCRETE TEMPERATURE WITHIN SPECIFIED LIMITS. /AUTHOR/

Waddell, JJ

Mcgraw Hill Book Company 898 pp, 1968

2A 215165

CONSTRUCTION OF ASPHALT PAVEMENTS IN THICK LIFTS ASPHALTIC CONCRETE PAVEMENT CONSTRUCTION IS DESCRIBED IN THE STATE OF WASHINGTON. AN INVESTIGATION WAS CONDUCTED ON THE EFFECT OF LIFT THICKNESS ON DENSITY AND PNEUMATIC COMPACTION METHODS. AN EXPERIMENTAL PROJECT WAS CONDUCTED TO INVESTIGATE THE EFFECT OF PLACING METHODS AND LIFT THICKNESS ON DENSITY AND RIDING QUALITIES OF ASPHALT CONCRETE. COMPACTION EQUIPMENT INCLUDED THREE TYPES OF STEEL WHEEL ROLLERS AND FOUR HIGH PRESSURE PNEUMATIC TIRED ROLLERS. COOLING CURVES WERE OBTAINED IN EACH SECTION BY INSERTING THERMOCOUPLES IN THE MIX AT VARIOUS LEVELS. SMOOTHNESS MEASUREMENTS WERE MADE BY A BPR ROUGHOMETER, A CALIFORNIA TYPE PROFILOGRAPH AND A WASHINGTON STATE ROUGHOMETER. ON THREE LEVELS OF LIFT THICKNESS, ROLLING PATTERNS WERE VARIED BY USING BOTH STEEL AND PNEUMATIC ROLLERS FOR BREAKDOWN COMPACTION, FOLLOWED IN ALL CASES BY STEEL FINISH ROLLING. TEST RESULTS SHOW THAT: (1) REGARDLESS OF LIFE THICKNESS PNEUMATIC BREAKDOWN PROVIDED THE HIGHEST DENSITY, (2) EQUAL OR HIGHER DENSITIES WERE OBTAINED WITH THE SINGLE LIFT, (3) THE RIDING QUALITIES OF THE FINISHED PAVEMENT WERE NOT AFFECTED BY THE DEPTH OR LIFT OR METHOD OF SPREADING THE BASE COURSE, AND (4) THE ROCK SPREADER PROVED TO BE A FULLY SATISFACTORY MACHINE FOR SPREADING THE BASE COURSE MIX. ANOTHER RESEARCH PROJECT WAS CONDUCTED TO ESTABLISH THE ROLLER WEIGHT, TIRE PRESSURE, AND NUMBER OF PASSES THAT WOULD INSURE UNIFORM OPTIMUM DENSITY AND PRODUCE AN ACCEPTABLE PAVEMENT SMOOTHNESS. AN ATTEMPT TO SHOW A DIRECT CORRELATION BETWEEN COMPACTIVE EFFORT, DENSITY AND PERMEABILITY WAS SUCCESSFUL ON THICK LIFT BASE COURSE. REASONABLE DENSITIES WERE

OBTAINED OVER A WIDE RANGE OF COMPACTION VARIABLES, BUT THE MOST UNIFORM RESPONSE OCCURRED WITH THE 20 TON ROLLER. RESPONSE WAS MORE UNIFORM WITH INCREASED PASSES.

Minor, CE *Am Assoc State Highway Officials Proc* 1966

2A 215167

QUALITY ASSURANCE IN HIGHWAY CONSTRUCTION, PART I- INTRODUCTION AND CONCEPTS

THIS ARTICLE IS THE FIRST OF A CONTINUING SIX-PART SERIES SUMMARIZING A RESEARCH EFFORT INITIATED TO IMPROVE QUALITY ASSURANCE METHODS IN HIGHWAY CONSTRUCTION. IN ADDITION TO THIS REPORT THE PRESENTATION WILL CONSIST OF THE FOLLOWING: (1) QUALITY ASSURANCE OF EMBANKMENTS AND BASE COURSES, QUALITY ASSURANCE OF PORTLAND CEMENT CONCRETE (2) VARIATIONS OF BITUMINOUS CONSTRUCTION (3) SUMMARY OF RESEARCH FOR QUALITY ASSURANCE OF AGGREGATES, (4) AND CONTROL CHARTS. STATISTICALLY BASED QUALITY-CONTROL METHODS HAVE BEEN USED SUCCESSFULLY IN INDUSTRY, PARTICULARLY IN THE DEFENSE PROGRAM, FOR MANY YEARS. ACCORDING TO RESEARCH RESULTS, STATISTICAL QUALITY-ASSURANCE METHODS ALSO SHOULD BE ADAPTABLE TO HIGHWAY CONSTRUCTION, PROVIDED THAT GOVERNING SPECIFICATIONS ARE PROPERLY WRITTEN AND SAMPLING AND TESTING VARIATIONS ESTABLISHED TO CONFORM TO THE CONDITIONS OF THE LOCALITY IN WHICH THEY WILL BE APPLIED. /AUTHOR/

McMahon, TF Halstead, WJ *Public Roads, Us Bureau Public Roads* Feb. 1969

2A 215179

WINDY CITY COMPLETES MAJOR RESURFACING PROJECT THE PROJECT INCLUDED PATCHING THE CONCRETE HIGHWAY, OVERLAYING IT WITH THREE INCHES OF HOT-MIX ASPHALT, INSTALLING IMPROVED GUARD RAILS, AND REPLACING EXISTING SIGN SUPPORTS WITH BREAKAWAY POSTS. THE PROJECT WAS CARRIED OUT WHILE TRAFFIC WAS MAINTAINED. THE EXISTING PAVEMENT ON THE EXPRESSWAY CONSISTED OF A TEN INCH PORTLAND CEMENT SLAB LAID OVER A 6 INCH GRANULAR SUBBASE. TO GET THE PAVEMENT IN SHAPE FOR RESURFACING, DAMAGED OR CRACKED SLAB WAS REMOVED AND REPLACED WITH FULL DEPTH AND PARTIAL PATCHES. THE MIX WAS LAID IN TWO COURSES OF 3 INCHES EACH, THE FIRST COURSE BEING BINDER AND THE SECOND BEING A WEARING MIX. GALLAGHER WHEELS WERE USED BEHIND THE ASPHALT FINISHER WHILE PLACING THE SURFACE COURSE. THIS MECHANICAL LEVELING DEVICE SUPPLEMENTED THE ELECTRONIC SCREED CONTROLS USED IN PLACING THE BINDER COURSE. ALTHOUGH THE GUARD RAIL AND SUPPLEMENTAL WORK WAS PERFORMED ON A 24-HOUR BASIS PAVING WAS LIMITED TO 12 HOURS PER DAY, SEVEN DAYS A WEEK.

Paving Forum /Napa/ June 1969

2A 215184

COL CO HIGHWAY 551: HOW MCB-8 BUILT THE FIRST PERMANENT HIGH-SPEED ROAD IN VIETNAM'S I CORPS A PERMANENT HIGHWAY WAS RECENTLY CONSTRUCTED LINKING HUE, THE ANCIENT IMPERIAL CAPITAL OF VIETNAM, AND A COASTAL PORT SEVEN MILES TO THE NORTH EAST. THIS SEABEE PROJECT WAS CONSIDERED NECESSARY AS A SUPPLY LINK TO PERMANENT LST AND LCU FACILITIES. BECAUSE OF CERTAIN GEOGRAPHIC SIMILARITIES THE ROAD WAS DIVIDED INTO THREE PARTS: (1) THE NARROWEST PART THROUGH A ONE-TIME WEALTHY RESIDENTIAL SUBURB OF HUE, (2) A SECTION PARALLELING A LARGE NAVIGABLE CANAL WITH A DENSE GROWTH OF BANANA TREES AND BAMBOO HUTS ON ITS EASTERN SHOULDER, AND (3) AREAS THROUGH THE RICE PADDIES WHICH REQUIRED AS MUCH AS SIX FEET OF FILL IN MANY AREAS. OVER 20,000 CUBIC YARDS OF DREDGE SAND WAS REQUIRED FOR THE ROADWAY

EMBANKMENT THROUGH THE RICE PADDIES. A SIX-INCH SAND LIFT WAS RETAINED UNDER THE SOIL CEMENT OF PART II TO PERMIT WATER RISING THROUGH THE LATERITE SUBGRADE TO DRAIN OFF INSTEAD OF BEING CONFINED BY THE OVERLYING SOIL CEMENT, AND TO PERMIT FLOOD WATERS TO EQUALIZE ON EITHER SIDE OF THE ROAD. THE 3.4 MILES OF SAND FILL ROADWAY IN THE RICE PADDIES COULD NOT BE LEFT EXPOSED TO RAIN AND FLOODS DURING THE MONSOONS. THE TOPSOIL OF THE SURROUNDING RICE PADDIES WAS SPREAD ON THE SLOPES BY DOZERS. THIS WAS COMPACTED WITH A GRIDROLLER AND GRADED TO EXTEND THE SLOPE TO 4 TO 1. THIS PROVIDED THE NECESSARY CONFINING PRESSURE TO GIVE THE SAND THE SHEAR STRENGTH REQUIRED FOR DESIGNED LOADS. VARIOUS TYPES OF CEMENT SPREADERS WERE TRIED, BUT NONE WORKED SATISFACTORILY. OVER 100 VIETNAMESE LABORERS WERE CONTRACTED TO PERFORM MANUAL LABOR ON THE ROAD, AND MANY OF THESE ASSISTED IN BAG LAYING AND BREAKING. LACK OF LOCAL ROCK DEPOSITS PRESENTED THE PROBLEM OF OBTAINING 57,000 TONS OF 21/2 INCH BASE ROCK. ROCK WAS BARGED FROM DANANG. PART I IS COMPLETELY PAVED, PART II AND III'S SIX-INCH BASE COURSE IS COMPLETED AND ONLY PAVING AND FINISH SLOPE WORK REMAINS.

Schroeder, JA *Navy Civil Engineer* Oct. 1968

2A 215191

ACCEPTANCE TESTING OF BITUMINOUS AND PORTLAND CEMENT CONCRETE IN THE FIELD

THE SAMPLING AND TESTING OF HIGHWAY MATERIALS IN THE STATE OF VIRGINIA IN THE PAST FIVE YEARS HAS DEVELOPED ALONG THE LINE OF PERFORMING AS MUCH OF THE FINAL ACCEPTANCE SAMPLING AND TESTING AT THE ORIGIN OR SOURCE AS POSSIBLE. EIGHT NEW DISTRICT LABORATORIES HAVE BEEN CONSTRUCTED, WHICH ARE 4 X 80 FEET, TWO STORIES HIGH. THE LABORATORIES WERE EQUIPPED WITH TESTING EQUIPMENT SIMILAR TO THAT USED IN THE CENTRAL LABORATORY FOR TESTING BITUMINOUS CONCRETE. EQUIPMENT WAS ALSO PROVIDED FOR TESTING PORTLAND CEMENT CONCRETE. AT THE SAME TIME, THE INSTALLATION OF A PENALTY AND REJECTION SYSTEM WAS MADE, WHEREBY BORDERLINE MATERIALS COULD BE USED, BUT AT A REDUCED COST. THE INSTALLATION OF THIS SYSTEM HAS REQUIRED THAT THE STATE PROVIDE: (1) MORE INTENSIVE TRAINING FOR THE INSPECTORS AS WELL AS INDUSTRY PERSONNEL, (2) MORE THOROUGH ON-THE-JOB SUPERVISION OF INSPECTORS, (3) MORE FREQUENT AND MORE EXTENSIVE PLANT INSPECTIONS OF BITUMINOUS LABORATORIES, AND (4) MORE DECENTRALIZATION OF LABORATORY TESTING. DEVELOPMENTS IN REGARD TO THESE REQUIREMENTS ARE DESCRIBED AND DISCUSSED. IN ADDITION TO RECORD SAMPLING OF CONCRETE, PROGRESS SAMPLES ARE ALSO OBTAINED OF CEMENT AND FINE AND COARSE AGGREGATES, AT THE RATE OF ONE OF EACH TYPE OR SIZE PER PROJECT, WITH NO LESS THAN ONE SAMPLE FOR EACH 5000 TONS OF AGGREGATE USED. THESE SAMPLES ARE OBTAINED AT THE BATCHING SOURCE OF CONCRETE. VIRGINIA FEELS THAT THIS IS THE MINIMUM AMOUNT OF SAMPLING AND TESTING THAT CAN BE CONDUCTED, AND STILL PROVIDE SOME ASSURANCE OF OBTAINING ACCEPTABLE PRODUCTS.

Edwards, JL *Southeast Assoc St Hwy Officials* pp 109-115, Nov. 1967

2A 215205

HEAVY TRAFFIC MAINTAINED ON NIGHT PAVING PROJECT CAREFUL PLANNING BY THE KENTUCKY DEPARTMENT OF HIGHWAYS, AND BY THE PRIME CONTRACTOR, MADE IT POSSIBLE TO RESURFACE THE HEAVILY-TRAVELLED EXPRESSWAY IN LOUISVILLE, KENTUCKY, BY PLACING HOT-MIX ASPHALT ON THE TEN MILE PROJECT DURING DARKNESS. A 6,000-8,500 POUND BATCH PLANT AND FOUR ASPHALT PAVERS WERE USED. ARMY SURPLUS GENERATORS WERE MOUNTED

ON EACH PIECE OF EQUIPMENT TO PROVIDE ELECTRICITY FOR EXTRA LIGHTING. POLE-MOUNTED CLUSTERS OF LIGHTS WERE USED AT THE HOT-MIX PLANT, AND MASTS OF LIGHTS WERE PUT ON THE PAVER AND THE ROLLERS HAD STREET LIGHT INTENSITY MERCURY LIGHTS MOUNTED IN FRONT AND TWO MASTS WITH CLUSTERS OF FIVE 150-WATT LIGHTS IN THE BACK. TRAFFIC TRANSMISSION TO ONE LANE AT PAVING SITES WAS DAYLIGHTED BY CLUSTERS OF FOUR MERCURY LIGHTS POWERED BY DIESEL DRIVEN GENERATORS. TRAFFIC DIVERSIONS AND WORK-SITES WERE CLEARLY BOUNDED AND MADE VISIBLE TO THE NIGHT TIME DRIVERS BY THIRTY INCH HIGH TRAFFIC CONES THAT WERE REFLECTORIZED ON THE UPPER EIGHT INCHES. THE HOT-MIX PLANT TURNED OUT AN AVERAGE OF 150 TONS PER HOUR, FEEDING THE HAUL TRUCKS FOR THEIR 15-MILE JOURNEY TO THE PROJECT. THE THIRTY-SEVEN FEET, DIRT TO DIRT WIDTH, THAT INCLUDED THREE FEET OF INSIDE SHOULDERING, THE ROADWAY, AND TEN FEET OF OUTSIDE SHOULDER, WAS LAID DOWN IN THREE PASSES WITH THE PAVERS. TOLERANCES WERE ONE QUARTER OF AN INCH ON THE BINDER AND ONE EIGHTH INCH ON THE SURFACE COURSE. TEN TO TWELVE TON THREE-WHEEL AND TANDEM ROLLERS COMPACTED THE MAT. TWO-THIRDS OF THE CONTRACT WAS COMPLETED AHEAD OF SCHEDULE BEFORE SEASONAL SHUTDOWNS LAST NOVEMBER 15.

Paving Forum /Napa/ June 1969

2A 215219

EVALUATION OF CONSTRUCTION CONTROL PROCEDURES: AGGREGATE GRADATION VARIATIONS AND EFFECTS
FOUR INDIVIDUAL STUDIES CONCERNED WITH THE GRADATION OF AGGREGATES USED IN HIGHWAY CONSTRUCTION WERE CONDUCTED ON: (1) EFFECT OF VARIATIONS IN GRADATION OF COARSE AGGREGATE ON CHARACTERISTICS OF PORTLAND CEMENT CONCRETE. (2) VARIATION IN GRADATION OF AGGREGATES IN BITUMINOUS HOT-MIX PLANTS, (3) EFFECT OF INCREMENT SIZE ON SAMPLING ACCURACY, AND (4) MATHEMATICAL STUDY OF THE PATTERN OF VARIATIONS IN GRADATION OF AGGREGATES. A STATISTICALLY DESIGNED EXPERIMENT WAS USED TO DETERMINE THE EFFECT OF GRADATION VARIATIONS ON THE WORKABILITY AND COMPRESSIVE STRENGTH OF THE RESULTANT CONCRETE. INVESTIGATION WAS MADE OF VARIATIONS IN GRADATION OF BOTH FINE AND COARSE AGGREGATES AND ASPHALT CONTENTS AT SEVERAL POINTS IN THE PRODUCTION PROCESS OF BITUMINOUS HOT-MIX PLANTS. AN EXPERIMENT WAS CONDUCTED TO ESTABLISH THE PRACTICAL RELATIONSHIP BETWEEN MAXIMUM PARTICLE SIZE AND MINIMUM INCREMENT SIZE FOR DETERMINING THE GRADATION OF A LOT OF AGGREGATE. SEVERAL LOTS OF KNOWN GRADATION WERE PREPARED AND SAMPLED WITH SAMPLING SCOOPS OF PREDETERMINED CAPACITY. IT APPEARED THAT VARIATIONS IN THE GRADATION OF AGGREGATES FOLLOWED AN INHERENT PATTERN. DATA WERE ANALYZED TO DETERMINE THE POSSIBILITIES FOR SELECTING A SINGLE SIEVE FOR USE AS A QUICK CHECK ON COMPLIANCE WITH GRADATION SPECIFICATIONS. THE CONCRETE STUDY INDICATES THAT SAVINGS IN MANPOWER AND TESTING TIME CAN BE EFFECTED BY REDUCING THE SAMPLING FREQUENCY OF COARSE AGGREGATES FOR CONCRETE. THE MOST SIGNIFICANT FINDING WAS THAT COMPRESSIVE STRENGTH REMAINED SUBSTANTIALLY CONSTANT, REGARDLESS OF LARGE VARIATIONS IN THE GRADATION OF THE COARSE AGGREGATE, PROVIDED THE SLUMP WAS MAINTAINED AT A UNIFORM LEVEL. RESCREENING OR RESIZING COARSE AGGREGATES IS CONTRAINDICATED, AND IT IS RECOMMENDED THAT RESTRICTIVE GRADATION SPECIFICATIONS BE BROADENED TO ACCOMMODATE GRADATION VARIATIONS ACTUALLY FOUND TO EXIST. THE HOT-MIX BITUMINOUS PAVING PLANT STUDY FOUND THAT INDICATED VARIATIONS IN THE GRADATION OF BINNED AGGREGATES WERE LARGELY DUE TO WITHIN-BATCH VARIATION. IT IS RECOMMENDED THAT COMPLIANCE WITH JOB-MIX FORMULA GRADATION RE-

REQUIREMENTS BE BASED ON QUALITY HISTORY CHARTS RATHER THAN ON THE RESULTS OF INDIVIDUAL TESTS. THE USE OF USUAL SAMPLING TOOLS DOES NOT SEEM TO SERIOUSLY BIAS THE RESULTS. THE MATHEMATICAL STUDY CONFIRMED THAT THERE IS A TYPICAL PATTERN TO VARIATIONS OF AGGREGATE GRADATION. GRADATION SPECIFICATION SHOULD HAVE THE GREATEST TOLERANCE ON THOSE SIEVES THAT PASS 50 TO 70% OF THE AGGREGATE. THE REQUIRED SIZE OF TEST PORTIONS DEPENDS ON BOTH THE MAXIMUM PARTICLE SIZE AND THE GRADATION OF THE AGGREGATE.

Hudson, SB Waller, HF *Highway Research Board Nchrp Reports* 1969

2A 215222

MEASURING THE VARIABILITY OF COMPACTED EMBANKMENTS

THE METHODS AND RESULTS ARE PRESENTED OF MEASURING THE VARIABILITY OF PERCENT COMPACTION AND MOISTURE CONTENT OF COMPACTED EMBANKMENTS IN ACCEPTABLE HIGHWAY CONSTRUCTION IN NORTH DAKOTA. SEPARATE FROM THE STATE HIGHWAY DEPARTMENT'S CONTROL SAMPLING, RANDOMLY LOCATED SAMPLES WERE TAKEN ON EACH OF THREE TYPICAL CONSTRUCTION PROJECTS. AT EACH SAMPLE LOCATION, THE FOLLOWING DUPLICATE SAMPLES WERE TAKEN: (1) IN-PLACE DENSITY USING THE WATER-BALLOON METHOD, (2) IN-PLACE MOISTURE BY DRYING TWO SOIL SAMPLES, (3) MOISTURE AND DENSITY USING A NUCLEAR MOISTURE-DENSITY GAGE IN BOTH DIRECT TRANSMISSION AND BACKSCATTER POSITIONS, AND (4) A SACK SAMPLE FOR DETERMINATION OF MAXIMUM DENSITY. FOR COMPARISON, STATE HIGHWAY DEPARTMENT DATA COLLECTED DURING THE SAME CONSTRUCTION PERIOD ARE ALSO REPORTED. THE MAJOR CONCLUSIONS ARE THAT (1) THE VARIABILITY IN PERCENT COMPACTION IS LARGE-FOR EXAMPLE, EVERY THIRD SAMPLE WILL DEVIATE FROM THE AVERAGE BY AT LEAST 3 TO 5 PERCENT, (2) THE AVERAGE PERCENT COMPACTION WAS VERY NEAR THE REQUIRED MINIMUM, (3) THE HIGHER IN-PLACE DENSITIES AND LOWER STANDARD DEVIATIONS OF THE HIGHWAY DEPARTMENT RESULTS COULD HAVE RESULTED FROM THE USE OF REPRESENTATIVE SAMPLES OR FROM RESAMPLING, (4) A LABORATORY CALIBRATION OF THE TWO NUCLEAR DENSITY GAGES INDICATED VERY CLOSE AGREEMENT WITH THE MANUFACTURER'S CURVES, (5) THE NUCLEAR INSTRUMENT, WHEN IN THE DIRECT TRANSMISSION POSITION, IS A MUCH MORE RELIABLE INDICATOR OF FIELD DENSITY THAN WHEN IN A BACKSCATTER POSITION AND IS SLIGHTLY MORE RELIABLE THAN THE CONVENTIONAL WATER-BALLOON TESTS; AND (6) THE AIR-GAP PROCEDURE WAS MORE RELIABLE THAN THE STANDARD BLOCK ONLY ON THAT PROJECT BELIEVED TO HAVE A LARGER VARIATION IN CHEMICAL CONTENT OF THE SOIL. /AUTHOR/

Jorgenson, JL *Highway Research Record, Hwy Res Board* 1969

2A 215227

SUBSURFACE: MANY STRONG PAPERS

THE USUAL METHOD OF CUT-AND-COVER SUBWAY CONSTRUCTION COULD NOT BE PERFORMED UNDER SAN FRANCISCO'S MARKET STREET. DEWATERING THE SITE WOULD HAVE PERMITTED PEAT LAYERS TO COMPRESS, WHICH WOULD HAVE INDUCED SUBSTANTIAL SETTLEMENTS AND CAUSED STRUCTURAL DAMAGE IN NEARBY BUILDINGS. THE ALTERNATIVE CHOSEN WAS TO EXCAVATE WITHIN A STRONG WATERTIGHT WALL, COMBINED WITH GROUNDWATER RECHARGE OUTSIDE THE WALL. SEEPAGE UNDER THE SUBWAYSTATION WALLS WAS CONTROLLED BY EXTENDING THE WALLS BELOW EXCAVATION LEVEL AT LEAST 20 FT. OR INTO ONE OF THE CLAY LAYERS. THIS METHOD WAS CALLED SOLDIER PILE TREMIE CONCRETE. THE METHOD IS OUTLINED. STOPPING SUBSIDENCE OF LAND OVER MINES IS DESCRIBED IN THE SCRANTON AND PITTSBURGH AREAS OF PENNSYLVANIA. HYDRAULIC BACKFILLING IS UNDER WAY ON A LARGE SCALE TO PREVENT FURTHER SUBSIDENCE.

ALTHOUGH SAND IS A PREFERRED MATERIAL FOR BACK-FILLING BECAUSE IT PROVIDES GOOD STRATA SUPPORT, COAL-MINE REFUSE AND OTHER MATERIALS ARE OFTEN USED. A SLURRY OF THIS MATERIAL AND WATER IS USED. GROUT-GRAVEL COLUMNS ARE USE FOR BUILDING OVER MINED AREAS IN THE PITTSBURGH AREA. THE GROUT-GRAVEL COLUMN IS PRESENTED IN DETAIL.

Civil Engineering Asce Nov. 1968

2A 215231

CE TESTS NEW ROAD CONSTRUCTION MATERIALS

THE ARMY CORPS OF ENGINEERS HAS ANNOUNCED A NEW CONCEPT TO REDUCE THE TIME AND COST OF HIGHWAY CONSTRUCTION UNDER ADVERSE SOIL CONDITIONS. USE OF A PLASTIC WRAPPER TO ENCASE THE SUBGRADE MATERIAL OF A ROAD, PROVIDES PROTECTION AS A WATERPROOF SEAL AGAINST MIGRATION OF SUBSURFACE MOISTURE INTO THE MATERIAL. THIS ENABLES BUILDERS TO SUBSTITUTE FINE GRAINED SUBGRADE MATERIALS FOR A GRANULAR BASE COURSE. THE WRAPPER CONSISTS OF POLYPROPYLENE FIBERS INSERTED INTO A COTTON SCRIM BY A NEEDLE POINT PROCESS THAT REINFORCES A DISTRIBUTOR APPLICATION OF ASPHALT TO FORM A MEMBRANE. ASPHALT IS APPLIED TO THE POLYPROPYLENE STRIP AFTER IT HAS BEEN LAID OVER THE SELECTED ROAD SITE. THE SUBGRADE MATERIAL IS FILLED IN, COMPACTED, AND COVERED BY ANOTHER STRIP OF THE MATERIAL. THE TWO SHEETS ARE THEN SEALED TO ENCASE THE MATERIAL.

Army Research & Development Aug. 1969

2A 215235

APPLICATION OF CONSTRUCTION MANAGEMENT TO THE PAVING PROCESS

THE APPLICATION OF CONSTRUCTION MANAGEMENT TO THE PAVING PROCESS BY THE CONTRACTOR CONSISTS OF THE FOLLOWING OPERATIONS: INTERPRETING THE SPECIFICATIONS, OBTAINING, ORGANIZING AND CONTROLLING MAN, EQUIPMENT, AND MATERIALS TO CONSTRUCT A PAVEMENT AT THE RIGHT COST. EVERY STEP OF THE PAVING PROCESS MUST BE PLANNED FROM THE MOMENT OF AWARD UNTIL ACCEPTANCE BY THE AWARDED AGENCY. A PAVING OPERATION SCHEDULE SHOULD BE DETAILED AND EXACT TO THE LAST MINUTE DETAIL. A SAFETY PROGRAM MUST BE DESIGNED TO PREVENT ACCIDENTS AND AVOID INJURIES, AND MUST BE CONSISTENTLY EMPLOYED AND ENFORCED IN EVERY PHASE OF THE PAVING PROCESS. SUPERVISION MUST BE PROVIDED THAT HAS EXPERIENCE, DRIVE, DETERMINATION, & THE ABILITY TO COMMUNICATE, TO INTERPRET SPECIFICATIONS, CARRY OUT THE PAVING PROCESS, STAY ON SCHEDULE, AND MAINTAIN A SAFE OPERATION.

Porter, RL

Sixth Paving Conference Proc pp 107-113, 1968

2A 215237

SOMETHING NEW ON THE E4 HIGHWAY

CONSTRUCTION PRACTICES BEING USED ON THE SWEDISH E4 HIGHWAY JUST SOUTH OF STOCKHOLM ARE REVIEWED. BECAUSE OF THE POOR NATURE OF THE CLAY SOIL, A CONSIDERABLE AMOUNT OF LECK IS USED FOR THE EMBANKMENTS. THIS LIGHTWEIGHT MATERIAL HELPS TO PREVENT EXCESSIVE SETTLEMENT. IT IS GENERALLY PLACED IN A LAYER 50 CM THICK, TOPPED WITH 30 CM OF GRAVEL AND COMPACTED BY 3-4 TON TRACTOR-DRAWN VIBRATING ROLLERS MAKING SIX PASSES. AFTER THE BASE COURSE IS PUT DOWN IT IS COVERED WITH A LAYER OF FINES AND A WATER TRUCK SPRINKLES IT DOWN. THE TANKER USES DETERGENTS IN THE WATER TO GIVE THE WATER 2 TO 3 TIMES MORE COVERAGE. THE CONTRACTOR IS USING A BARBER-GREENE SR40 PAVER, A 10-TON STATIC ROLLER AND A 10-TON VIBRATING ROLLER. A LAYER OF PAPER IS SPREAD BETWEEN EACH LAYER OF ASPHALT AT THE CUT OFF POINT EACH DAY. THE NEXT DAY, BEFORE LAYING IS RECOM-

MENCED, THE MEN CUT ACROSS THE WIDTH OF THE ROAD WITH A COBRA PETROL-POWERED PAVEMENT BREAKER AND ROLL THE LAYERS BACK CLEANLY. THIS MAKES FOR SMOOTH TRANSITIONARY SURFACE AND GOOD ADHESION BETWEEN ADJACENT SECTIONS. THE CONTRACTORS LAY ABOUT 500 TONS OF ASPHALT PER 11-12 HOUR DAY. THE ASPHALT HAULERS HAVE ONE RATE OF PAY FOR THE RUN TO THE SITE, AND A LOWER RATE FOR THE EMPTY RUN BACK TO THE PLANT. THE IDEA IS TO ENCOURAGE A HASTY RETURN.

World Construction Nov. 1969

2A 215238

TURKISH ROAD PROGRESS

IMPROVEMENTS IN THE HIGHWAY SYSTEM IN TURKEY ARE DESCRIBED. CONSTRUCTION OF A PARALLEL ROAD ALONG THE EXISTING ONE ON THE 14-KM DISTANCE BETWEEN TWO TOWNS IS DESCRIBED. THE BASE COURSE FOR THIS PROJECT CONSISTS OF THREE LAYERS. THE FIRST LAYER WAS MECHANICALLY STABILIZED WITH 5 CM SCREENED MATERIALS LAID DIRECTLY ON THE PREPARED SUBGRADE TO A DEPTH OF 30 CM. THE SECOND LAYER WAS STABILIZED WITH CEMENT LAYED IN A 20 CM LAYER AND TOPPED WITH A SEAL COAT. A THIRD LAYER OF BITUMINOUS WAS PLACED TO 10 CM THICKNESS AND CAPPED WITH A 5 CM BINDER COURSE AND A 5 CM WEARING COURSE. GRAVEL AND SAND HAD TO BE BROUGHT IN FROM 35 TO 50 KM AWAY AND STONE FROM 18 KM. THE WORK IS SCHEDULED FOR COMPLETION BY THE END OF 1969, AND EMPLOYS 9 CONTRACTORS AND 14 SUBCONTRACTORS.

Somer, S *World Construction* Nov. 1969

2A 215270

HOW TO BUILD A SLURRY WALL

ONE OF THE MOST COMPLICATED CONSTRUCTION SECTIONS OF THE SAN FRANCISCO PORTION OF THE BAY AREA RAPID TRANSIT SYSTEM IS ALONG MARKET STREET, THE CITY'S MAIN ARTERY. CONTRACTS CALL FOR CONSTRUCTION OF DEEP, MASSIVE COFFERDAM WALLS WITHIN WHICH CUT-AND-COVER STATION CONSTRUCTION WILL FOLLOW. WORKING ENTIRELY FROM STREET LEVEL, IN TIGHT QUARTERS, THE CONTRACTOR MUST: (1) DRILL SLURRY-FILLED HOLES FOR INSTALLATION OF 405 STEEL SOLDIER PILES 5 FT, 10 IN. APART, (2) EXCAVATE OF SLURRY-FILLED SLOTS BETWEEN PILES, AND (3) FILL SLOTS WITH TREMIE-PLACED CONCRETE. THE FIRST STEP IS TO SET SEVERAL LAYERS OF TIMBER MATS ASTRIDE THE CENTER LINE OF A WALL SECTION TO PROVIDE A LEVEL WORKING AREA FOR A CRANE. SLURRY IS PREPARED NEARBY IN IN-SITE MIXING TANKS. POWDERED BAROID BENTONITE IN BAGS IS ADDED TO WATER IN MEASURED QUANTITIES TO PRODUCE A STABLE SUSPENSION WITH A DENSITY OF 65-70 LB. PER CU. FOOT. SLURRY IS CONTAINED AND CONTROLLED AND TESTED REGULARLY AS TO PROPER WEIGHT, VISCOSITY, WATER LOSS AND SAND CONTENT. A BATTERY OF DIESEL-POWERED VAC-SEAL PUMPS CIRCULATES SLURRY FROM TANKS THROUGH 2 AND 3-IN. RUBBER HOSE TO THE SLURRY TRENCH, THEN BACK TO OTHER TANKS FOR CLEANING AND FILTERING. WITHIN 24 HOURS AFTER A SERIES OF HOLES IS DRILLED, STEEL SOLDIER PILES MUST BE INSTALLED. DEPENDING ON WIDTH OF PILE AND SOIL CONDITIONS, DEPTH OF DRIVING WILL VARY. SOME PILES CAN BE DRIVEN WITH THE VIBRO-DRIVER TO FULL DEPTH AND OTHERS REQUIRE HEAVY PERCUSSION BLOWS OF A LARGE DIESEL HAMMER. AFTER EACH PILE IS INSTALLED, THE HOLE IS FILLED WITH CRUSHED STONE TO ASSURE SOIL STABILITY. WHEN A LINE OF PILES IS INSTALLED, THE NEXT STEP IS TO EXCAVATE ALL SOIL IN "SLOTS" BETWEEN PILE FLANGES. A HYDRAULICALLY OPERATED BUCKET WAS DEVELOPED THAT QUICKLY AND ACCURATELY GRABS A 1 1/2-YD BITE, EVEN AT DEPTHS OF 100 FEET. THE RIG CONSISTS OF A PIPE WITHIN A PIPE. THE INNERPIPE SERVES AS A RAM WHICH OPENS AND CLOSES THE BUCKET. WHEN A SLOT IS COMPLETELY EXCAVATED, A

SOLDIER PILE HALF WAY BETWEEN THE TWO DRIVEN PILES, IS INSTALLED, RESULTING IN A FINAL PILE SPACING. THE DOUBLE SLOT MUST THEN BE FILLED WITH TREMIE-PLACED CONCRETE. A FRAME IS USED THAT STRADDLES THE SLOTS WITH TWO TREMIE PIPES, ONE FOR EACH SLOT, SUSPENDED FROM THE FRAME.

Western Construction Apr. 1970

2A 215280

A NEW METHOD OF CONSTRUCTING ROADS ON SOFT SOIL (IN GERMAN)

THE NEW DESIGN COMPRISES A THIN REINFORCED CONCRETE SLAB, 10-15 CM THICK, BONDED TO A SUITABLE SUPPORTING SYSTEM WHICH CONSISTS OF VERTICAL PRECAST REINFORCED CONCRETE PIPES ASSEMBLED IN THE SOIL BENEATH THE SLAB. THE PIPES HAVE AN EXTERNAL DIAMETER OF 1-1.5 M AND A WALL THICKNESS OF 7-10 CM. THE DISTANCE BETWEEN THE PIPES IS 2-2.5 M. THE BOTTOM OF THE PIPE IS APPROXIMATELY 2-3 M BELOW THE ROAD SURFACE, DEPENDING ON THE BEARING CAPACITY OF THE SOIL. /AUTHOR/

Sedijatmo, RM *Bauingenieur /Germany/* 1970

2A 215296

METHODS FOR CONSTRUCTING SMOOTH RIDING BITUMINOUS SURFACES

CUSTOMARY AND IMPROVED METHODS AND RESULTS ARE DESCRIBED FOR; SURFACE TREATMENT TYPES, MIXED-IN-PLACE TYPES, PREMIXED-LAID-COLD TYPES, PREMIXED-LAID-HOT TYPES, AND PENETRATION MACADAM. AN IMPORTANT DEVELOPMENT IS THE USE OF MECHANICAL SPREADERS AND FINISHERS.

Conner, CN *Highway Research Board Proceedings* 1928

2A 215297

APPLICATION OF PRESENT KNOWLEDGE IN THE CONSTRUCTION AND MAINTENANCE OF BITUMINOUS MACADAM AND BITUMINOUS CONCRETE

THE IMPROVEMENT OF BITUMINOUS MACADAM AND BITUMINOUS CONCRETE TYPES OF SURFACES HAS BEEN DEVELOPED BY LONG CONTINUED EXPERIENCE RATHER THAN BY PLANNED RESEARCH. A NUMBER OF PERTINENT SUGGESTIONS FOR DETAILS OF CONSTRUCTION AND MAINTENANCE THAT HAVE BEEN PROVED TO BE SATISFACTORY, ARE GIVEN.

Henderson, GH *Highway Research Board Proceedings* 1928

2A 215309

CONSTRUCTION VIEW POINTS ON VIBRATED CONCRETE

DATA WERE OBTAINED FROM PERSONAL OBSERVATION AND STUDY IN THE FIELD AND FROM REPORTS SUBMITTED BY VARIOUS PROJECT ENGINEERS ON CONSTRUCTION WORK. THE STUDY INCLUDES INTERNAL VIBRATORS ON STRUCTURES AND VIBRATORS ON SIX PAVEMENT PROJECTS, COVERING WORK WITH MIXED AGGREGATES AND COARSE AGGREGATES AS USED IN HIGHWAY CONSTRUCTION IN KANSAS. GENERALLY, VIBRATORS WERE ENTIRELY SATISFACTORY, AS THE VIBRATED CONCRETE HAD STRENGTH COMPARABLE WITH NON-VIBRATED CONCRETE HAVING A GREATER CEMENT CONTENT. /AUTHOR/

Wills, RB *Highway Research Board Proceedings* 1935

2A 215312

METHODS OF VIBRATION OF CONCRETE ACCORDING TO FRENCH PRACTICE

FRENCH PRACTICE WENT IN FOR HEAVY VIBRATING OR TAMPING OF PAVEMENT CONCRETE. BRIEF DESCRIPTIONS OF SEVERAL MACHINES WERE GIVEN, SOME OF WHICH RAN ON SIDE RAILS AND OTHERS RESTED DIRECTLY UPON THE FRESH CONCTETE. A FEATURE OF THE PRACTICE WAS A BRUSHING MACHINE FOR ROUGHENING THE SURFACE TO

MAKE IT SKID PROOF BY REMOVING THE FINE MATERIAL DURING THE SETTING AND HARDENING PERIOD. ONE BELIEF WAS IN USING LEAN MIXTURES WITH ENOUGH VIBRATION OR RAMMING TO FORCE THE INDIVIDUAL PIECES OF LARGE SIZE AGGREGATE INTO SUCH INTIMATE POSITIONS THAT WERE SECURELY BONDED TO EACH OTHER BY A MINIMUM AMOUNT OF CEMENT. ALMOST NO CRACKING AND LITTLE WEAR WAS OBSERVABLE ON TEN YEAR OLD PAVEMENTS, IN THE HEART OF PARIS, LAID BY THESE METHODS. /AUTHOR/

Crandell, JS *Highway Research Board Proceedings* 1937

2A 215325

REVTMENT CONSTRUCTION BY FABRIFORM PROCESS

THE FABRIFORM PROCESS EMPLOYS HIGH STRENGTH, WATER-PERMEABLE SYNTHETIC FABRIC AS A CONCRETE FORMING MATERIAL. WATER/CEMENT RATIO IS REDUCED BY FORCING VEHICLE WATER THROUGH FABRIC, CAUSING SUBSTANTIAL INCREASE IN STRENGTH AND VERY RAPID STIFFENING. PROPER FABRIC DESIGN IS ESSENTIAL TO AVOIDING MORTAR LOSS. APPLIED TO CONSTRUCTION OF EROSION-CONTROL REVTMENTS, DUAL WALL FABRIC IS PLACED ON THE SURFACE TO BE PROTECTED AND FILLED WITH MORTAR. THE TWO LAYERS OF FABRIC MAY BE WOVEN TOGETHER AT REGULAR INTERVALS TO FORM FILTER POINTS PORVIDINGS RELIEF FROM HYDROSTATIC UPLIFT. A UNIFORM CROSS SECTION IS ALSO AVAILABLE, CONTAINING INTERNAL FIBER REINFORCING. /ASCE/

Lamberton, BA *Am Soc Civil Engr J Construction Div* July 1969

2A 215339

PRESENT-DAY INADEQUACIES AND NEEDED IMPROVEMENTS IN THE TECHNOLOGY OF CUT-AND-COVER CONSTRUCTION

THE CUT-AND-COVER TUNNELLING IS MORE FREQUENTLY EMPLOYED FOR BUILDING ROAD TUNNELS IN CITIES THAN ROCK AND SOFT-GROUND TUNNELLING. SEVENTEEN COUNTRIES COMPLETED THE QUESTIONNAIRES ON THE CUT-AND-COVER CONSTRUCTION METHOD. THE MAIN INADEQUACIES OF THE CUT-AND-COVER CONSTRUCTION METHOD ARE: (1) LARGE CONSTRUCTION SITES CAUSING HINDRANCE TO LOCAL RESIDENTS, BLOCKING ACCESS TO SHOPS AND BUSINESSES, CREATING PROBLEMS OF TRAFFIC DIVERSION, AND OCCUPYING ADJACENT ROAD SPACE FOR CURRENT WORK AND STORAGE DUMPS, AND (2) NUISANCE CAUSED THROUGH NOISE, VIBRATION, DIRT AND THE EFFECTS OF SETTLEMENT ON NEARBY BUILDINGS DURING CONSTRUCTION AND THROUGH ANY SUBSEQUENT MOVEMENT OF THE STRUCTURE AND LOWERING OF THE WATER-TABLE. THE WALLS OR WALL ELEMENTS FOR UNDERGROUND CONSTRUCTION WORK USED TO BE CONSTRUCTED BY PILE DRIVING WHICH IS GENERALLY NO LONGER ALLOWED IN CITIES OWING TO THE NOISE AND VIBRATION. NO-NOISE METHODS HAVE BEEN DEVELOPED, SUCH AS SETTING THE I-BEAMS IN PREVIOUSLY BORED HOLES, BORED PILE RETAINING WALLS, AND BENTONITE REPLACEMENT WALLS. THE DISADVANTAGE OF INTERNAL STRUCTURING HAVE BEEN ELIMINATED WITH THE RECENT ADOPTION OF REVERSE ANCHORS USING GROUTED GROUND ANCHORS. MANY IMPROVEMENTS ARE NEEDED IN THE INVESTIGATION OF THE SOIL AND RESEARCH ON SOIL MECHANICS. IT IS INDICATED THAT THE MOST URGENTLY NEEDED IMPROVEMENTS ARE: (1) BORING METHODS TO OBTAIN CONTINUOUS CORES IN LOOSE ROCK, (2) CORE-BORING METHODS THAT DO NOT REQUIRE THE INJECTION OF WATER TO AVOID DISTURBANCE OF THE INTERMEDIATE CLAYEY LAYERS, (3) IMPROVEMENT IN METHODS TO OBTAIN THE MECHANICAL CHARACTERISTICS OF SOIL BY DETERMINING SHEAR STRENGTH AND THE DEGREE OF SOIL COHESION, (4) METHODS TO DETERMINE THE SUITABILITY OF THE SOIL FOR PILE-DRIVING, (5) IN SITU METHODS OF MEASURING THE PERMEABILITY OF VARIOUS STRATA AT THE CONSTRUCTION SITE, (6) RESEARCH ON

ACTIVE AND PASSIVE EARTH PRESSURE, WALL FRICTION IN RELATION TO WALL DISPLACEMENT AND SIZE DISTRIBUTION OF SOILS, (7) IMPROVED RESEARCH METHODS TO DETERMINE THE PROPORTIONS OF GROUNDWATER AND THE RATE OF GROUNDWATER FLOW IN STRATA OF DIFFERING PERMEABILITIES, (8) IMPROVEMENTS OF METHODS OF DETERMINING THE COMPACTION OR COMPACTNESS OF THE SOILS IN CRAMPED WORKING SPACES, AND (9) DEVELOPMENT OF METHODS OF DETECTING OBSTACLES AND VOIDS. DESIGN AND CONSTRUCTION METHODS USED ARE DISCUSSED.

Schmidbauer,
Oecd, Paris /France/ June 1970

CFSTI PB 193286, HRIS 33 213480, HRIS 33 213479, 1P33213476, HRIS 33 213478, HRIS 33 213477, HRIS 33 213475

2A 215341

INADEQUACIES AND NEEDED IMPROVEMENTS IN THE TECHNOLOGY OF IMMersed TUNNELS

THE TERM "IMMERSED TUNNELS" MEANS TUNNELS COMPOSED OF ELEMENTS CONSTRUCTED IN A DRY-DOCK OR ON A SLIPWAY AND SUBSEQUENTLY TRANSPORTED TO THE CONSTRUCTION SITE, WHERE THEY ARE SUNK, PLACED ON A FOUNDATION AND CONNECTED TOGETHER UNDER WATER. THIS METHOD OF CONSTRUCTION OFFERS ADVANTAGES ONLY IN A RELATIVELY LIMITED FIELD. VIRTUALLY NO COUNTRY HAS BUILT A LARGE NUMBER OF IMMersed TUNNELS. STANDARDIZATION OF CONSTRUCTION METHODS AND DEVELOPMENT OF SPECIAL EQUIPMENT HAS BEEN ALMOST NON-EXISTENT. DURING THE LAST TEN YEARS EXPERIENCE HAS BEEN MAINLY CONCENTRATED IN THE UNITED STATES, BELGIUM, DENMARK AND THE NETHERLANDS. UNITED STATES TECHNOLOGY IS MOSTLY BASED ON CIRCULAR STEEL TUNNEL HULLS CONSTRUCTED ON SLIPWAYS. THE CONCRETE IS PLACED WHILE THE HULLS ARE IN A FLOATING POSITION AND THEY ARE SUBSEQUENTLY LOWERED ONTO AN ACCURATELY-FINISHED FOUNDATION BED. IN THE LOW-LYING COUNTRIES OF EUROPE REINFORCED-CONCRETE TUNNEL ELEMENTS, MOSTLY OF A RECTANGULAR CROSS-SECTION, ARE CONSTRUCTED IN A DRY-DOCK. THEY ARE FOUNDED ON PILES OR PLACED ON TEMPORARY FOUNDATIONS AND SAND-JETTED. IN BOTH THESE PARTS OF THE WORLD, THERE IS RELATIVE SATISFACTION WITH THE PRESENT-DAY STATE OF TECHNOLOGY. THE MOST IMPORTANT NEED FOR IMPROVEMENTS APPEARS TO LIE IN THE FIELD OF BASIC KNOWLEDGE OF GEOLOGY, HYDROLOGY AND SOIL MECHANICS AND DREDGING AND MEASURING TECHNIQUES. IN THE CASE OF BASIC KNOWLEDGE, THE FUNDAMENTAL RESEARCH IN MOST CASES IS BEING DONE BY UNIVERSITIES, WHEREAS RESEARCH INSTITUTES CARRY OUT INVESTIGATIONS FOCUSED ON APPLICATIONS. THERE IS NO CO-ORDINATION OF THESE ACTIVITIES, AND INTERNATIONAL EXCHANGES ARE INSUFFICIENT. THE MOST IMPORTANT NEEDS ARE FOR: (1) A STANDARD CLASSIFICATION OF ROCKS AND SOILS TO ACHIEVE A COMMON UNDERSTANDING OF GEOLOGICAL CONDITIONS, (2) IMPROVED TECHNIQUES FOR DETERMINING BED-LOAD TRANSPORT AND FOR PREDICTING THE RATE AND EXTENT OF SILTING OF TRENCHES, (3) IMPROVED TECHNIQUES FOR DETERMINING THE EFFECT OF WAVES AND CURRENTS, (4) IMPROVED LABORATORY TESTS FOR DETERMINING PERMEABILITY, COMPRESSION AND SWELLING CHARACTERISTICS, EARTH PRESSURE AT REST, AND SOIL BEHAVIOR DURING EARTHQUAKES, (5) IMPROVED METHODS OF CORRELATING LABORATORY AND FIELD TESTS TO PREDICT THE BEHAVIOR OF THE IN-SITU GROUND, AND (6) IMPROVED METHODS OF PREDICTING THE STABILITY OF TRENCH SLOPES. THE DREDGING OF TUNNEL TRENCHES INVOLVED SPECIAL PROBLEMS FOR WHICH THE EQUIPMENT AT PRESENT AVAILABLE IS INADEQUATE AND OFTEN RESULTS IN HIGH COSTS. SUITABLE EQUIPMENT FOR DIGGING TRENCHES AT DEPTH EXCEEDING 40 METERS IS NOT YET AVAILABLE. THE METHODS

COMMONLY USED FOR MEASURING DEPTH RELY ON THE ECHO SOUNDER AND THE MARINER'S SOUNDING LEAD.

Oecd, Paris /France/ June 1970

CFSTI PB 193286, HRIS 33 213477, HRUS 33 213476, 1P33213478, HRIS 33 213479, HRIS 33 213475, HRIS 33 213480

2A 215342

PRESENT-DAY INADEQUACIES AND NEEDED IMPROVEMENTS IN THE TECHNOLOGY OF SOFT GROUND TUNNELLING

THE PRESENT-DAY INADEQUACIES AND IMPROVEMENTS NEEDED IN THE TECHNOLOGY OF SOFT-GROUND TUNNELLING ARE SUMMARIZED FROM THE REPLIES RECEIVED FROM 17 COUNTRIES TO THE OECD QUESTIONNAIRE. THE APPROACH MOST FREQUENTLY ADOPTED WAS TO DEDUCE SITE CONDITIONS FROM GENERAL GEOLOGICAL AND HYDROLOGICAL DATA, AMPLIFIED BY CORE SAMPLING, EXPLORATORY PITS AND TRENCHES, AND GROUND WATER INVESTIGATIONS. LITTLE USE WAS MADE OF GEOPHYSICAL INVESTIGATIONS, PILOT TUNNELS, DATA ACQUISITION BY BOREHOLE INSPECTIONS, ETC. GEOLOGICAL INVESTIGATIONS WERE CONSIDERED TIME-CONSUMING, DIFFICULT AND COSTLY IN RELATION TO THE FRAGMENTARY AND IMPRECISE RESULTS OBTAINED. THE MOST URGENT IMPROVEMENTS RELATE TO: (1) HYDROLOGICAL PROBLEMS, (2) THE DEVELOPMENT OF RAPID AND CONTINUOUS METHODS FOR GEOLOGICAL AND ESPECIALLY GEOPHYSICAL INVESTIGATION, (3) INVESTIGATIONS ON THE TUNNEL FACE WITHOUT HOLDING UP THE WORK, (4) THE ESTABLISHMENT OF A UNIFIED TERMINOLOGY COMMON TO THE VARIOUS SPECIALISTS, (5) THE DEVELOPMENT OF REGIONAL DOCUMENTATION CENTERS. THE SOIL MECHANICS LABORATORY TESTS LISTED IN THE QUESTIONNAIRE WERE USED QUITE FREQUENTLY, AS ARE THE IN-SITU STRENGTH AND PERMEABILITY TESTS. HOWEVER, THE NEED IS RECOGNIZED OF THE ESTABLISHMENT OF A RELIABLE CORRELATION BETWEEN PRELIMINARY TESTS AND SITE DATA WHICH WOULD SEEM TO JUSTIFY EXPERIMENTAL INVESTIGATIONS ON TUNNELS AT DIFFERENT SITES. THE EXCAVATION PROCESS IS A MATTER OF GREAT CONCERN TO THE RESPONDENTS. THE TRADITIONAL METHODS OF HEADING-AND-BENCH EXCAVATION AND EXCAVATION IN FULL-FACE HEADING, WHICH ARE DISCONTINUOUS SYSTEMS, ARE STILL WIDELY USED. HOWEVER, A SYSTEMATIC TREND IS INDICATED TOWARDS CONTINUOUS SYSTEMS OF MECHANICAL EXCAVATION, OFTEN USING SHIELDS. THE INADEQUACIES WHICH WERE STRESSED WITH RESPECT TO SHIELDS AND MECHANICAL DIGGERS RELATE TO COMPLEXITY, EXCESSIVE WEIGHT AND BULK, AND LACK OF FLEXIBILITY OF EQUIPMENT AVAILABLE. NEW PROCESSES SUCH AS HIGH-VELOCITY JET EROSION, EXTRUSION AND ELECTROCHEMICAL CONSOLIDATION ARE CONSIDERED TO BE OF GREAT INTEREST. GREAT INTEREST IS EXPRESSED IN THE DEVELOPMENT OF CONTINUOUS METHODS OF EXCAVATION. RELATIVELY LITTLE INTEREST WAS SHOWN IN MATERIALS HANDLING. GROUND SUPPORT AND TUNNEL LINING METHODS MET WITH A GENERAL FEELING OF DISSATISFACTION. THE USUAL PRACTICE OF TUNNEL LINING IS TO USE CONCRETE POURED IN SITU OR PRECAST REINFORCED CONCRETE SEGMENTS. ATTENTION IS DRAWN TO THE NEED FOR SIMPLE METHODS FOR THE RAPID AND EARLY DETECTION OF VARIOUS HAZARDS AT THE TUNNEL FACE; THE IMPORTANCE OF THE FULLEST POSSIBLE AUTOMATION OF OPERATIONS AT THE FACE; AND THE NEED FOR THOROUGH STUDY AND GOOD ORGANIZATION OF THE SITE FROM THE SAFETY STANDPOINT.

Deschamps, MJ

Oecd, Paris /France/ June 1970

CFSTI PB 193286, HBIS 33 213478, HRIS 33 213477, 1P33213479, HRIS 33 213476, HRIS 33 213475, HRIS 33 213480

2A 215343

RESEARCH AND DEVELOPMENT IN THE FIELD OF TUNNELLING

AN ESTIMATED TOTAL OF \$86 MILLION AND 5,800 MAN-YEARS OF EFFORT WERE DEVOTED BY THE 17 REPORTING OECD COUNTRIES TO RESEARCH AND DEVELOPMENT (R & D) IN THE FIELD OF TUNNELLING DURING THE PERIOD 1960-69. THE LARGEST SHARE OF EFFORT WENT TO RESEARCH ON GROUND SUPPORT, ROCK MECHANICS, ENVIRONMENTAL CONTROL AND SAFETY, AND EXCAVATION, WHILE ONLY AN INSIGNIFICANT AMOUNT OF EFFORT WAS DEVOTED TO MATERIALS HANDLING. A DETAILED BREAKDOWN IS PRESENTED OF R&D EXPENDITURES FURNISHED BY EACH COUNTRY AND ALL THE R&D PROJECT UNDERTAKEN DURING THE LAST DECADE IN THE APPENDICES. THE UNITED STATES LEADS IN THE LEVEL OF EFFORT DEVOTED TO RESEARCH AND DEVELOPMENT IN THE FIELD OF TUNNELLING. THE REPLIES INDICATE THAT DIRECT GOVERNMENT SUPPORT OF RESEARCH IN OECD COUNTRIES VARIES BETWEEN 20 AND 100 PERCENT. THERE APPEARS TO BE NO SERIOUS DUPLICATION IN R&D ACTIVITIES WITHIN OR AMONG NATIONS. SUBJECTS OF SOME OVERLAP WERE IDENTIFIED. THE MOST SERIOUS RESEARCH GAP APPEARS TO BE THE ABSENCE OF ADEQUATE METHODS OF ANALYSIS, PLANNING AND PROGRAMMING OF RESEARCH AND DEVELOPMENT ACTIVITIES. THE MOST RESEARCH AND DEVELOPMENT IS CONDUCTED IN THE FIELDS OF ROCK MECHANICS, SOIL MECHANICS AND GEOLOGY. INDICATED AREAS OF RESEARCH EMPHASIS NEEDED APPEAR TO BE IN EXCAVATION, GROUND SUPPORT AND MATERIALS HANDLING. THE LEVEL OF RESEARCH AND DEVELOPMENT IS SUMMARIZED IN THE 14 OECD COUNTRIES BY PRINCIPLE FIELDS OF RESEARCH.

Oecd, Paris /France/ June 1970

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2A 215344

DETERMINATION OF THE EFFECT OF ENVIRONMENTAL TEMPERATURES ON COMPACTION OF ASPHALTIC PAVEMENTS

A FIELD STUDY WAS CONDUCTED TO LEARN THE EFFECT OF AMBIENT TEMPERATURES AND CONDITIONS ON THE COOLING RATE FOR 0.2 FT. AND 0.4 FT. PLANT-MIX COURSES DURING THE LAYDOWN AND ROLLING PHASES OF ASPHALTIC CONCRETE PAVEMENT CONSTRUCTION. THERMOCOUPLES WERE PLACED IN THE TOP, MIDDLE AND BOTTOM OF THE PAVEMENT COURSE. TEMPERATURES WERE RECORDED AT FREQUENT INTERVALS BEGINNING WITH LAYDOWN AND CONTINUING UNTIL ALL ROLLING WAS COMPLETED. AIR AND BASE TEMPERATURES, CLOUD COVER AND WIND CONDITIONS WERE RECORDED. DENSITIES OF THE FINISHED PAVEMENT AFTER FINAL ROLLING WERE DETERMINED BY BOTH NUCLEAR METHODS AND BY CORES TAKEN AT TWO FOOT INTERVALS ACROSS THE LANE. AIR VOID MEASUREMENTS WERE MADE ON EACH CORE. A CORRELATION BETWEEN THE ROLLER COVERAGES, TEMPERATURES DURING ROLLING AND THE DENSITIES AND AIR VOIDS OBTAINED FROM TESTS ON THE CORES WAS MADE OF THE FINISHED PAVEMENT. RESULTS SHOWED THAT THE TEMPERATURE DROP WITHIN THE MIDDLE OF THE 0.2 FT. COURSE OF PLANT-MIX IS MORE RAPID THAN IN THE 0.4 FT. COURSE AND THE TEMPERATURES AT THE MIDDLE OF THE COURSE WERE CONSISTENTLY 5-15 DEGREES HOTTER THAN AT THE TOP. BREAKDOWN AND INTERMEDIATE ROLLING WAS COMPLETED ABOVE THE SPECIFIED TEMPERATURE OF 140F AND IN SOME INSTANCES MUCH HIGHER. THE 0.4 FT. COURSE PAVEMENT AVERAGED HIGHER DENSITIES AND LOWER AIR VOIDS THAN THE 0.2 FT. COURSE. THE DENSITY OF THE TOP, MIDDLE AND BOTTOM PORTION OF 0.4 FT. COURSE CORES CORRELATES WITH THE TEMPERATURES ACTUALLY MEASURED AT THESE LEVELS. THE RESEARCH CONFIRMS THAT AIR VOIDS, DENSITY AND ASPHALT FILM THICKNESS ARE

IMPORTANT FACTORS IN DETERMINING THE DURABILITY OF ASPHALT PAVEMENT. THE TEMPERATURE OF THE MIXTURE, AIR AND BASE TEMPERATURE, WIND VELOCITY AND SOLAR RADIATION INFLUENCE THE RATE OF COOLING OF A MIXTURE PLACED ON A BASE. REDUCTION OF AIR VOID TO A MINIMUM (3-5%) IS ESSENTIAL TO SATISFACTORY PERFORMANCE.

Wortham, GR Erickson, LF
Idaho Department of Highways July 1970

2A 215357

RAPID TEST METHODS FOR FIELD CONTROL OF HIGHWAY CONSTRUCTION

RESEARCH WAS CONDUCTED TO DETERMINE THE STATE OF THE ART IN THE DEVELOPMENT, NEED, AND USE OF RAPID TEST METHODS. THE FIRST PHASE COMPRISES A LITERATURE SURVEY OF CURRENT PRACTICES IN QUALITY CONTROL AND ACCEPTANCE TESTING, ALONG WITH A STUDY USING STATISTICAL METHODS TO ASSESS THE TIME LIMITS FOR RAPID TESTS. THE SECOND PHASE IS CONCERNED WITH THE DEVELOPMENT AND EVALUATION OF NEW RAPID TEST METHODS OR PRINCIPLES TO SELECT THOSE WORTHY OF FURTHER INVESTIGATION. THIRTY-EIGHT STATE HIGHWAY DEPARTMENTS PARTICIPATED IN THE STUDY, AND INTERVIEWS WERE CONDUCTED WHEN APPROPRIATE. THE SECOND PHASE OF THE STUDY APPLIED TO RAPID TEST METHODS FOR ASPHALT CONTENT DETERMINATION, COMPACTION CONTROL, GRADATION OF SEVERAL TYPES OF AGGREGATE, DENSITY OF BASE COURSE MATERIALS AND SOILS, AND MOISTURE CONTENT. THE RESULTS OF ALL TESTS ARE APPENDED. IN ADDITION TO 226 TEXTUAL REFERENCES, THE REPORT CONTAINS AN ANNOTATED BIBLIOGRAPHY OF 105 REPORTS AND ARTICLES ON RAPID TEST METHODS. /AUTHOR/

Antrim, JD Brown, FB Busching, HW Chisman, JA Moore,
JH Rostron, JP Schwartz, AE *Highway Research Board Nchrp Reports*
1970

2A 215360

CRITERIA FOR USE OF SAND DRAINS IN HIGHWAY CONSTRUCTION

THE USES AND MISUSES OF VERTICAL SAND DRAINS, INSTALLED TO ACCELERATE THE RATE OF SETTLEMENT OF A COHESIVE DEPOSIT SUPPORTING A CONSTRUCTION LOAD AND THE RELATED REDUCTION OF THE INDUCED PORE PRESSURES, HAVE CAUSED MUCH CONTROVERSY OVER THE YEARS. ONE OF THE MOST CRITICAL FACTORS INFLUENCING THE EFFICIENCY OF SAND DRAINS IS THE GEOTECHNICAL PROPERTIES OF THE SOIL DEPOSITS AND THE EMPHASIS IS PUT ON THE IMPORTANCE OF CAREFUL AND APPROPRIATE SITE INVESTIGATION. THE NEED FOR ADEQUATE SAMPLING AND TESTING IS STRESSED IN ORDER THAT IMPORTANT, THOUGH PERHAPS SMALL, GEOLOGICAL FEATURES MAY NOT BE OBSCURED, AND THEREBY A FALSE ASSESSMENT OF THE TRUE DRAINAGE BEHAVIOR, PARTICULARLY LATERAL, BE MADE. A SHORT SUMMARY OF THE MOST SALIENT GEOTECHNICAL FEATURES IS GIVEN. A REVIEW OF PRESENTLY AVAILABLE INSTALLATION TECHNIQUES FOR SAND DRAINS IS MADE TOGETHER WITH AN IDENTIFICATION OF THE UNIT COSTS OF INSTALLATION OF THESE METHODS AND AN ASSESSMENT OF THE ECONOMICS OF THEIR USE RELATIVE TO CONSTRUCTION TIMES, STABILITY AND POST CONSTRUCTION SETTLEMENTS IN HIGHWAYS. /AUTHOR/

Mcgown, A Younger, JS *Roads & Road Construction, London /UK/*
Nov. 1970

2A 215361

ECONOMICS OF THE CONSTRUCTION INDUSTRY

THE CONTRACT CONSTRUCTION INDUSTRY IS DEFINED, AND ITS IMPACT ON THE NATIONAL ECONOMY IS MEASURED. TO ASSESS THE BARRIERS TO ENTRY AND NEW COMPETITION, THE ANALYSIS FOCUSES ON THE STRUCTURE OF THE INDUS-

TRY. AN EXAMINATION OF THE FACTORS INFLUENCING THE RISE OF CONSTRUCTION COSTS DISCLOSES THAT GAINS IN LABOR PRODUCTIVITY WERE MORE THAN OFFSET BY RISING WAGE RATES. THE ANALYSIS OF THE PERFORMANCE OF THE CONSTRUCTION INDUSTRY CONCENTRATED ON THE ASSESSMENT OF ECONOMIC EFFICIENCY AND THE ECONOMIC FORCES RESPONSIBLE FOR THE OBSERVED BEHAVIOR. THE IMPENDING VAST OUTLAYS IN TRANSPORTATION FACILITIES AND URBAN RENEWAL OFFER AN UNUSUAL OPPORTUNITY FOR LARGE-SCALE CONSTRUCTION. THE SUGGESTION IS OFFERED THAT THE GOVERNMENT, ON AN EXPERIMENTAL BASIS AT LEAST, INCORPORATE IN THE DESIGN OF THESE PROJECTS INNOVATING FEATURES THAT MIGHT LEAD TO THE ADOPTION OF NEW CONSTRUCTION MATERIALS AND TECHNIQUES BY THE CONSTRUCTION INDUSTRY. /AUTHOR/

Cassimatis, PJ
National Industrial Conference Board

2A 215362

CONTROL AND PERFORMANCE DURING CONSTRUCTION OF A HIGHWAY EMBANKMENT ON WEAK SOILS

METHODS OF CONTROLLING EMBANKMENT CONSTRUCTION OVER COMPRESSIBLE AND WEAK FOUNDATIONS TO ENSURE SAFETY AGAINST SHEAR FAILURE ALONG A CIRCULAR ARC ARE DESCRIBED IN THIS PAPER. THE DESIGN AND CONSTRUCTION PERFORMANCE OF A HIGHWAY EMBANKMENT CONSTRUCTED IN REVERE, MASSACHUSETTS, ON INTERSTATE 95 BY THE MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS OVER DEEP COMPRESSIBLE DEPOSITS OF BOSTON CLAY ARE DESCRIBED, WITH EMPHASIS ON THE METHODS OF CONSTRUCTION CONTROL USED TO ENSURE STABILITY AGAINST CIRCULAR SHEAR-TYPE FAILURES DURING CONSTRUCTION. THE USE OF A RECENTLY DEVELOPED ICES COMPUTER PROGRAM TO COMPILE CONSTRUCTION CONTROL CHARTS BASED ON EFFECTIVE STRESS STABILITY ANALYSES, WHICH RELATE THE FACTOR OF SAFETY TO THE MEASURED PORE PRESSURES, IS PRESENTED, AND ASSESSMENT IS MADE OF ITS VALUE. DETAILED RESULTS OF SITE MEASUREMENTS OF EXCESS PORE PRESSURE, SETTLEMENT, AND HORIZONTAL DEFORMATIONS ARE PRESENTED TO INDICATE THE MAGNITUDE AND VALUE OF THESE MEASUREMENTS IN CONTROLLING THE RATE OF CONSTRUCTION AND IN DELINEATING AREAS IN WHICH REMEDIAL MEASURES ARE WARRANTED. A COMPARISON BETWEEN PREDICTED AND MEASURED EXCESS PORE PRESSURES IS MADE TO ASSESS THE APPLICABILITY OF SOME CURRENT THEORETICAL METHODS OF ANALYSIS IN PREDICTING STABILITY OF EMBANKMENTS BY THE EFFECTIVE STRESS METHOD. CONCLUSIONS ARE DRAWN ON THE APPLICABILITY OF THE EFFECTIVE STRESS METHOD OF STABILITY ANALYSIS USED IN CONJUNCTION WITH ON-SITE PORE PRESSURE MEASUREMENTS TO COMPILE FIELD CONTROL CHARTS FOR USE IN CONTROLLING THE RATE OF EMBANKMENT CONSTRUCTION. /AUTHOR/

Elias, V Storch, H *Highway Research Record, Hwy Res Board* 1970

2A 215371

STATISTICAL QUALITY CONTROL OF HIGHWAY CONSTRUCTION AND MATERIALS

EXISTING LOCAL PRACTICES USED IN ESTABLISHING AND ENFORCING HIGHWAY SPECIFICATIONS AND CONSTRUCTION PROCESSES ARE REVIEWED AND COMPARED WITH PROCEDURES BASED ON STATISTICAL QUALITY CONTROL CONCEPTS. IN ORDER THAT STATISTICAL QUALITY CONTROL CONCEPTS MAY BE PROPERLY USED WHERE APPLICABLE, THE FIRST PART OF THIS REPORT CONSIDERS THE GENERAL THEORY UNDERLYING THE USE OF STATISTICAL CONTROL METHODS AND THE DEVELOPMENT OF DIFFERENT TYPES OF ACCEPTANCE PLANS WHICH MAY BE USED IN THE HIGHWAY CONSTRUCTION INDUSTRY. THE SECOND PORTION OF THE REPORT IS CONCERNED WITH ANALYZING AND COMPARING KENTUCKY'S CURRENT SPECIFICATION REQUIREMENTS

WITH TYPICAL QUALITY CONTROL REQUIREMENTS ESTABLISHED USING BASIC STATISTICAL THEORY. SPECIFICATIONS USED BY SOME OTHER AGENCIES WHICH ARE BASED ON STATISTICAL PRINCIPLES ARE PRESENTED TO ILLUSTRATE THE USE BEING MADE OF THIS TYPE OF ACCEPTANCE PLAN. /AUTHOR/

Venable, JB
Kentucky Department Highways Dec. 1970

2A 215409
STRUCTURAL TIMBER FOR BRIDGE CONSTRUCTION IN CENTRAL AMERICA

THE LATIN AMERICAN RESOURCES PROJECT WAS FORMED TO DETERMINE THE SUITABILITY OF THE TREES IN LOCAL FORESTS FOR SPECIFIC WAR USES. TIMBERS USED IN BRIDGE CONSTRUCTION MUST MEET STRENGTH AND DECAY-RESISTANCE STANDARDS. PRESERVATIVE TREATMENT CAN BE APPLIED TO NONDURABLE WOODS AND DESIGN CAN PROVIDE INCREASED SIZE TO COMPENSATE FOR LOW STRENGTH. MORE INFORMATION MUST BE OBTAINED ABOUT THE PROPERTIES AND CHARACTERISTICS OF CENTRAL AMERICAN WOODS BEFORE THEY CAN BE WIDELY USED.

Scholten, JA *Highway Research Board Proceedings* 1944

2A 215410
AN EXAMPLE OF GRAVEL BASE CONSTRUCTION IN MARYLAND UNDER HEAVY TRAFFIC CONDITIONS
LOCAL BANK RUN GRAVEL IS UDED WITH CALCIUM CHLORIDE TO PROVIDE A SURFACE FOR UNUSALLY HEAVY WARTIME TRAFFIC. /AUTHOR/

Wood, JE *Highway Research Board Proceedings* 1944

2A 215457
DEVELOPMENT AND TRIAL USE OF ACCEPTANCE SAMPLING PLANS FOR ASPHALT CONSTRUCTION
THE RESEARCH ON VARIABILITY IN ASPHALT CONSTRUCTION IN NORTH DAKOTA BROUGHT TO LIGHT MANY CHARACTERISTICS OF CURRENT ACCEPTABLE ASPHALT CONSTRUCTION. THEY ARE (1) SINGLE TEST RESULTS EXHIBITED A LARGE VARIABILITY CAUSING MANY OF THE MEASUREMENTS TO BE OUTSIDE THE SPECIFICATIONS; (AVERAGE TEST RESULTS ARE RECOMMENDED); (2) THE CURRENT GRADATION BAND WAS ONLY PARTIALLY EFFECTIVE IN CONTROLLING AGGREGATE GRADATION; (TARGET VALUES SHOULD BE CHOSEN EITHER AT THE CENTER OF THE BAND OR IN 2 OR 3 STANDARD DEVIATIONS FROM THE CURRENT SEPECIFICATION LIMITS; AND (3) PAYMENTS TO THE CONTRACTOR WERE INDEPENDENT OF THE QUALITY OF HIS WORK; (SPECIFICATIONS SHOULD REQUIRE THE CONTRACTOR TO BEAR A GREATER RESPONSIBILITY FOR THE QUALITY OF HIS WORK, SUBSTANDARD WORK WOULD NOT BE PERMITTED OR THE PRICE COULD BE ADJUSTED).

Jorgenson, JL *Highway Research Record, Hwy Res Board* 1971

2A 215466
EVALUATION OF BITUMINOUS COMPACTION PROCEDURES USING NUCLEAR GAGES
THE COMPACTION PROCEDURES USED IN BITUMINOUS CONSTRUCTION ARE EVALUATED USING NUCLEAR GAGES. NUCLEAR DENSITY TESTS WERE TAKEN BOTH DURING ROLLER OPERATIONS AND AFTER COMPACTION HAD BEEN COMPLETED. THE DENSITY DATA WERE ANALYZED TO STUDY THE FEASIBILITY OF USING NUCLEAR GAGES TO ESTABLISH OPTIMUM ROLLING PATTERNS FOR SEVERAL DIFFERENT TYPES OF BITUMINOUS PAVEMENT MATERIALS FOR THE ROLLERS ENCOUNTERED. AFTER FINAL COMPACTION, CONTINUED NUCLEAR TESTS WERE TAKEN IN A STUDY OF ANY DENSITY VARIATIONS IN THE COMPACTED PAVEMENT. DENSITY TESTS WERE TAKEN TRANSVERSELY, ON JOINTS, ALONG THE PAVEMENT EDGES, ALONG THE LONGITUDINAL WHEEL-PATH AREAS, AND IN RANDOM LOCATIONS ALONG THE

PAVEMENT. THE PREVIOUS VIEW, THAT AREAS OF LOW DENSITY ARE PREDOMINANTLY THE JOINTS AND PAVEMENT EDGES, WAS CONFIRMED. A SEPARATE STUDY WAS CONDUCTED WITH TWO COMMERCIALY AVAILABLE NUCLEAR DENSITY GAGES TO EVALUATE THE EFFECTIVE DEPTH OF MEASUREMENT. BOTH BACKSCATTER AND AIR-GAP TECHNIQUES WERE ANALYZED. THE AIR-GAP DENSITY TEST WAS SHOWN TO BE DEPENDENT ON ONLY THE TOP 1 3/4 IN. OF MATERIAL TESTED USING THE TEST METHOD DESCRIBED. /AUTHOR/

Grey, RL *Highway Research Record, Hwy Res Board* 1971

2A 215472
CONTROL OF SEDIMENTS RESULTING FROM HIGHWAY CONSTRUCTION AND LAND DEVELOPMENT
THE TECHNICAL CAPABILITY OF CONTROLLING EROSION AND SEDIMENT DEPOSITION IS AVAILABLE. IT INVOLVES PROTECTION OF DISTURBED SOIL FROM THE ENERGY OF FALLING RAIN AND FLOWING RUNOFF WATER BY INSTALLING PROTECTIVE COVERS, CONTROLLING RUNOFF, AND TRAPPING SEDIMENTS IN TRANSPORT. THE COST OF EFFECTIVE EROSION AND SEDIMENT CONTROL PROBABLY IS MINIMAL. THE PRINCIPAL PROBLEM LIES IN ACHIEVING EFFECTIVE ADMINISTRATIVE CONTROL AND ENFORCEMENT BY CONCERNED AGENCIES OF EROSION AND SEDIMENT CONTROL PROGRAMS. /AUTHOR/

Thronson, RE
Environmental Protection Agency 50 pp, Sept. 1971

AVAILABLE: U.S. GOVT, . PRINTING OFFICE \$, .60, 1P33221303

2A 215473
ROCKFILL
THIS PAPER REVIEWS THE DEVELOPMENT OF COMPACTED ROCKFILL AS A CONSTRUCTION MATERIAL FOR EMBANKMENTS, ILLUSTRATES POST-CONSTRUCTION SETTLEMENTS OF ROCKFILL EMBANKMENTS, AND DISCUSSES THE VALUE OF ROCKFILL AS A CONSTRUCTION MATERIAL FOR ROAD EMBANKMENTS. THE ERA OF FREEWAY CONSTRUCTION HAS BROUGHT A REQUIREMENT FOR EMBANKMENT HEIGHTS NOT PREVIOUSLY USED FOR ROAD CONSTRUCTION. ROCK-FILL HAS MARKED ADVANTAGES OVER EARTHFILL FOR HIGH EMBANKMENTS BECAUSE, BEING SUBSTANTIALLY WITHOUT CONSTRUCTIONAL PORE PRESURES, IT CAN SAFELY BE RAISED AT A FAST RATE AND BECAUSE STEEPER SIDE SLOPES CAN BE USED AS COMPARED WITH EARTHFILL, SO THAT THE EMBANKMENT REQUIRES A SMALLER VOLUME OF FILL. /AUTHOR/

Penman, AD
Building Research Station /UK/ Apr. 1971

2A 215477
PRECAST CONCRETE TUNNEL LININGS FOR TORONTO SUBWAY
PRECAST CONCRETE TUNNEL LININGS HAVE BEEN USED IN THE TORONTO SUBWAY SYSTEM IN A WIDE RANGE OF SOIL CONDITIONS. THE LININGS ARE 16-FT. ID AND ARE USED WITHOUT SECONDARY LINING. THEY ARE INTERCHANGEABLE WITH CAST IRON LININGS WHICH ARE ALSO USED ON THE PROJECT. EIGHT SEGMENTS PLUS A KEY ARE BOLTED WITH 3/4-IN. BOLTS TO MAKE A COMPLETE RING. SEGMENTS WERE PRODUCED AT THE RATE OF 300 PER DAY IN A PRECAST CONCRETE PLANT USING STEEL FORMS. SPECIFIED CONCRETE STRENGTH WAS 6,500 PSI AND OVER 7,000 PSI WAS ACHIEVED. ERECTION WAS ACHIEVED WITH THE AID OF SHIELDS OF TYPICAL DESIGN. SOME SPALLING AND CRACKING OCCURRED DURING SHIELD SHOVING, BUT THIS TYPE OF DAMAGE WAS MOSTLY SUPERFICIAL; REPLACEMENT OF DAMAGED SEGMENTS WAS RARE. GROUTING OUTSIDE THE LINING WAS CARRIED OUT IMMEDIATELY AFTER SHIELD SHOVING USING NEAT CEMENT GROUT. THE COST SAVING COMPARED WITH CAST IRON LINING IS OVER \$300 PER RING. /ASCE/

Bartlett, JV Noskiewicz, TM Ramsay, JA *Am Soc Civil Engr J Construction Div* Nov. 1971

2A 215478

CHANGED SOIL AND ROCK CONDITIONS IN CONSTRUCTION
THE OBJECT OF THE CHANGED CONDITIONS CLAUSE IN CONSTRUCTION CONTRACTS IS TO MINIMIZE THE GAMBLE IN BIDDING ON SOIL AND ROCK WORK BY PAYING THE CONTRACTOR FOR UNEXPECTED SOIL AND ROCK CONDITIONS. FOUR CATEGORIES OF CLAIMS APPEAR: (1) REAL DIFFERENCES, WHICH COULD NOT HAVE BEEN ANTICIPATED; (2) FORESEEABLE CHANGES CAUSED BY THE SPECIFIED CONSTRUCTION; (3) PSEUDO OR PREVENTABLE CHANGES CAUSED BY FAULTY CONSTRUCTION METHODS AND; (4) MISTAKEN CHANGES, WHICH ARE COSTS BLAMED ON THE SOIL BUT WHICH ARE THE RESULT OF OTHER JOB CONDITIONS. ONLY THE FIRST CATEGORY DESERVES COMPENSATION. THE DIAGNOSIS OF CHANGED CONDITIONS REQUIRE IMMEDIATE EXPERT EVALUATION TO DETERMINE THE TRUE CONDITIONS AS WELL AS TO PREVENT THE CHANGE FROM GENERATING A CATASTROPHE. QUICK ACTION NOT ONLY PROVIDES THE BASIS FOR A VALID CLAIM BUT ALSO MINIMIZES THE ULTIMATE COST TO BOTH THE CONTRACTOR AND THE OWNER. /ASCE/

Sowers, GF *Am Soc Civil Engr J Construction Div* Nov. 1971

2A 215480

MORAINIC SOIL DEPOSITS AND THEIR USE IN LOWER COST ROADS

THE TYPE OF CONSTRUCTION NORMALLY ADOPTED IN FOREST ROADS CONSISTS OF A MECHANICALLY STABLE BASE, AS THE RUNNING SURFACE, OVER THE SUBGRADE MATERIALS. WHEN SOILS FROM MORAINIC MOUNDS ARE TO BE USED, THEIR GEOLOGICAL NATURE SHOULD BE DETERMINED, AND THEIR ENGINEERING BEHAVIOR CHARACTERIZED. THEY APPEAR TO FALL SHORT OF THE IDEAL ROAD CONSTRUCTION MATERIAL ON THREE MAIN POINTS: LACK OF BINDER, THE NEED OF HIGH COMPACTIVE EFFORT TO OBTAIN ACCEPTABLE C. B. R. VALUES, AND THEIR SUSCEPTIBILITY TO FROST HEAVE. THESE MAY BE CORRECTED BY THE ADDITION OF CEMENT OR BITUMINOUS EMULSION BUT THE COST OF SUCH MEASURES IS PERHAPS BEYOND WHAT IS ECONOMICALLY VIABLE FOR THE CONSTRUCTION OF THE ROAD. MECHANICAL STABILIZATION BY CRUDELY MIXING IN COARSE AGGREGATE MAY, HOWEVER, BE FEASIBLE ALTHOUGH LESS EFFECTIVE. LABORATORY INVESTIGATIONS HAVE INDICATED THAT THE OPTIMUM COMBINATION OF THE COARSE AND FINE FRACTIONS OF THESE SOILS LIES BETWEEN 45 TO 25 PER CENT FINES FOR THE MATERIAL LESS THAN 3/4 IN. SIEVE SIZE. /AUTHOR/

McGown, A Mearthur, AA *Roads & Road Construction, London /UK/* Nov. 1971

2A 215483

INDUSTRIALIZED BUILDERS HANDBOOK

SUBTITLED "TECHNIQUES OF COMPONENT AND MODULAR FABRICATION", THIS HANDBOOK IS DIRECTED TO THOSE INVOLVED IN DESIGN, MANUFACTURE, CONSTRUCTION, AND FINANCING OF INDUSTRIALIZED BUILDINGS. THE APPENDIX INCLUDES TABLES AND DISCUSSION OF TOOLS AND EQUIPMENT. A SPECIFIC SEGMENT OF THE MANUFACTURING PROCESS IS COVERED IN DETAIL. /CA/

Lytle, RJ
Structures Pub Co

ACKNOWLEDGMENT: Concrete Abstracts

2A 215510

DEEP LIFT ASPHALTIC CONCRETE, WITH DISCUSSIONS AND CLOSURE
DEEP LIFT ASPHALTIC PAVEMENTS, BY ELIMINATING THE NEED FOR BASES OF CRUSHED ROCK OR UNTREATED

GRAVEL, ALLOW TRENCHING FOR UTILITIES AND SUBSEQUENT REINSTATEMENT TO BE UNDERTAKEN WITH LESS TRAFFIC DISRUPTION AND LESS DISTURBANCE TO THE ROAD ITSELF. RECOMMENDATIONS ON MIX CHARACTERISTICS AND DESIGN, PAVEMENT LAYING AND COMPACTION METHODS ARE MADE, BASED ON EXPERIENCE GAINED WITH DEEP LIFT ASPHALT PAVEMENTS IN NEW SOUTH WALES. THE METHOD WAS FOUND TO GIVE STRONG PAVEMENTS POSSESSING GOOD RIDING QUALITIES, WITHOUT THE PROBLEM OF REFLECTIVE CRACKING ASSOCIATED WITH CONCRETE PAVEMENTS.

Giffen, JC Divnich, G Bone, EJ DISCUSSER Bila, JA DISCUSSER Lacombe, LA DISCUSSER *Australian Road Research Board Proc* Vol. 5 1970, pp 231-47, 5 Fig, 5 Tab, 7 Ref

2A 215512

THE COMPACTION CHARACTERISTICS OF BITUMINOUS CONCRETE WITH PARTICULAR REFERENCE TO DESIGN METHODS, WITH DISCUSSION AND CLOSURE

RESEARCH WAS UNDERTAKEN TO DETERMINE WHETHER A FUNCTIONAL RELATIONSHIP EXISTS BETWEEN COMPACTIVE EFFORT AND DEGREE OF COMPACTION. THE PARAMETER OBTAINED FROM SUCH A RELATIONSHIP WOULD BE USEFUL IN CORRELATING THE DEGREE OF COMPACTION GIVEN BY THE VARIOUS COMPACTION METHODS THAT HAVE BEEN DEvised. THE THREE METHODS WERE: STATIC COMPRESSION (HUBBARD-FIELD METHOD), MECHANIZED IMPACT COMPACTION (MARSHALL HAMMER METHOD), MECHANICAL KNEADING (HVEEM METHOD). IT WAS FOUND THAT THE DEGREE OF COMPACTION WAS LINEARLY RELATED TO THE LOGARITHM OF COMPACTIVE EFFORT. A PARAMETER DERIVED FROM THIS FUNCTION, THE 'COMPACTIVE EFFICIENCY', IS SUGGESTED AS A BASIS FOR A RATIONAL DESIGN PROCEDURE FOR BITUMINOUS CONCRETE MIXTURES. TO DO THIS, A CURVE RELATING COMPACTIVE EFFORT TO STRAIN IS ESTABLISHED.

Fung, KY Dickinson, EJ DISCUSSER *Australian Road Research Board Proc* Vol. 5 1970, pp 268-88, 21 Fig, 8 Tab, 3 Phot, 2 Ref

2A 215514

POLLUTION CONTROL-ANTI-POLLUTION CONSTRUCTION

PROGRESS IS BEING MADE IN DEVELOPING NEW PROGRAMS AND METHODS TO KEEP AIR AND WATER POLLUTION TO A MINIMUM DURING HIGHWAY CONSTRUCTION. PREVENTIVE MEASURES THAT SHOULD BE ADHERED TO RELATE TO (1) CONTROLLING DUST, (2) LIMITING BURNING, (3) CONTROLLING WATER POLLUTION AND, (4) MINIMIZING SOIL EROSION.

Sigler, CW *Kentucky Highway Conference Proceedings* July 1971, p 74

2A 215528

EVALUATION OF CONCRETE CURBING

OWING TO THE CLOSING OF MOST OF MAINE'S GRANITE QUARRIES, WHICH HAD BEEN THE PRINCIPAL SOURCE OF CURBING, RESEARCH WAS UNDERTAKEN INTO THE USE OF TWO TYPES OF PCC--CAST-IN-PLACE AND PRECAST--WITH AND WITHOUT COATINGS (PG-1024 AND THIOPOXY 61) AS A SUBSTITUTE. THE THREE MAJOR CRITERIA FOR EVALUATION WERE APPEARANCE, DAMAGE, AND SAFETY. QUARTERLY RATINGS WERE MADE FROM SUMMER 1966 THROUGH LATE SPRING 1971. THE TWO CONCRETES EXHIBITED NO SIGNIFICANT DIFFERENCES IN DURABILITY, NOR DID COATINGS HAVE AN EFFECT; HOWEVER, AFTER BEING DAMAGED THE COATINGS LENT A MUCH WORSE APPEARANCE TO THE CURBINGS. IN ALL RESPECTS CONCRETE WAS FOUND INFERIOR TO GRANITE, AND IT IS RECOMMENDED THAT PCC NOT BE USED IN SUBSTITUTION OF GRANITE IN MAINE.

Merrow, FC
Maine Dept of Transportation Oct. 1971, 30 pp, 2 Fig, 2 Tab, 25 Phot

2A 215558

KEEP ROAD BUILDING QUALITY UP TO SPECIFICATIONS
STATISTICAL QUALITY CONTROL SUPPOSES THE AVAILABILITY OF PRIOR ESTIMATES OF THE VARIABILITY LIKELY TO OCCUR IN THE MOST IMPORTANT PROPERTIES---GRADING, BINDER CONTENT, STABILITY, FLOW, VOID CONTENT, THICKNESS, DENSITY, CEMENT CONTENT, PLASTICITY INDEX, AND CBR--- OF THE MATERIALS USED. TENTATIVE ESTIMATES ARE MADE OF THE COEFFICIENTS OF VARIATION IN THESE PROPERTIES. THE ESTIMATES ARE BASED ON ANALYSIS OF DATA FROM COMPLETED ROAD AND AIRFIELD PROJECTS IN SOUTH AFRICA AND ELSEWHERE.

Kuhn, SH Slavik, MM
Nat Inst Road Research /S Africa/ 6 pp, 3 Fig, 4 Tab, 18 Ref

2A 215564

RECOMMENDED PRACTICE FOR HOT WEATHER CONCRETING

SUCH ENVIRONMENTAL FACTORS AS HIGH TEMPERATURE, LOW HUMIDITY, AND WIND CAN HAVE UNDESIRABLE EFFECTS ON CONCRETE PROPERTIES AND CONSTRUCTION OPERATIONS. POSSIBLE UNDESIRABLE EFFECTS ARE LISTED, AND RECOMMENDATIONS FOR MINIMIZING THEM ARE SUGGESTED. AMONG THESE RECOMMENDATIONS ARE SUCH MEASURES AS PRECOOLING INGREDIENTS, LIMITATION OF CONCRETE TEMPERATURE AS PLACED, LENGTH OF HAUL, FACILITIES FOR HANDLING CONCRETE AT THE SITE, AND SPECIAL PLACING AND CURING TECHNIQUES. /AUTHOR/

Am Concrete Inst Journal & Proceedings Vol. 69 No. 5, May 1972, p 261

2A 215566

RESPONSIBILITY FOR INSPECTION-SYMPIOSIUM WITH FIVE PAPERS

WHERE THE ACTUAL RESPONSIBILITY FOR INSPECTION OF CONCRETE CONSTRUCTION LIES IS A HIGHLY CONTROVERSIAL SUBJECT AND ONE THAT HAS BEEN A TOPIC OF INTENSE DISAGREEMENT BETWEEN VARIOUS COMMITTEES OF THE AMERICAN CONCRETE INSTITUTE. FIVE BRIEF PAPERS GIVEN AT THE 1971 ACI CONVENTION DISCUSS THE QUESTION FROM THE POINT OF VIEW OF THE OWNER OF MAJOR PROJECTS, THE DESIGN ENGINEER, THE CONTRACTOR, AND THE INDEPENDENT TESTING AGENCY.

O'brien, D Weinberg, BE Samanie, DP Fling, RS Lombard, MA Artuso, JF *Am Concrete Inst Journal & Proceedings* Vol. 69 No. 6, June 1972, pp 320-33

2A 215590

CONSTRUCTION ECONOMY THROUGH SYSTEMS BUILDING
ALTHOUGH THE SYSTEMS BUILDING CONCEPT IS 20 YEARS OLD, AND ALTHOUGH SYSTEMS COMPONENTS ARE BEING UTILIZED IN ACTUAL CONSTRUCTION, CURRENT APPLICATIONS OF THE CONCEPT BEAR ABOUT THE SAME RELATION TO OUR UNDERSTANDING OF IT AS DOES COL. LINDBERGH'S AIRPLANE TO SUPERSONIC JETS. THE PRESENT AND ANTICIPATED ECONOMIC CLIMATE DICTATES OPTIMIZATION IN THE ECONOMY OF CONSTRUCTION, BUT ENGINEERS ARE OFTEN REQUIRED TO INNOVATE BY USING TRADITIONAL TOOLS UNDER TIGHT DEADLINES. WHAT IS NEEDED ARE PROGRAMS THAT PERMIT ADVANCED ENGINEERING STUDIES AT THE VERY PRELIMINARY CONCEPTION OF A PROJECT IDEA TO ENSURE THAT DURING THE FINAL DESIGN PHASE ALL POSSIBLE COST-SAVING INNOVATIONS CAN BE INCLUDED. PRINCIPLES OF INNOVATION IN PROCEDURE, DESIGN, AND CONSTRUCTION ARE LISTED. OF THESE, THE MOST IMPORTANT ARE SIMPLICITY AND MODULARITY. THE FIGURES, KEYED TO TEXTUAL DESCRIPTIONS, PRESENT EXAMPLES OF INNOVATION IN A PROGRESSION FROM ELEMENTARY COMPONENTS TO VERY LARGE, COMPLEX STRUCTURES. FOUR OF THE FIGURES ARE DEVOTED TO THE GEOMETRIC DESIGN, SUPPORT, AND INSTALLATION OF A 25-FOOT-LONG BRIDGE MADE OF PAPER.

Zetlin, L *Highway Research Board Special Reports* No. 132, 1972, pp 22-30, 28 Fig

2A 215591

CURRENT PRACTICES IN STEEL CONSTRUCTION

SYSTEMS CONCEPTS HAVE BEEN APPLIED TO STEELS CHIEFLY IN TWO AREAS: MODULAR COMPONENTS FOR SUBASSEMBLIES, AND TECHNIQUES TO REDUCE ON-SITE TIME. HOWEVER, THE SUBASSEMBLIES THEMSELVES ARE NEITHER STANDARDIZED NOR STOCK BECAUSE THE LIKELIHOOD OF USING A PARTICULAR PREFABRICATED ELEMENT IN TWO DIFFERENT JOBS IS TOO REMOTE TO JUSTIFY STOCKING. TO THIS IS ADDED THE COST OF HAVING PIECES IN INVENTORY. AS TO CONSTRUCTION, ONE OF THE MAIN DETERRENTS TO SYSTEMIZATION IS THE SOVEREIGNTY EXERCISED BY INDIVIDUAL OWNERS AND DESIGNERS, EVEN IN SUCH AREAS AS SPECIFICATIONS AND INSPECTION.

Elsasser, HB *Highway Research Board Special Reports* No. 132, 1972, pp 31-3

2A 215603

UNDERWATER TRANSPORTING OF CONCRETE WITH THE HYDRO-VALVE

A NEW METHOD DEVELOPED IN THE NETHERLANDS FOR PLACING CONCRETE UNDER WATER IS DESCRIBED. THE DEVICE ALLOWS PLACING CONCRETE OF HIGHER QUALITY THAN PREVIOUSLY POSSIBLE AND PROVIDES A MEANS OF PLACING REINFORCED CONCRETE UNDERWATER.

Schoewert, LC Hillen, HF *Am Concrete Inst Journal & Proceedings* Vol. 69 No. 9, Sept. 1972, pp 584-8, 5 Fig, 1 Tab

2A 215604

RECOMMENDED PRACTICE FOR CONSOLIDATION OF CONCRETE

CONSOLIDATION IS THE PROCESS OF REMOVING ENTRAPPED AIR FROM FRESH CONCRETE IN THE FORM. SEVERAL METHODS AND TECHNIQUES ARE AVAILABLE-THE CHOICE DEPENDING MAINLY ON THE WORKABILITY OF THE MIX, PLACING CONDITIONS, AND DEGREE OF DEAERATION DESIRED. SOME FORM OF VIBRATION IS USUALLY EMPLOYED. THIS RECOMMENDED PRACTICE INCLUDES UP-TO-DATE INFORMATION ON THE MECHANISM OF CONSOLIDATION, AND GIVES RECOMMENDATIONS ON EQUIPMENT CHARACTERISTICS AND PROCEDURES FOR VARIOUS CLASSES OF CONSTRUCTION.

Am Concrete Inst Journal & Proceedings Vol. 69 No. 10, Oct. 1972, pp 613

2A 215605

TERMINAL ROAD BRIDGES FOR SAN FRANCISCO INTERNATIONAL AIRPORT

THE PLANNING, DESIGN, AND CONSTRUCTION OF TWO PARALLEL ELEVATED ROAD BRIDGES FOR THE SAN FRANCISCO INTERNATIONAL AIRPORT EXPANSION IS DESCRIBED. IT UTILIZES PRECAST, PRESTRESSED INVERTED DOUBLE-T PANELS, CANTILEVERING 22 FT EACH SIDE FROM A CENTRAL SPINAL BEAM WHICH CONTAINS POST-TENSIONED CABLE TO TIE TOGETHER THE PRECAST SEGMENTS. LIMITATIONS IMPOSED BY TRAFFIC AND UNDERGROUND UTILITIES TOGETHER WITH HIGH STANDARDS FOR AESTHETIC AND SEISMIC REQUIREMENTS DICTATED THE PLANNING AND DESIGN OF THE SUPERSTRUCTURE AND THE PIER. OPTIMUM USE OF BOTH PRETENSIONING AND POST-TENSIONING, COMBINATION OF PRECASTING AND CAST-IN-PLACE CONCRETE, TOGETHER WITH INTENSIVE COOPERATION BETWEEN ENGINEERS AND ARCHITECTS HAVE MADE THIS UNIQUE DESIGN A SUCCESS.

Yang, YC *Am Concrete Inst Journal & Proceedings* Vol. 69 No. 10, Oct. 1972, pp 614-8, 7 Fig

2A 215621**SAFE SHORE LOADS FOR NEW LUMBER SIZES**

DESIGN TABLES SHOW CARRYING CAPACITY OF SINGLE POST WOOD SHORES, BASED ON NEW STANDARD LUMBER SIZES AND WORKING STRESSES RECOMMENDED BY THE NATIONAL FOREST PRODUCTS ASSOCIATION. A CHECK OF COMPRESSION PERPENDICULAR TO THE GRAIN OF SUPPORTED WOOD MEMBERS IS RECOMMENDED, AND BRACING REQUIREMENTS ARE NOTED. /AUTHOR/

Hurd, MK *Am Concrete Inst Journal & Proceedings* Vol. 70 No. 5, May 1973, pp 362-7, 8 Tab, 5 Ref

2A 215622**CONSTRUCTION OF FULL-DEPTH ASPHALTIC CONCRETE PAVEMENTS**

CONSIDERABLE ATTENTION HAS BEEN DEVOTED TO THE DESIGN AND USE OF FULL-DEPTH ASPHALTIC CONCRETE PAVEMENTS. AN EXPERIMENTAL FULL-DEPTH PAVEMENT WAS CONSTRUCTED ON THE CANNONSBURG-ASHLAND ROAD (US 60), AND THE MECHANICAL RESPONSE OF EACH ASPHALTIC CONCRET LAYER TO STATIC AND DYNAMIC LOADING HAS BEEN TESTED DURING CONSTRUCTION. THIS REPORT IS A DOCUMENTATION OF SECTION DESIGNS AND CONSTRUCTION PROCEDURES AND SUMMARILY PRESENTS CONSTRUCTION TEST RESULTS TO BE USED IN FUTURE ANALYSES. /AUTHOR/

Ross, JD Southgate, HF
Kentucky Department Highways Res Rept No. 340, Sept. 1972, 62 pp, 51 Fig, Tabs

2A 215625**TWO-LAYER PLASTIC LINER SYSTEM WILL KEEP AUSTRIAN ALPINE TUNNEL DRY**

TWIN LAYERS OF POLYVINYL CHLORIDE (PVC) OUTSIDE THE CONCRETE LINING WILL KEEP DRY 2 PARALLEL BORES ALONG A NEW SECTION OF EXPRESSWAY SOUTH OF SALZBURG. THE TWO-LANE VEHICULAR TUNNELS THROUGH SOUND LIMESTONE FORMATIONS, ARE CONNECTED BY A POST-TENSIONED CONCRETE BOX GIRDER BRIDGE SPANNING THE SALZACH VALLEY. AFTER BORES ARE MUCKED OUT, ROCK ANCHORS ARE PLACED TO HOLD A WIRE MESH MAT AGAINST THE ROCK FACING BEFORE SPRAYING A CONCRETE LAYER WHICH SMOOTHS THE TUNNEL WALLS. A 0.047-IN.-THICK PVC LAYER WILL BE STRETCHED ACROSS THE TUNNEL WALLS AND SECURED TO THE ROCK BY PNEUMATICALLY DRIVEN BOLTS THAT FASTEN PLASTIC COVERED STEEL DISKS, THE DISKS (3.5-IN-DIA), SPACED 3.5 FT APART, PROVIDE A SOLID BASE FOR THE OUTER 0.055-IN THICK PVC LAYER, WHICH IS PROCESSED AGAINST THE BASE LAYER BY A SPECIALLY DESIGNED TRUCK-MOUNTED ROCK. THE TWO LAYERS ARE WELDED BY HIGH FREQUENCY HEATING AT DISK POINTS. THREE STEEL FORM WORK SECTIONS ARE THEN POSITIONED TO CAST THE INNER CONCRETE LINING. THIS METHOD INSURES A COMPLETE WATERTIGHT LINING THAT KEEPS THE 10-IN. THICK INNER CONCRETE SHELL COMPLETELY DRY. THE PVC IS SHRINKPROOF AND CAN STRETCH THREEFOLD WITHOUT RUPTURING. THE CONSTRUCTION OF THE 3.7-MILE EXPRESSWAY SECTION WHICH INCLUDES THE TWO TUNNELS (5.44 9-FT.-LONG NORTHERN TUNNEL AND 7, 929-FT.-LONG SOUTHERN TUNNEL) WILL COST \$95 MILLION EXCLUDING THE BRIDGE.

Engineering News-record Vol. 190 No. 15, Apr. 1973, p 68, 2 Phot

2A 215629**RECLAMATION PROCESS CUTS STREET CONSTRUCTION COSTS BY 35%**

RECLAMATION OF EXISTING PAVING MATERIALS IS PROVING TO BE A SATISFACTORY METHOD OF REBUILDING BITUMINOUS STREETS. THE OPERATION INVOLVES BREAKING UP THE OLD PAVEMENT, GATHERING THE MATERIAL IN WINDOWS, PULVERIZING AND MIXING THE BROKEN PIECES WITH A PORTABLE HAMMER MILL, THEN BLADING THE MIXTURE

TO GRADE AND COMPACTING IT WITH A PNEUMATIC ROLLER. THE ONLY NEW MATERIAL ADDED IS THE WEARING SURFACE OF PLANT-MIX ASPHALT. AT NO TIME DURING THE WORK CITED WERE RESIDENTS OF THE STREET UNABLE TO REACH THEIR HOMES BY CAR.

Phillips, DL *American City* Vol. 88 No. 3, Mar. 1973, pp 67-8

2A 215638**CONCRETE CANTILEVERED BOXES ARE U.S. FIRST**

POST-TENSIONED BOX GIRDER SEGMENTS MAKE UP ONLY THE MAIN SPANS OF THE BRIDGE ACROSS THE GULF INTER-COASTAL WATERWAY, A 200-FT SPAN FLANKED BY A 100-FT SPAN ON EACH SIDE. A LIFTING RIG AND MATING METHOD ARE BEING USED IN PLACE OF A LAUNCHING TRUSS. THE ERECTION OF THE 10-FT-LONG UNITS PROCEEDS IN BALANCED CANTILEVERS FROM SECTIONS BOLTED ATOP THE PIERS WITH 5-FT UNITS COMPLETING THE ENDS OF EACH GIRDER. THE 27-FT. WIDE WINGED SECTIONS WEIGH UP TO 52 TONS EACH. A 2-FT WIDE, CAST-IN-PLACE STRIP BETWEEN THE GIRDERS WILL COMPLETE THE DECK, TO BE TOPPED BY ASPHALTIC CONCRETE. THE PROCESS OF ERECTION OF THE 84 BOX SECTIONS IS DESCRIBED. TO ASSURE PERFECT MATING WHEN SEGMENTS WERE ERECTED ON A 5-DAY CURVE, THEY WERE CAST AGAINST EACH OTHER ON A 90-FT-LONG BED THAT WAS BUILT ON STEEL BEAMS WITH SCREW JACKS AT EACH END FOR ADJUSTMENTS. CONSTRUCTIONAL EXPERIENCES ARE DESCRIBED AND PROBLEMS ARE DISCUSSED. IT IS HOPED THAT THE PROJECT (WHICH WILL COST \$2.82 MILLION) WILL LEAD TO STANDARDIZED ELEMENTS THAT WILL RELIEVE SOME OF THE PROBLEMS OF BUILDING BRIDGES AND VIADUCTS AND DOUBLE DECKING EXPRESSWAYS IN CONGESTED AREAS BY ELIMINATING FALSEWORK. IT IS EXPECTED THAT STANDARDIZATION WILL LEAD TO A DROP IN TIME AND COST.

Engineering News-record Vol. 190 No. 14, Apr. 1973, pp 22-3, 5 Phot

2A 215640**POLLUTION: SOURCES AND SOLUTIONS IN BITUMINOUS CONSTRUCTION**

THE PAPER BRIEFLY SUMMARIZES POSSIBLE SOURCES OF POLLUTION IN BITUMINOUS CONSTRUCTION AND DISCUSSES METHODS TO SOLVE SOME PROBLEMS. HOT-MIX OPERATIONS IN CENTRAL-PLANT MIXING IS DISCUSSED. AGGREGATE DUST, FLY ASH, SOOT AND UNBURNED DROPLETS OF FUEL ARE THE MAIN PARTICULATES RESULTING FROM ASPHALT PLANT OPERATIONS. FIVE TO TEN TONS OF DUST PER HOUR LEAVE THE DRYING CHAMBER OF AN AVERAGE SIZED DRYER WITHOUT A DUST COLLECTING SYSTEM. FLY ASH RESULTS FROM IMPURITIES IN FUEL OIL OR INCOMPLETE COMBUSTION. POOR COMBUSTION CAN RESULT IN UNBURNED OIL DROPLETS BEING EMITTED FROM THE STACK OR DEPOSITED ON THE DRYER. THE DUST-WATER MIXTURE (FROM WET WASHES USED TO CONTROL DUST) IS SOMETIMES DRAINED INTO RIVERS OR LAKES, AND THUS CAUSES A POLLUTION PROBLEM. NOISE AT AN ASPHALT PLANT CAN BE CAUSED BY MANY FACTORS BUT MAXIMUM LEVELS OCCUR AT OR NEAR THE HOT-BIN SCREENS, THE PUB MILL, THE EXHAUST FANS AND THE BURNERS. OFFENSIVE ODORS AND NOXIOUS GASES PRODUCED VARY WITH THE TYPE OF FUEL USED, THE BURNING TEMPERATURE AND THE EFFICIENCY OF THE COMBUSTION PROCESS. THE VARIOUS OPERATIONS CONSTITUTING THE ROAD-MIX CONSTRUCTION PROCEDURE, REQUIRES DIESEL-OR GASOLINE-POWERED INTERNAL COMBUSTION ENGINES WHICH ARE SOURCES OF POLLUTION. DUST IS CREATED DURING THE OPERATIONS AND NOXIOUS VOLATILES MAY ESCAPE INTO THE AIR. POLLUTION CONTROL METHODS MAY BE CATEGORIZED IN 3 CLASSES. AUXILIARY EQUIPMENT USED IN MIXING AND HANDLING OPERATIONS ARE SUMMARIZED. THESE INCLUDE DUST CONTROL, WATER CONTROL, NOISE CONTROL, AND ODOR AND NOXIOUS GAS CONTROL SYSTEMS. EQUIPMENT MANUFACTURERS ARE MAKING IMPROVED PRODUCTS. A NEW MIXING

CONCEPT THAT COMBINES THE AGGREGATE HEATING AND MIXING PROCESS IS A SINGLE OPERATION IN THE LOCATING DRUM, AND WHICH OFFERS PROMISE OF A RELATIVELY POLLUTION FREE PLANT IS DESCRIBED. SPECIAL MIXES THAT MAY BE DEVELOPED TO CONTROL POLLUTION ARE REVIEWED.

Epps, JA Galloway, BM Terrel, RL *Highway Research Board Special Reports* No. 138, 1973, pp 142-9, 4 Fig, 11 Ref

2A 215641

NEW AUSTRIAN TUNNELING METHOD

THIS METHOD IS DESIGNED FOR WORKING IN GROUND WHICH CANNOT BE WORKED UNSUPPORTED WHEN APPLYING THE TRADITIONAL TUNNELING TECHNIQUES. IT HAS BEEN USED SUCCESSFULLY IN EUROPE FOR JOBS INCLUDING RAPID TRANSIT SYSTEM TUNNELS IN FRANKFORT AND NUREMBERG. THE IDEA IS TO PREVENT PRESSURE BUILD UP. AS QUICKLY AS A NEW SURFACE IS EXPOSED, IT IS COVERED WITH SHOTCRETE SO THAT THE SOIL ITSELF BECOMES THE SUPPORTING MATERIAL. WHERE NECESSARY THIS INITIAL SHOTCRETE LINING CAN BE REINFORCED. AS SOON AS THE FULL TUNNEL SECTION IS OPENED, THE OUTER LINING IS CLOSED BY A CONCRETE INVERT ARCH WHICH FORMS A FULL RING. SAVINGS RESULT IN THAT COSTLY TEMPORARY SUPPORTS, HEAVY TUNNEL ARCHES, AND LININGS USED IN TRADITIONAL TUNNELING METHODS ARE ELIMINATED.

Von, FALCK K *World Construction* Vol. 26 No. 3, Mar. 1973, pp 11-3

2A 215689

CONSTRUCTION MATERIALS INPUT INTO HIGHWAY CONSTRUCTION

DATA ARE PRESENTED IN THIS ARTICLE WHICH ARE ALSO COMPARED TO THOSE IN EARLIER ARTICLES ON THIS SUBJECT WHICH APPEARED IN 1956, 1960, 1962 AND 1966. A METHOD OF EXAMINING THE DEMAND FOR MATERIALS IN HIGHWAY CONSTRUCTION, OTHER THAN ON A BASIS OF DOLLAR VOLUME IS TO ANALYZE EACH ITEM ON THE BASIS OF A "USE FACTOR," WHICH, AS USED BY THE FEDERAL HIGHWAY ADMINISTRATION, IS THE EXPRESSION OF PHYSICAL UNITS CONSUMED PER MILLION DOLLARS OF HIGHWAY CONSTRUCTION COSTS. A TABLE SHOWS THE "USE FACTORS" FOR THE MORE IMPORTANT MATERIALS AND SUPPLIES BY THE THREE MAIN CATEGORIES OF HIGHWAYS (INTERSTATE, OTHER PRIMARY AND SECONDARY) AND FOR ALL HIGHWAYS. /AUTHOR/

Williams, FE
Construction Review Vol. 19 No. 8, AUG73, pp 2-5

2A 215702

VIBRATORY COMPACTION OF ASPHALT CONCRETE PAVEMENTS

THERE ARE SEVERAL MODELS OF VIBRATORY ROLLERS THAT CAN MEET THE CALIFORNIA DIVISION OF HIGHWAYS' 95 PERCENT RELATIVE COMPACTION REQUIREMENT FOR ASPHALT CONCRETE PAVEMENTS. USE OF VIBRATORY ROLLERS PRODUCED LOWER ASPHALT CONCRETE PERMEABILITIES THAN THOSE OBTAINED USING PNEUMATIC ROLLERS, EITHER PARTIALLY OR EXCLUSIVELY. PAVEMENT SURFACE UNDULATIONS WILL NOT RESULT IF VIBRATORY ROLLERS ARE OPERATED AT A FREQUENCY ABOVE 1800 VPM. THE DOUBLE VIBRATORY DRUM ROLLERS TESTED TO DATE HAVE PROVIDED HIGHER ASPHALT CONCRETE DENSITIES WITH FEWER COVERAGES THAT ALL THE OTHER TYPES OF COMPACTORS TESTED. COMPATIBLE COMBINATIONS OF AMPLITUDE, FREQUENCY, AND ROLLER WEIGHT MUST BE PROVIDED FOR SATISFACTORY COMPACTION TO BE ACHIEVED. /DOT/

Cechetini, JA Sherman, GB
California Department Transportation Interm Rep Vol. o July 1973, 29 pp

2A 215704

AN ALL-CONCRETE LOOK FOR RAILWAY TRACK

THE ARTICLE DISCUSSES THE LAYING OF A MILE LONG SECTION OF PAVED CONCRETE TRACK (PACT) AT DUFFIELD, AS PART OF A HIGH SPEED BRITISH RAIL ROUTE. THE PACT SYSTEM CONSISTS OF LAYING CONTINUOUSLY WELDED RAILS ON A NARROW CONCRETE BED LAID TO A HIGH DEGREE OF SURFACE ACCURACY BY A SPECIALLY DEVELOPED, SELF-PROPELLED SLIP-FORM PAVING TRAIN CAPABLE OF LAYING 40M OF TRACK BED PER HOUR. THE CONCRETE TRACK OFFERS ADVANTAGES OF MAINTAINING ALIGNMENT AND PROFILE COMPARED WITH THE TRADITIONAL BALLAST AND SLEEPER CONSTRUCTION. /TRRL/

Concrete /UK/ Vol. 6 N7 July 1972, pp 32-3, 5 Phot

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/IRRD 202 410, 3C33235463

2A 215705

ACCURACY IN THE SAMPLING OF CHIPPINGS

IN MOST METHODS OF TESTING ROAD CONSTRUCTION MATERIALS THE ERRORS IN THE METHOD ITSELF AND THE FLUCTUATIONS BROUGHT ABOUT BY THE SAMPLING AND PROCESSING OF THE SAMPLE ARE UNKNOWN; THE AUTHOR HAS THEREFORE STARTED DETAILED INVESTIGATIONS WHICH ARE TO DETERMINE THE INFLUENCE OF THE DIVISION OF THE SAMPLE ON THE RESULT OF THE ANALYSIS OF THE PARTICLE SIZE DISTRIBUTION OF CHIPPINGS. AN EXAMPLE OF AN 8/12 CHIPPING IS USED TO SHOW HOW THE FLUCTUATIONS IN THE VALUES CAN BE DETERMINED, AND HOW A CORRECT EVALUATION OF THE MATERIAL BEING TESTED CAN BE MADE.

Loos, H
Natursteinindustrie, Offenbach /Ger/ Vol. 7 No. 3, Mar. 1971, pp 95-8, 5 Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/IRRD 300 169, 3C33235468

2A 215711

TILT-UP PIER FORMS REDUCE BRIDGE COSTS

IDENTICAL PIER GEOMETRY DESIGNED INTO A LONG BRIDGE ENABLED THE CONTRACTOR TO PRETIE ALL REINFORCING ON THE GROUND AND TILT-UP THE PIER SHAFT FORMS. CORRELATION OF GEOMETRY WITH AVAILABLE MODULAR FORMWORK DIMENSIONS PERMITTED FLEXIBLE CONSTRUCTION PROCEDURES RESULTING IN REDUCED COSTS. /AUTHOR/

Ashton, WD *Am Concrete Inst Journal & Proceedings* Vol. 71 No. 1, Jan. 1974, pp 17-9, 4 Fig, 1 Tab

2A 215714

RATIONAL DESIGN TO CONTROL THE OPENING OF CRACKS IN UNBOUND POST-TENSIONED SLABS

A METHOD OF USING THE EFFECTIVE STRESS IN THE TENDON TO CONTROL THE FORMATION OF WIDE CRACKS IN UNBONDED PRESTRESSED CONCRETE CONSTRUCTION IS DESCRIBED. A NUMERICAL EXAMPLE IS INCLUDED TO SHOW THE APPLICATION OF THE DESIGN METHOD. THIS METHOD WAS INCORPORATED INTO A COMPUTER PROGRAM FOR THE DESIGN OF CONTINUOUS SPANS OF PRESTRESSED POST-TENSIONED CONCRETE. AN OPTION IN THE PROGRAM PERMITS THE USER TO DETERMINE THE DEGREE OF PROTECTION HE DESIRES BY SPECIFYING A SERVICE OVERLOAD FACTOR IN THE INPUT DATA.

O'neil, HM *Prestressed Concrete Institute Journal* Vol. 19 No. 1, Jan. 1974, pp 96-103

2A 215747

QUALITY CONTROL IN ASPHALTIC CONCRETE ROAD CONSTRUCTION

THE FUNCTION OF QUALITY CONTROL IN ASPHALTIC CONCRETE AND CONSTRUCTION IS TWOFOLD-(1) CONTROL OF AN

ASPHALT PLANT AND (2) PAVING OPERATIONS. THE BATCH TYPE OF HOT-MIX PLANT IS CONSIDERED TO GIVE CLOSER CONTROL OF QUALITY THAN THE CONTINUOUS TYPE, AND OTHER FACTORS AFFECTING THE PRODUCTION OF A UNIFORM HIGH QUALITY ASPHALTIC CONCRETE ARE DISCUSSED. THESE INCLUDE-(1) SELECTION AND CONTROL OF OPTIMUM ASPHALT CONTENT; (2) TESTING AND INSPECTION OF AGGREGATES; (3) COLD FEEDING PROPORTIONING; (4) DRYER OPERATION (5) HOT BIN GRADATION; (6) HOT AGGREGATE PROPORTIONING; (7) TEMPERATURE CONTROL; (8) MIXING TIME; (9) MIXING TEMPERATURE AND (10) MIXTURE SAMPLING AND TESTING. PAVING OPERATIONS ARE ALSO DESCRIBED UNDER THE MAIN HEADINGS OF (1) GENERAL (2) HAULING EQUIPMENT (3) CONTROL OF SPREADER OPERATOR; (4) TEMPERATURE CONTROL; (5) CONTROL OF ROLLING OPERATIONS; (6) CONTROL OF FIELD DENSITY; (7) CONTROL OF JOINTS; (8) CONTROL OF TRAFFIC AND (9) CONTROL OF FINISHED SURFACE.

Bijlani, HU Gupta, OP *Indian Highways* No. 244, Dec. 1970, pp 84-92, 2 Tab

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

2A 215752

GUSSASPHALT: MACHINE-LAID MASTIC IN ROAD CONSTRUCTION

THE DEVELOPMENTS IN MANUFACTURING PROCESSES FOR AND THE PROPERTIES OF MASTIC ASPHALT, OR GUSSASPHALT, ARE DISCUSSED UNDER THE FOLLOWING HEADINGS, PRINCIPLES OF THE COMPOSITION OF GUSSASPHALT; SPECIFICATION OF GUSSASPHALT; MANUFACTURE OF GUSSASPHALT; LAYING GUSSASPHALT; AND ASSOCIATED BINDER COURSE. AN EXTRACT FROM GERMAN SPECIFICATION TV BIT 6/60 AND DETAILS OF INDENTATION TEST (DIN 1996 SHEET 13) ARE APPENDED. /TRRL/

Shell Refining Limited /UK/ R&d Rept 1971, 16 pp, 2 Fig, 4 Tab, 19 Phot

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/IRRD 201 447, 3C33301447

2A 215758

ANALYSIS OF DEFECTS IN CONCRETE AND BRICK STRUCTURES DURING CONSTRUCTION AND IN SERVICE

THIS STUDY CONCERNS THE CAUSES OF DISTRESS OR FAILURE OF PERMANENT AND TEMPORARY STRUCTURES DURING CONSTRUCTION AND IN SERVICE. THE MAIN OBJECTIVES ARE TO ANALYZE THE CAUSES OF THE MOST FREQUENTLY OCCURRING FAILURES AND ADVERSE PERFORMANCE OF STRUCTURES, AND TO INVESTIGATE THE PATHOLOGY OF MATERIALS, ERRORS IN DESIGN AND CONSTRUCTION, ETC. THE TYPES OF STRUCTURES CONSIDERED ARE: BUILDINGS, FACTORIES, SCHOOLS, TANKS AND, TO A LESSER EXTENT, BRIDGES AND EARTHWORKS. THE MATERIALS DISCUSSED ARE MAINLY CONCRETE, BRICKWORK AND SOILS. THE PRINCIPAL EFFECTS DISCUSSED ARE: GRAVITY AND LATERAL FORCES, TEMPERATURE AND MOISTURE CHANGES, CREEP AND SHRINKAGE, SETTLEMENT, DEFECTS AND DETERIORATION OF MATERIALS WITH TIME, INADEQUATE WORKMANSHIP, FAULTY CONSTRUCTION, ERRORS AT THE DESIGN STAGE AND DURING CONSTRUCTION, AND LACK OF STABILITY. /TRRL/

Smolira, M

Dept of Environment Dir Gen /UK/ R & D Rpt Oct. 1972, 142 pp, 105 Fig, 2 Tab, 184 Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

2A 215786

EFFECTS OF TYPE OF MATERIAL ON NUCLEAR DENSITY MEASUREMENTS

THE PAPER DESCRIBES LABORATORY AND FIELD INVESTIGATIONS CARRIED OUT TO IMPROVE THE PRACTICAL APPLICA-

TION OF THE NUCLEAR METHOD IN HIGHWAY CONSTRUCTION. VARIOUS FACTORS HAVE BEEN STUDIED, INCLUDING THE EFFECTS OF DENSITY GRADIENT, SOURCE ENERGY, AND PARTICULARLY SOIL TYPE, ON DENSITY MEASUREMENTS. TWO METHODS ARE DESCRIBED FOR THE POSSIBLE ELIMINATION OF THE EFFECT OF SOIL TYPE IN PRACTICAL DENSITY MEASUREMENTS. IN THE FIRST, DIRECT TRANSMISSION IS USED AS AN AUXILIARY TEST WITH BACKSCATTER MEASUREMENTS. RESULTS ARE GIVEN TO ILLUSTRATE THE ADVANTAGES OF THIS METHOD FOR DETERMINING THE CORRECT CALIBRATION CURVE FOR THE BACKSCATTER METHOD AND ALSO FOR THE EVALUATION OF ANY DENSITY GRADIENT IN THE SOIL LAYER. IN THE SECOND METHOD INTRODUCTION OF A CERTAIN AIR GAP BETWEEN THE SURFACE PROBE AND THE SOIL SURFACE IS USED TO OBTAIN A COUNT RATIO WHICH, WHEN PLOTTED AGAINST DENSITY, GIVES A POSITIVE SLOPE RELATIONSHIP INDEPENDENT OF SOIL TYPE FOR DENSITIES UP TO 400 PCF. THIS METHOD ONLY EMPLOYS THE BACKSCATTER TECHNIQUE AND IS THEREFORE COMPLETELY NONDESTRUCTIVE. IT IS SHOWN FURTHER HOW THE AIR-GAP METHOD CAN BE USED FOR EFFECTIVE DENSITY MEASUREMENTS ON SOIL LAYERS. MEASUREMENTS AT PREDETERMINED AIR GAPS FURTHER PERMIT CONTINUOUS RECORDS OF DENSITY TO BE OBTAINED BY USING A SUITABLE RATEMETER. /AUTHOR/

Kuhn, SH *Highway Research Record, Hwy Res Board* 1965

2A 215825

STUDY IN THE GENERAL FIELD OF QUALITY CONTROL ENGINEERING

THIS REPORT DESCRIBES CURRENT METHODS OF CONTROL FOR VARIOUS CONSTRUCTION MATERIALS AND APPLICATIONS OF RANDOM SAMPLING TECHNIQUES FOR THE USE OF THESE MATERIALS. RESEARCH AREAS FOR ADDITIONAL DEVELOPMENT WERE DEFINED FROM LIMITED STUDIES IN MANY AREAS RATHER THAN EXPLORING A FEW AREAS TO THEIR FULLEST EXTENT AND THOSE STUDIES INCLUDED WERE' A/ INSTRUCTION OF STATE ROAD DEPARTMENT PERSONNEL IN METHODS AND APPLICATIONS OF STATISTICAL ANALYSIS; B/ ASPHALT PENETRATION AND VISCOSITY CONTROL TESTS; C/ BITUMINOUS MIX MATERIALS CONTROL TESTS; D/ EVALUATION OF RECORD TEST DATA; E/ RANDOM SAMPLING TECHNIQUES; F/ RESEARCH PROBLEM TESTING AREAS RECOMMENDED FOR ADDITIONAL STUDY WERE' /1/ ASPHALT EXTRACTION TESTING, /2/ MARSHALL STABILITY MIXING TEMPERATURES, /3/ COMPARATIVE MOISTURE DETERMINATION METHODS, /4/ MOISTURE-DENSITY TEST REPEATABILITY, /5/ FLORIDA BEARING VALUE TEST, /6/ NUCLEAR DENSITY CALIBRATION CURVE DEVELOPMENT. /BPR/

Warden Engineers, Incorporated Mar. 1965

ACKNOWLEDGMENT:

2A 215893

APPLICATION OF INSTRUMENTAL METHODS FOR EVALUATING HIGHWAY MATERIALS. THIRD PROGRESS REPORT: PYROLYSIS GAS CHROMATOGRAPHY

A RELATIVELY NEW TECHNIQUE OF COMBINING PYROLYSIS (THERMAL DECOMPOSITION) AND GAS CHROMATOGRAPHY HAS BEEN USED TO PRODUCE CHARACTERISTIC IDENTIFYING FRAGMENTATION PATTERNS OF MANY PLASTIC AND RUBBER MATERIALS WHICH ARE USED IN HIGHWAY CONSTRUCTION AND MAINTENANCE. PYROLYSIS GAS CHROMATOGRAPHY HAS SPECIFICALLY BEEN USED TO DETECT COMPOSITIONAL OR PROCESSING DIFFERENCES, OR BOTH, IN PREFORMED NEOPRENE JOINT SEALS SUPPLIED BY DIFFERENT MANUFACTURERS AND BETWEEN DIFFERENT WIDTH JOINT SEALS FROM THE SAME MANUFACTURER. SUCH DIFFERENCES ARE PERTINENT SINCE JOINT SEALS WHOSE PYROLYSIS COMPONENTS HAVE LONG RETENTION TIMES GENERALLY HAVE HIGH TENSILE STRENGTH AND HIGHER RECOVERY FROM COMPRESSION TESTS THAN THOSE HAVING

SHORT RETENTION TIMES. PROCEDURAL DETAILS OF THE METHODS AND EQUIPMENT DESCRIPTIONS ARE INCLUDED. SPECIFIC MATERIALS USED IN DELINEATOR BUTTONS, ELECTRICAL WIRE INSULATION, TRAFFIC CONES, ETC., WOULD ALSO BE AMENABLE TO THIS TYPE OF ANALYSIS. IT IS RECOMMENDED THAT: (1) OTHER PLASTICS AND RUBBERS BE CHARACTERIZED BY PYROLYSIS GAS CHROMATOGRAPHY, (2) THE INVESTIGATION OF NEOPRENE JOINT SEALS BE CONTINUED, AND (3) PYROLYSIS GAS CHROMATOGRAPHY BE APPLIED TO THE ANALYSIS OF THE BITUMINOUS MATERIALS AND PAINTS. /AUTHOR/

Ellis, JT Frederick, WL
Michigan Dept State Highways, Bureau of Public Roads /US/ Aug. 1968

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4674063 68)PB-179 877, 2P32089442, 3C34021490

2A 215912
POTENTIAL OF NEUTRON ACTIVATION ANALYSIS OF HIGHWAY MATERIALS-PHASE I, REPORT

A FEASIBILITY STUDY WAS MADE REGARDING THE APPLICATION OF NEUTRON ACTIVATION ANALYSIS TECHNIQUES TO THE QUANTITATIVE LABORATORY ANALYSIS OF SUCH HIGHWAY MATERIALS AS ALUMINUM, FERROUS METALS, ZINC, PAINT PIGMENTS, LIMESTONE AND CEMENT. THE REALISTIC POTENTIAL OF ACTIVATION ANALYSIS WAS COMPARED WITH CONVENTIONAL WET METHODS OF ANALYSIS AS WELL AS WITH X-RAY FLUORESCENCE AND ATOMIC ABSORPTION SPECTROSCOPY. OF THESE METHODS, IT WAS CONCLUDED THAT ATOMIC ABSORPTION-FLAME EMISSION METHODS HAVE THE GREATEST POTENTIAL FOR REPLACING AND IMPROVING UPON CURRENT HIGHWAY MATERIALS ANALYSIS PROCEDURES. /BPR/

Blackshaw, GL
West Virginia University, Bureau of Public Roads /US/, West Virginia State Road Commission Nov. 1969

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4674083 70)REPORT PENDING, 1C34021977

2A 215930
EVALUATION OF BITUMINOUS COMPACTION PROCEDURES USING NUCLEAR GAUGES

A STUDY WAS CONDUCTED USING NUCLEAR GAUGES TO EVALUATE PRESENT BITUMINOUS CONSTRUCTION PROCEDURES. SPECIFICALLY, NUCLEAR DENSITY TESTS WERE TAKEN BOTH DURING ROLLER OPERATIONS AND AFTER COMPACTION HAD BEEN COMPLETED. THE DENSITY DATA WERE ANALYZED TO STUDY THE FEASIBILITY OF USING NUCLEAR GAUGES TO ESTABLISH OPTIMUM ROLLING PATTERNS FOR SEVERAL DIFFERENT TYPES OF BITUMINOUS PAVEMENT MATERIALS FOR THE ROLLERS ENCOUNTERED. AFTER FINAL COMPACTION, CONTINUED NUCLEAR TESTS WERE TAKEN IN A STUDY OF ANY DENSITY VARIATIONS IN THE COMPACTED PAVEMENT. DENSITY TESTS WERE TAKEN TRANSVERSELY, ON JOINTS, ALONG THE PAVEMENT EDGES, ALONG THE LONGITUDINAL WHEELPATH AREAS, AND FINALLY, IN RANDOM LOCATIONS ALONG THE PAVEMENT. AREAS OF LOW DENSITY APPEARED TO BE PREDOMINANTLY THE JOINTS AND PAVEMENT EDGES. A SEPARATE STUDY WAS CONDUCTED WITH TWO COMMERCIALY AVAILABLE NUCLEAR DENSITY GAUGES TO EVALUATE THE EFFECTIVE DEPTH OF MEASUREMENT. BOTH BACKSCATTER AND AIR-GAP TECHNIQUES WERE ANALYZED. THE AIR-GAP DENSITY TEST WAS SHOWN TO BE DEPENDENT ON ONLY THE TOP 1 3/4 INCHES OF MATERIAL TESTED. /AUTHOR/

Grey, RL
Pennsylvania Department Transp, Bureau of Public Roads /US/ 64-15

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4723152 70)NTIS PB 194333, 1C34022208

2A 215995
FINAL REPORT ON THE FEASIBILITY OF USING HIGHWAY LITTER IN HIGHWAY CONSTRUCTION AND MAINTENANCE
THE TECHNICAL AND ECONOMIC FEASIBILITY OF UTILIZING HIGHWAY LITTER IN HIGHWAY CONSTRUCTION AND MAINTENANCE WAS INVESTIGATED. A RESEARCH TEAM GATHERED INFORMATION AND MADE TECHNICAL AND ECONOMIC ASSESSMENTS OF SIXTEEN POTENTIAL USES OF HIGHWAY LITTER. A MAJOR FINDING WAS THAT IF HIGHWAY LITTER IS CONSIDERED BY ITSELF NON OF THE POTENTIAL USES INVESTIGATED WOULD BE ECONOMICALLY FEASIBLE AT THE PRESENT TIME. IN ORDER TO BE ECONOMICALLY FEASIBLE, HIGHWAY LITTER SHOULD BE COMBINED WITH OTHER SOLID WASTES IN ORDER TO PROVIDE EITHER SUFFICIENT QUANTITIES OR LOWER THE UNIT COST OF PROCESSING. OTHER MAJOR FINDINGS WERE THAT SIX POTENTIAL USES WERE ASSESSED TO BE BOTH TECHNICALLY AND ECONOMICALLY FEASIBLE, PROVIDING THE LITTER IS COMBINED WITH OTHER SOLID WASTES. THESE SIX USES ARE (1) LANDFILL OPERATIONS, (2) AGGREGATE REPLACEMENT FOR BASE AND SUBBASE, (3) AGGREGATE REPLACEMENT FOR STABILIZED MATERIALS, (4) INDUCED TRENCH, (5) VEHICLE IMPACT ATTENUATORS, AND (6) MAINTENANCE MATERIALS. /FHWA/

Galloway, BM
Texas Transportation Institute Final Rpt. FHWA-RD-72-47, Dec. 1971, 272 pp

Contract FH-11-7692

ACKNOWLEDGMENT: Federal Highway Administration (M-0082)
PB-224532/AS

2A 216010
TECHNICAL CONTROL OF SULFATE WASTE MATERIALS AT THE TRANSPO '72 SITE

THIS REPORT IS AN IN DEPTH STUDY OF TECHNICAL ASPECTS OF UTILIZATION OF SULFATE WASTE MATERIALS. IT TREATS THE SUBJECTS OF DESIGN OF PRODUCTS UTILIZING WASTE MATERIALS, DETERMINATIONS OF PHYSICAL PROPERTIES OF THE COMBINED WASTE MATERIALS, AND CONTROL OF THE PRODUCTION OF THESE PRODUCTS. THE WASTE MATERIALS USED IN THE DEMONSTRATIONS AT THE TRANSPO '72 SITE INCLUDE WASTES FROM POWER PLANTS, CHEMICAL INDUSTRIES, AND MINING INDUSTRIES. THE REPORT DEMONSTRATES THE USE OF WASTE MATERIALS IN SUCH CONSTRUCTION APPLICATIONS AS ROAD BASE AND SYNTHETIC AGGREGATE COMPOSITIONS. THE RESULTS CLEARLY INDICATE THE COMPETITIVE NATURE OF THE PRODUCTS MADE FROM INDUSTRIAL WASTES AS COMPARED WITH THE CONVENTIONAL CONSTRUCTION MATERIALS. /FHWA/

Minnick, LJ Webster, WC Hilton, RG
Corson, G. & W.H., Inc Final Rpt 1972, 73 pp

ACKNOWLEDGMENT: Federal Highway Administration FHWA M-0044, NTIS PB 228 975/AS, 1C34023611

2A 216011
ARKANSAS WASTE IN MUNICIPAL AREAS SUITABLE FOR HIGHWAY CONSTRUCTION OR MAINTENANCE
THE CATEGORIES AND QUANTITIES OF MUNICIPAL WASTE PRODUCTS ARE AGGREGATES (2 MILLION TONS/YR), GLASS (2200 TONS/YR), CHEMICAL WASTES (3 MILLION TONS/YR), WOOD PRODUCTS AND PAPER (50,000 TONS/YR), RUBBER (2000 TONS/YR), AND TEXTILES AND MISCELLANEOUS (VARIABLE QUANTITIES). AGGREGATES, WOODCHIP MULCHES, BROWN MUD, DRIED SEWAGE SLUDGE, INCINERATOR RESIDUES CAN BE USED IN FILLS AND EMBANKMENTS. WOODCHIP MULCHES ARE EFFECTIVE IN PREVENTING EROSION. DRIED SEWAGE SLUDGE IS AN EFFECTIVE SOIL CONDITIONER AND FERTILIZER. BROWN MUD AND HYDRATED LIME CAN STABILIZE PLASTIC CLAYS. RUBBER, BRINE, AND ACID HOLD PROMISE FOR FUTURE USE. RUBBER HOLDS PROMISE AS A VISCO-ELAS-

TIC LAYER TO ELIMINATE PAVEMENT CRACKING AND AS A PLASTICIZER IN WEARING COURSES BUT THE TECHNOLOGY FOR THIS IS NOT SUFFICIENTLY DEVELOPED. BRINE, GYPSUM, AND SPENT SULFURIC ACID APPEAR TO BE GOOD SOIL STABILIZERS AND CONDITIONS. STUDIES ON THE EFFECT OF BRINE AND ACID ON THE ENVIRONMENT SHOULD BE MADE BEFORE USE. /NTIS/

Thornton, SI Welch, RC
Arkansas University Final Rpt June 1973, 90 pp

ACKNOWLEDGMENT: Arkansas State Highway Department, Federal Highway Administration FHWA M-0120, NTIS PB 230 951/AS, 1C34023630

2A 216012

THE LOCATION AND POTENTIAL HIGHWAY USE OF BY-PRODUCTS IN ARKANSAS

EIGHT HUNDRED NINETY-NINE COMPANIES WERE SURVEYED IN RURAL ARKANSAS AND 287 COMPANIES REPORTED 309 WASTES WITH TOTAL MONTHLY AMOUNTS OF 22,752 TONS OF WOOD; 762 TONS OF PAPER 4,352 TONS OF LIQUID; 1,355 TONS OF METAL; 12,804 TONS OF AGRICULTURAL WASTES; 52 TONS OF LEATHER AND CLOTH; 15 TONS OF GLASS, 31,745 TONS OF MINERALS; AND 71 TONS OF POLYMERS. THESE MATERIALS AND THEIR SOURCES ARE TABULATED BY TYPE AND BY HIGHWAY DISTRICT IN THE REPORT SUPPLEMENT. A COMPREHENSIVE LIST OF THE USES OF WASTE BY OTHER STATE HIGHWAY DEPARTMENTS IS INCLUDED. SOME LABORATORY TESTING WAS DONE AND THE RESULTS ARE INCLUDED IN DETAIL. BY-PRODUCTS RECOMMENDED FOR DIRECT USE BY THE ARKANSAS HIGHWAY DEPARTMENT ARE PINE BARK, RICE HULLS, BRINE, $Al(OH)_3$, $Ca(OH)_2$, CEMENT KILN STACK DUST, LIME CORE, GLASS USED FIRE BRICK, USED CONCRETE, SLAG, BARITE TAILINGS, OILY FILTER CLAY, AND CLASSIFIER SAND. OTHER MATERIALS WHICH REQUIRE PROCESSING OR STUDY BEFORE USE ARE RECOMMENDED FOR POSSIBLE APPLICATIONS AS MULCH, DUST PALLIATIVES, EROSION CONTROLS, SEED BED PREPARATIONS, SOIL STABILIZERS, SHOULDER SANDING, WINTER SANDING, FINE AGGREGATES, GROUT, INSULATION LAYERS, CUSHION COATS, TACK COATS, JOINT FILLERS, PAINT THINNERS, AND BINDERS.

Jimerson, GD Wyatt, WV
Arkansas State University, Jonesboro Final Rep Aug. 1973, 114 pp

ACKNOWLEDGMENT: Arkansas State Highway Department, Federal Highway Administration FHWA M-0125, NTIS PB 230 953/AS, 1C34023631

2A 216063

USE OF LIME IN THE CONSTRUCTION AND MAINTENANCE OF SASKATCHEWAN HIGHWAYS. 1962-1968

VARIOUS USES OF LIME BY THE SASKATCHEWAN DEPARTMENT OF HIGHWAYS FOR HIGHWAY CONSTRUCTION AND MAINTENANCE ARE OUTLINED. PROJECTS INCLUDE LIME STABILIZATION AND MODIFICATION OF HIGHLY PLASTIC LACUSTRINE CLAY SOILS, LIME DRYING OF EXCESSIVELY WET SUBGRADES, FILLING AND INJECTING LIME SLURRY INTO PAVEMENT CRACKS TO CONTROL FORMATION AND DEVELOPMENT OF TRANSVERSE RIDGES, AND LIME MODIFICATION OF DIRTY AGGREGATE FOR ASPHALTIC CONCRETE. /RATAOC/

Culley, RW
Saskatchewan Dept Hwys, Regina /Canada/ Apr. 1970

ACKNOWLEDGMENT: Roads & Transportation Assoc /Canada/

2A 216069

IMPACT OF NUCLEAR TECHNOLOGY ON HIGHWAY ENGINEERING

MODERN AUTOMOTIVE TRANSPORTATION REQUIRES WISE HANDLING, PROCESSING AND TESTING OF NATURAL MATERIALS FOR HIGHWAY CONSTRUCTION. NEW MATERIALS ARE BEING USED TO BUILD AND MAINTAIN THE HIGHWAY STRUCTURE. NUCLEAR TECHNOLOGY IS RAPIDLY BEING

APPLIED AS A TOOL FOR MEASURING AND TESTING MATERIALS IN CONSTRUCTION AND MAINTENANCE OPERATIONS. PERFORMANCE OF NONDESTRUCTIVE TESTS FOR MATERIAL SUITABILITY AND SPEED OF MEASURING BY NUCLEAR METHODS PROVIDE BETTER PROCESSING AND CONSTRUCTION CONTROLS. THE FLOW OF MATERIALS CAN BE MEASURED AND TESTED BY EXTREMELY SMALL QUANTITIES OF RADIOACTIVE MATERIALS. SUCH TRACER TECHNIQUES ASSIST BOTH IN MATERIAL PRODUCTION AND IN HIGHWAY STRUCTURAL DESIGN. NUCLEAR ENERGY ALSO HAS SOME PROMISE FOR CHANGING THE CONSISTENCY OF INFERIOR SOILS TO PRODUCE A SUITABLE ENGINEERING MATERIAL. NUCLEAR POWER, HEAT AND EXPLOSIVES MAY AFFECT HIGHWAY LOCATION, DESIGN AND CONSTRUCTION PROCEDURES, AND EVENTUALLY MAY BRING ABOUT NEW PRINCIPLES AND TECHNOLOGY IN HIGHWAY ENGINEERING.

Blackwell, PL *Am Soc Testing Matls Spec Tech Publ* 1965

ACKNOWLEDGMENT: Highway Res Abstracts Hwy Res Board

2A 216106

THERMISTORS FOR TEMPERATURE MEASUREMENT IN CONCRETE

THE USE OF THERMISTORS FOR TEMPERATURE MEASUREMENT OF THE INTERIOR OF CONCRETE CONSTRUCTION IS BEING INVESTIGATED. AN INVESTIGATION WAS CARRIED OUT ON THE DISTRIBUTION OF TEMPERATURES WITH TIME IN A REINFORCED CONCRETE MINE-SHAFT LINING CONSTRUCTED AGAINST GROUND WHICH HAD BEEN FROZEN TO PREVENT WATER INFILTRATION. THERMISTORS WERE USED IN LABORATORY STUDIES OF THE FROST-RESISTANCE OF CEMENT GROUTS AND IN A STUDY OF THE TEMPERATURE-LAG EFFECT FOR CONCRETE SPECIMENS PLACED IN COLD ROOMS.

Geddes, JD *Civil Eng & Public Works Review /UK/* Sept. 1965

2A 216131

SPLICES IN TENSILE REINFORCING BARS

INFORMATION IS TO BE PROVIDED ON THE RELATIVE MERITS OF THE VARIOUS METHODS OF CONNECTING TENSILE REINFORCING BARS IN REINFORCED CONCRETE CONSTRUCTION. IN PART I, A SERIES OF 122 DIFFERENT BAR SAMPLES WERE PREPARED AND TESTED TO FAILURE. EIGHT DIFFERENT SPlicing SYSTEMS WERE STUDIED PLUS A SERIES OF CONTROL BARS /CONTINUOUS BARS WITHOUT ANY SPLICES/. STRESS-STRAIN DIAGRAMS ARE INCLUDED FOR ALL SAMPLES THAT YIELDED SUFFICIENT DATA. ON THE BASIS OF THIS STUDY, THE MOST PROMISING TYPES OF SPlicing DEVICES WERE SELECTED FOR FLEXURAL TESTS. IN PART II, EIGHT REINFORCED CONCRETE BEAMS WERE FORMED. EACH BEAM WAS TWELVE FEET IN LENGTH AND HAD A CROSS-SECTION OF 8 IN. WIDE BY 12 IN. DEEP. FOUR DIFFERENT SPlicing DEVICES WERE STUDIED IN THIS SERIES PLUS ONE BEAM WHICH CONTAINED A SIMILAR, CONTINUOUS REINFORCING BAR /WITHOUT A SPLICE/ FOR CONTROL PURPOSES. /AUTHOR/

Segner, EP
Oklahoma University 59 pp, Aug. 1965

ACKNOWLEDGMENT: Highway Res Abstracts Hwy Res Board

2A 216203

SYMPOSIUM ON VIBRATION TESTING OF ROADS AND RUNWAYS

CONTENTS: MECHANICAL PROPERTIES OF BITUMEN, R. N. J. SAAL. MECHANICAL PROPERTIES OF BITUMINOUS ROAD MIXTURES, L. W. NIJBOER. VIBRATION TESTING OF SOILS, H. LORENZ. VIBRATION TESTING OF ROADS, L. W. NIJBOER. INTERPRETATION OF SURFACE VIBRATION MEASUREMENTS, R. JONES. DYNAMIC STIFFNESS OF SOILS AND PAVEMENTS, W. HEUKELOM. DYNAMIC INVESTIGATIONS OF ROADS IN GERMANY, G. BAUM. MEASUREMENT OF EFFECTS OF TRAFFIC

WITH THE SHELL ROAD VIBRATION MACHINE, A. A. MAXWELL & A. H. JOSEPH. A CONTRIBUTION TO THE STUDY OF DEFORMATIONS AND STRAINS IN ROADS, G. JEUFFROY & J. BACHELEZ. THE CALCULATION OF STRESSES AND DISPLACEMENTS IN LAYERED SYSTEMS, K. R. PEATTIE.

Intl Symp Vibra Testing Rds & Runways Apr. 1959

2A 216264

EVALUATION OF A CONTINUOUS-LOGGING NUCLEAR MOISTURE-DENSITY MEASUREMENT SYSTEM (LANE-WELLS ROAD LOGGER)

EVALUATION OF A LANE-WELLS ROAD LOGGER AS A REPLACEMENT FOR CONVENTIONAL MOISTURE CONTENT AND DRY DENSITY MEASUREMENTS IN HIGHWAY CONSTRUCTION WAS BEGUN IN 1965 WITH ONE UNIT. THE EVALUATION CONSISTED OF CORRELATION STUDIES ON ACCURACY AND REPEATABILITY, AND GENERAL DEVELOPMENT OF MULTI-PROJECT OPERATING PROCEDURES TO FIT CONSTRUCTION PRACTICES IN SASKATCHEWAN. THE EVALUATION PROGRAM WAS EXPANDED IN 1966 TO THREE UNITS WITH EACH UNIT RESPONSIBLE FOR CONTRACT COMPACTION CONTROL OF SUBGRADE, GRANULAR SUB-BASE AND BASE COURSE, AND ASPHALTIC CONCRETE SURFACE COURSE ON SEVERAL PROJECTS. IN ADDITION, THE UNIT'S ABILITY TO PROVIDE TIGHT CONTROL TO ESTABLISH UNIFORMITY OF COMPACTION WAS ASSESSED AND FOUND SATISFACTORY. THE TWO-YEAR EVALUATION PROGRAM INDICATED THAT WHEN PROPERLY USED, THE ROAD LOGGER MEASUREMENTS ARE AS ACCURATE AS CONVENTIONAL TEST MEASUREMENTS. THE VOLUME OF DATA, THE MATTER IN WHICH IT IS PRESENTED, AND THE SPEED AT WHICH IT IS OBTAINED HAVE BROUGHT THE POSSIBILITY OF QUALITY CONTROL OF COMPACTION PROCESSES, INCLUDING SOILS SELECTION, TO THE POINT WHERE IT IS A PRACTICAL PROCEDURE. THE MAIN DISADVANTAGES OF THE ROAD LOGGER METHOD ARE THE INITIAL COST OF THE DATA AND THE ADDITIONAL TRAINING REQUIRED BY TECHNICIANS TO PROPERLY INTERPRET THE DATA. /AUTHOR/

Culley, RW

Saskatchewan Dept Hwys, Regina /Canada/ Mar. 1967

2A 216289

HANDBOOK OF STEEL DRAINAGE & HIGHWAY CONSTRUCTION PRODUCTS

THE HANDBOOK OF STEEL DRAINAGE AND HIGHWAY CONSTRUCTION PRODUCTS IS INTENDED TO SERVE A LONG ESTABLISHED NEED. ITS PRIMARY USE LIES IN HIGHWAY, RAILWAY, MUNICIPAL, AGRICULTURAL, INDUSTRIAL, AND OTHER FIELDS WHERE DRAINAGE AND CONSTRUCTION PROBLEMS MUST BE OVERCOME. ITS PRINCIPAL MERIT CAN BE FOUND IN THE DEGREE TO WHICH CONSENSUS HAS BEEN ATTAINED AMONG THE NUMEROUS REPUTABLE CONTRIBUTING AUTHORITIES ON THE ENGINEERING OF DRAINAGE STRUCTURES AND RELATED STEEL PRODUCTS. THE TEXT AIMS TO PRESENT THE BEST ENGINEERING METHODS AND PRACTICES COMPATIBLE WITH EXISTING TECHNOLOGY. BEHIND THESE METHODS ARE MORE THAN 60 YEARS' PRACTICAL EXPERIENCE BY ENGINEERS, PUBLIC OFFICIALS, MANUFACTURERS, AND CONTRACTORS FOR METAL DRAINAGE STRUCTURES. DESIGN DATA AND DESIGNER AIDS ARE CITED EXTENSIVELY FROM PUBLISHED LITERATURE, AND ARE SUPPLEMENTED WITH NUMEROUS REFERENCES TO SUPPORTING RESEARCH. THEORY IS KEPT AT A MINIMUM. HEIGHT OF COVER TABLES ILLUSTRATE HOW CULVERT DIAMETER AND WALL THICKNESS FOR SEVERAL CORRUGATION PROFILES AND CONDITIONS OF BACKFILL, INFLUENCE HEIGHT-OF-COVER LIMITS.

American Iron & Steel Institute 1967

2A 216323

CORROSION CONTROL AT WELDED JOINTS IN CONSTRUCTIONAL STEELS

CORROSION PROBLEMS AT WELDED JOINTS ARE CONSIDERED. MEANS OF CORROSION CONTROL ARE DISCUSSED SO THAT WELDS IN STRUCTURES HAVE CORROSION RESISTANCE EQUAL TO THAT OF THE JOINED MEMBERS. WHERE THE TECHNICALLY BEST METHOD IS NOT PRACTICABLE, CHEAPER AND EASIER EXPEDIENTS ARE POINTED OUT.

Hoar, TP *British Corrosion Journal /UK/* Mar. 1967

2A 216344

CORROSION PREVENTION FOR THE CONCRETE AND METAL REINFORCING IN THE CONSTRUCTION INDUSTRY

IMPROVED PRACTICES AND TECHNIQUES OF FORMULATING CONCRETE HAVE INCREASED ITS ABILITY TO RESIST DETERIORATION AND CORROSION. IN MANY ENVIRONMENTS, HOWEVER, CONCRETE MAY BE SUSCEPTIBLE TO CHEMICAL ATTACK. THIS ARTICLE BRIEFLY DISCUSSES THE MAKE-UP OF CONCRETE, INCLUDING AIR-ENTRAINED CONCRETE, AND PRESENTS DOCUMENTED INFORMATION ON THE CORROSION OF REINFORCING METALS. METHODS OF PROTECTING AND REINFORCING CONCRETE ALSO ARE PRESENTED. THE INFORMATION IS INTENDED TO BE ONLY AN INTRODUCTION AND SHOULD NOT BE USED AS A GUIDE FOR PROTECTING CONCRETE STRUCTURES. THIS ARTICLE IS A CONTINUATION OF A SERIES ON THE PROTECTION OF MATERIALS IN THE CONSTRUCTION INDUSTRY. /AUTHOR/ REFERENCES: MATERIALS PROTECTION, JANUARY, 1968, VOL. 7, PAGES 19-23.

Castleberry, JR *Materials Protection* Mar. 1968

2A 216385

**CAUSES OF DETERIORATION OF BUILDING MATERIALS II
ROLE OF MICROBIOLOGICAL AGENCIES IN
DETERIORATION OF STONE**

THE WAY IN WHICH MICROBIOLOGICAL AGENCIES CAN AGGRAVATE OR EVEN CAUSE THE DECAY OF LIMESTONE AND SANDSTONE MASONRY IS ILLUSTRATED BY REFERENCE TO THE POWDERY GYPSEOUS LAYER BELOW THE SURFACE SCALE AT CERTAIN LOCALITIES. THIS LAYER GIVES HEAVY COUNTS OF THIOBACILLUS THIO-OXIDANS, WHICH NEEDS REDUCED SULFUR TO PRODUCE SULFATE IONS BY OXIDATIVE METABOLISM. IT IS PROBABLE THAT SOIL SULPHATES ARE ANAEROBICALLY REDUCED TO SULPHIDE BY DESULPHOVIBRIO DESULPHURICANS (OFTEN FOUND AT BASE OF DAMP WALLS) AND THAT AN AQUEOUS SOLUTION OF THE SULPHIDES RISES UPWARDS FOR USE BY T. THIO-OXIDANS. THE PARTLY MICROBIOLOGICAL ORIGIN OF 'MOND-MILCH' (CRYST. CALCITE OR ARAGONITE) AS SOFT OR HARD INCrustATIONS, OR MILKY AQUEOUS SUSPENSIONS, IN SOME LIMESTONE CAVES IS DISCUSSED. THE ACTIVITIES OF THE N-CYCLE, N-FIXING AND AMMONIA PRODUCING ORGANISMS AND THE RESULTING EQUILIBRIUM BETWEEN AMMONIA, CARBON DIOXIDE AND AMMONIUM CARBONATES AND BICARBONATES IN SOLUTION ARE HELD RESPONSIBLE. /BSA/

Ponchon, MJ Jaton, MC *Chemistry & Industry /UK/* 67

ACKNOWLEDGMENT: Building Science Abstracts /UK/

2A 216388

MATERIALS PERFORMANCE IN SAN DIEGO'S SEWERS
RESULTS OF AN EXAMINATION OF THE MATERIALS AND CONSTRUCTION METHODS OF THE SAN DIEGO METROPOLITAN SEWERAGE SYSTEM UNDER CORROSIVE OPERATING CONDITIONS ARE PRESENTED. THE SYSTEM IS DESCRIBED AND GENERAL CORROSION PROBLEMS (INCLUDING DETERIORATION OF MAN-HOLE AND ACCESS STRUCTURES, A TUNNEL LINED WITH POLYVINYL CHLORIDE, AND SACRIFICIAL MATERIAL ON PIPING) ARE DISCUSSED. CORROSION DIFFICULTIES IN THE SYSTEM'S POINT LOMA TUNNEL AND IN THE PRIMARY TREATMENT PLANT (INCLUDING DETERIORATION OF THE ENCLOSED SEDIMENTATION STRUCTURE AND THE

FUME INCINERATOR AND CORROSION OF THE HYDRAULIC PUMP AND THE VORTEX STRUCTURE) ARE EXAMINED. PROTECTION OF THE OCEAN OUTFALL LINE IS ALSO DISCUSSED. /AUTHOR/

Graham, RE *Materials Protection* May 1968

2A 216392

EPOXY MORTARS IN CONSTRUCTION

EPOXY RESINS ARE BEING INCREASINGLY APPLIED IN CONSTRUCTION IN RECENT YEARS. THIS IS DUE TO THEIR EXCELLENT PROPERTIES AND AN IMPROVING TECHNOLOGY, WHICH ENABLES THESE RESINS TO BE APPLIED TO MORE DELICATE AND DIFFICULT USES. THIS ARTICLE DESCRIBES THE WORK DONE BY THE AUTHOR AS PART OF AN EXTENSIVE PROGRAM OF EXPERIMENTAL WORK AT THE INSTITUTO EDUARDO TORROJA LABORATORY. THIS PROGRAM OF WORK REFERS PARTICULARLY TO MORTARS WITH A LOW CONTENT OF EPOXY RESINS. BY THIS IS MEANT A MIXTURE OF COARSE AGGREGATE WITH THE LEAST QUANTITY OF RESIN NECESSARY TO OBTAIN A SUITABLE BOND. THE INVESTIGATION INVOLVED A STUDY OF THE PROPORTIONING OF SAND AND RESIN, THE RELATION BETWEEN PROPORTIONING, THE AGE AND THE MECHANICAL STRENGTH AND ALSO THE PHYSICAL PROPERTIES OF THE RESULTING MORTARS. /AUTHOR/

Canovas, MF *Informes De La Construccion /Spain/* Jan. 1968

2A 216460

WELDED STRUCTURES-A SYMPOSIUM

PAPERS PRESENTED DISCUSS THE FOLLOWING: (1) STEEL REQUIREMENTS, (2) DESIGN AND RESEARCH, AND (3) FABRICATION AND CONSTRUCTION. THE PROPERTIES OF STEEL THAT IS TO BE WELDED MUST BE MORE CAREFULLY SPECIFIED THAN THOSE FOR STEEL THAT IS TO BE FABRICATED BY OTHER JOINING METHODS. THE TYPE OF CONSTRUCTION ALSO AFFECTS THESE REQUIREMENTS. IT IS PRESUMED THAT WELDED STRUCTURES WILL BE USED WIDELY. OF THE MORE THAN 35 DIFFERENT WELDING PROCESSES CURRENTLY USED, MANUAL SHIELDED METAL-ARC WELDING IS THE MOST COMMON FOR STRUCTURAL FABRICATION. MECHANICAL PROPERTIES OF THE STEEL MUST BE KNOWN AS WELL AS THE FOLLOWING: (1) THE CHEMISTRY OF STEEL, (2) HOW THE STEEL IS MADE, AND (3) THE THICKNESS OF THE PLATES AND SHAPES TO BE USED. RECOMMENDATION IS MADE FOR THE USE OF ASTM A7 STEEL. THE ADEQUACY OF WELDED JOINTS, SPECIAL REQUIREMENTS IN SPECIFICATIONS TO ASSURE WELDABILITY, THE BEHAVIOR OF WELDED JOINTS UNDER REPEATED STRESSES, IMPACT AND VIBRATION, AND RESIDUAL STRESS PROBLEMS ARE EVALUATED AND DISCUSSED. THE FABRICATING AND CONSTRUCTING OF WELDED STRUCTURES ARE ANALYZED. A BRIEF HISTORY IS GIVEN OF THE DEVELOPMENT OF THE USE OF STEEL STRUCTURES.

Greenberg, SA Grover, L Kreidler, CL *Am Soc Civil Engr Transactions* 1955

ACKNOWLEDGMENT: Highway Research Board

2A 216463

LEAD AND CORROSION RESISTANCE

THE REFERENCES ON LEAD AND CORROSION RESISTANCE INCLUDE: MEANS OF COMBATING CORROSION; CATHODIC PROTECTION; PROTECTIVE COATINGS, DETERIORATION OF LEAD CABLE SHEATHING, CORROSION RATES AND INFLUENCE OF IMPURITIES; CORROSION TESTS; RELATIVE CORRODIBILITIES OF FERROUS AND NON-FERROUS METALS AND ALLOYS; ELECTROLYTIC DESTRUCTION OF METALS IN SOIL; ATMOSPHERIC ACTION; ACTION OF ACIDS, ALKALIES AND SALTS; HIGH TEMPERATURE OXIDATION; INTERCRYSTALLINE BRITTLENESS; FATIGUE STUDIES; AND AS CONSTRUCTION MATERIAL FOR CHEMICAL APPARATUS.

Highway Research Information Service Feb. 1970

2A 216487

ELECTRONICS AND ACCOUSTICAL METHODS FOR TESTING CONSTRUCTION MATERIALS /IN RUSSIAN/
THIS BOOK CONTAINS THE FOLLOWING CHAPTERS: (1) PHYSICAL PRINCIPLES OF ACCOUSTICAL METHODS AND WORKING PRINCIPLES OF ELECTRONIC EQUIPMENT FOR THE QUALITY CONTROL OF CONSTRUCTION MATERIALS. (2) ELECTRONIC EQUIPMENT FOR TESTING CONSTRUCTION MATERIALS BY ACCOUSTICAL METHODS, AND (3) SOME RESULTS AND POSSIBLE APPLICATIONS OF ACCOUSTICAL METHODS AND ELECTRONIC ENGINEERING STRUCTURES. /LCPC/RRL/

Zashchuk, IV
Vyssaja Skola /Ussr/ 1968

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 216509

JOINTS AND JOINT CONSTRUCTION IN CONCRETE AND REINFORCED CONCRETE CONSTRUCTION /GERMAN/
THIS IS THE FIRST COLLECTION OF APPROVED METHODS OF CONSTRUCTION IN THIS IMPORTANT FIELD. THIS FIRST PART OF THE BOOK DEALS WITH QUESTIONS OF CONSTRUCTION AND MATERIAL IN THE PRODUCTION OF STRUCTURAL JOINTS; THEIR NUMBER AND DESIGN, THE DIFFERENT KINDS OF JOINTS AND JOINT SEALERS. THE USE OF PVC COMPRESSIBLE SEALERS IS ALSO CONSIDERED. THE SECOND PART CONTAINS DETAILED DISCUSSIONS OF JOINTS AND JOINT CONSTRUCTION IN VARIOUS BUILDING PROJECTS, INCLUDING JOINTS IN BRIDGES AND CONCRETE ROADS. /FG/RRL/

Von, MENG W Schweigert, B *Beton-herstellung-verwendung /Germany/* 1966

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 216514

PRACTICAL EXPERIMENTS WITH PLASTIC OVERLAYS IN ROAD CONSTRUCTION /IN GERMAN/
DURING PARALLEL TESTING OF NEW TYPES OF CONSTRUCTION MATERIAL, VESTOPAL MORTAR BEHAVED PARTICULARLY WELL. APPROXIMATELY 15% WEIGHT OF VESTOPAL TYPE A OR LT WITH LOW PROPORTIONS OF HARDENER AND ACCELERATOR IS ADDED AS A BINDER TO THE GRADED AGGREGATE WHICH CONSISTS OF NATURAL SAND AND/OR CRUSHED STONE SAND (UP TO 3MM KG). MORTAR PRISMS ATTAINED 216 KP/CM SQUARED TENSILE STRENGTH, 805 KP/CM SQUARED COMPRESSIVE STRENGTH AND UP TO 35 KP/CM SQUARED SHEARING STRENGTH AFTER 7 DAYS; SIMILARLY OUTSTANDING WAS ITS RESISTANCE TO ABRASION, FROST AND THAWING SALTS. ALL TYPES OF DAMAGE TO CONCRETE ROADS CAN THUS BE SATISFACTORILY AND PERMANENTLY REPAIRED; THE ADDITIONAL USE OF GLASS FIBER HAS ALSO PROVED USEFUL. /FG/RRL/

Buchholz, H *Inzenyrske Stavby /Czech/* 1967

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 216515

RUBBER AND POLYTETRAFLUOROETHYLENE AS CONSTRUCTION MATERIALS IN BRIDGE BUILDING
THE USE OF PLASTICS IN BRIDGE BUILDING IS DISCUSSED, WITH PARTICULAR REFERENCE TO POLYTETRAFLUOROETHYLENE, WHICH HAS EXCELLENT CHEMICAL, MECHANICAL, THERMAL AND ELECTRICAL PROPERTIES. THE AUTHOR DESCRIBES TESTS ON THE MATERIAL TO ASCERTAIN DEFORMATION BEHAVIOUR AND SLIDING PROPERTIES. THE MAIN DISADVANTAGE OF ALL THE PLASTIC MATERIALS TESTED WAS THEIR LOW COEFFICIENT OF FRICTION. /RRL/

Spaethe, G Mahlo, G *Strasse, Berlin /Germany/* Dec. 1966

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 216525

THE USE OF EPOXY RESIN IN CONSTRUCTION AND CIVIL ENGINEERING (IN FRENCH)

THE HIGH MECHANICAL STRENGTH OF EPOXY RESIN LED TO A REVIEW OF ITS MAIN USES WITH PARTICULAR REFERENCE TO THE GLUEING OF HARDENED CONCRETE TO HARDENED CONCRETE AS IN THE CASE OF BRIDGE SEGMENTS. IT FACILITATES THE RESUMPTION OF CONCRETING, HIGH STRENGTH SEALING, FILLING OF CRACKS AND POTHOLES, GLUEING OF ALL MATERIALS, AND WATERPROOFING OF ENGINEERING STRUCTURES (IN THIS CASE, COAL TAR PITCH IS ADDED TO EPOXY RESIN). /LCPC/RRL/

Winne, G

Revue Caoutchouc Et Plastiques /France/ Mar. 1968

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 216565

MATERIALS CONTROL IN HIGHWAY CONSTRUCTION

THE IMPORTANCE OF THE QUALITY, THE ECONOMICS AND THE CONTROL OF MATERIALS ARE STRESSED AND THE NEED FOR COMPETENT ENGINEERS AND TECHNICIANS IS DISCUSSED. FIELD CONTROL OF SOILS, BITUMINOUS MATERIALS AND CONCRETE IS CONSIDERED AND REFERENCES ARE MADE TO OFFSITE TESTING AND TO THE CONTROL OF STEELWORK AND WELDING. /RRL/

Sandberg, AC Strongman, FS *Inst Hwy Engineers Journal, London* /UK/ Oct. 1967

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 216589

QUALITY CONTROL IN CONCRETE ROAD CONSTRUCTION /IN FRENCH/

THE CONDITIONS NECESSARY TO ENSURE THE PRODUCTION OF HIGH-QUALITY CONCRETE ARE: PRELIMINARY CONTROL OF INGREDIENTS AND CONTINUOUS CONTROL DURING MANUFACTURE BY RECORDING PRODUCTION PARAMETERS. RECENT TESTS ON CONSTRUCTION SITES SHOW THAT IT IS POSSIBLE TO RECORD THE TEMPERATURE OF CEMENT AND WATER, TO RECORD THE WEIGHT OF AGGREGATES, CEMENT AND WATER IN A BATCH, AND TO EVALUATE THE CONSISTENCY OF CONCRETE AND REGULARITY OF PRODUCTION BY RECORDING THE ENERGY CONSUMPTION OF THE MIXER. RESULTS SHOW THAT IF CARE IS TAKEN IN OPERATING AND MAINTAINING THE EQUIPMENT, IT IS POSSIBLE TO OBTAIN A HIGH DEGREE OF REGULARITY IN PRODUCTION. TESTS CARRIED OUT ON SAMPLES SHOW A WIDE DISPERSION IN MEASUREMENTS ON FRESH CONCRETE. THIS DISPERSION DECREASES FOR RESULTS OF MECHANICAL TESTS ON HARDENED CONCRETE. /LCPC(A)/RRL/

Parey, C *Bull Liaison Labs Routiers* /France/ Dec. 1969

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 216764

EPOXY RESINS

THE NAME, ORIGIN, HISTORY, AND DEVELOPMENT OF EPOXY RESINS OVER THE LAST 20 YEARS ARE DESCRIBED. WHILE EARLY DEVELOPMENTS MADE USE OF THE PROPERTIES AS ADHESIVES, ELECTRICAL INSULATION, AND PROTECTIVE COATINGS, THESE RESINS ARE NOW USED EXTENSIVELY IN THE BUILDING INDUSTRY. TO USE THE EPOXY, THE COMPONENTS OF THE RESIN AND HARDENER MUST BE WELL MIXED AND THEN THE RESULTING LIQUID GRADUALLY GETS WARM, SOLIDIFIES, AND COOLS TO FORM A HARD, INFUSIBLE SOLID. /ACIJP/

Scales, GM

American Concrete Institute 1968

2A 216883

A MODERN BUILDING MATERIAL FROM ASPHALT AND SOIL

A PROCESS IS DESCRIBED FOR THE MANUFACTURE OF A NEW BUILDING MATERIAL FROM ASPHALT AND SOIL WHICH IS COMPETITIVE WITH CONVENTIONAL MASONRY PRODUCTS IN COMPRESSIVE, TENSILE, AND FLEXURAL STRENGTH, EXCELS IN WATER REPELLENCY AND FREEZE-THAW RESISTANCE, AND HAS LOW COST. THIS TYPE OF PRODUCT, KNOWN AS BMX, CAN BE MANUFACTURED WITHIN SUCH CLOSE TOLERANCE THAT VERY THIN (1/16-INCH) MORTARS CAN BE USED. THESE MORTARS, COMPOSED OF CEMENT, ORGANIC ADHESIVES, AND FILLERS, CAN BE APPLIED WITH PAINT ROLLERS, RESULTING IN SUBSTANTIALLY LOWER LABOR COSTS. THE HIGHER QUALITY PRODUCTS MADE FROM CAREFULLY SELECTED SOILS CAN BE USED BELOW GRADE WITHOUT WATER-PROOFING TREATMENT. THE PRODUCTS ARE COMPATIBLE WITH ALL TYPES OF WATER AND OIL-BASED PAINTS, AND BECAUSE OF LOW POROSITY ABSORB MUCH LESS PAINT THAN OTHER MASONRY PRODUCTS. DURABILITY TESTS, SOME OF WHICH HAVE BEEN IN PROGRESS FOR SEVEN YEARS, INDICATE A HIGH DEGREE OF STABILITY.

Rogers, DT Munday, JC

I & Ec Product Res & Dev Sept. 1969

2A 216911

QUALITY ASSURANCE IN HIGHWAY CONSTRUCTION-PART 5-SUMMARY OF RESEARCH FOR QUALITY ASSURANCE OF AGGREGATE

A REVIEW OF THE EVALUATION BY STATISTICAL TECHNIQUES OF HIGHWAY AGGREGATE CHARACTERISTICS IS PRESENTED AS A CONDENSED COMPILATION OF BOTH HISTORICAL DATA AND DATA FROM DESIGNED QUALITY-MEASUREMENT PROJECTS IN WHICH THE DEGREE OF CONFORMANCE TO SPECIFICATIONS WAS STATISTICALLY ESTIMATED. REPORTS FROM NINE STATES ON PROJECTS IN WHICH RESEARCH DATA HAVE BEEN OBTAINED ARE ABSTRACTED AND SUMMARIZED IN THIS COMPILATION TO ILLUSTRATE TRENDS IN GRADATION ANALYSIS, SAMPLING AND TESTING PROCEDURES, SAND EQUIVALENT ANALYSIS AS AN ALTERNATE TO GRADATION ANALYSIS, AND SOUNDNESS TESTS FOR AGGREGATE QUALITY. SPECIFICATIONS FOR BASE COURSE AGGREGATE USUALLY CONTAIN LIMITS FOR GRADATION, PLASTICITY, SOUNDNESS, AND AMOUNT OF DELETERIOUS MATERIAL. THE DEGREE OF CONFORMANCE TO GRADATION SPECIFICATIONS WAS FOUND TO VARY FROM STEP TO STEP IN THE PROCESSING. ANALYSIS OF VARIANCE WAS APPLIED DURING CONSTRUCTION TO DETERMINE CAUSES OF THE VARIATION AND TO LOCATE CONDITIONS NEEDING CORRECTIVE ACTION. FOR AGGREGATE CONTROL, THE SAND-EQUIVALENT TEST RATHER THAN GRADATION IS PREFERRED IN SOME STATES. AND STATISTICAL RESEARCH, CONDUCTED TO ASCERTAIN WHETHER THE SAND-EQUIVALENT TEST IS INFORMATIVE AND REPRODUCIBLE, HAS CONFIRMED ITS USEFULNESS, ALTHOUGH THE AMOUNT OF DATA AT PRESENT IS RATHER LIMITED. STATISTICAL RESEARCH ON SALT-SOUNDNESS DETERMINATION INDICATED THAT DRYING TIME DID NOT NEED TO BE CHANGED; THAT SODIUM SULPHATE TESTING COULD BE DISCONTINUED, AS MAGNESIUM SULPHATE TESTING IS SATISFACTORY; AND THAT IT IS POSSIBLE TO PLACE ACCEPTANCE OF FINE AGGREGATE SOURCES ON A SOUND STATISTICAL FOUNDATION. IN STATISTICALLY-ORIENTED RESEARCH ON AGGREGATE GRADATION FOR BITUMINOUS MIXTURES, INFORMATION SIMILAR TO THAT FOR BASE COURSES WAS DEVELOPED, AND INDICATED THAT VARIATION FROM THE SPECIFICATIONS DIFFERS ACCORDING TO THE POINT OF SAMPLING. THE RESEARCH ALSO INDICATED THAT SAMPLING AT THE HOT BINS WAS PREFERRED FOR PROCESS CONTROL, WHEREAS SAMPLING AT THE COMPACTED BITUMINOUS LAYER WAS BEST FOR ESTABLISHING UNIFORMITY OF THE MIXTURE. DATA INDICATED THAT AGGREGATE USED IN PORTLAND CEMENT CONCRETE HAD A SMALLER STANDARD DEVIATION

THAN THE AGGREGATE USED IN BITUMINOUS MIXTURES OR IN BASE COURSES, BUT THAT STATISTICAL ANALYSIS PROVIDED INFORMATION FOR EARLY DETECTION OF UNDESIRABLE GRADATION OR UNDESIRABLE QUALITY. THE USE OF STATISTICALLY DESIGNED CONTROL CHARTS IS HIGHLY RECOMMENDED FOR CONTROL OF THE CHARACTERISTICS OF AGGREGATE BY SOME STATES.

Kelley, JA *Public Roads, Us Bureau Public Roads* Oct. 1969

2A 217018

PROPOSED ACI STANDARD: SPECIFICATIONS FOR CAST-IN-PLACE NONREINFORCED CONCRETE PIPE

THESE SPECIFICATIONS ARE A REFERENCE STANDARD WHICH THE ENGINEER OR ARCHITECT MAY MAKE APPLICABLE TO ANY CAST-IN-PLACE PIPE PROJECT BY CITING THEM IN THE PROJECT SPECIFICATIONS. INDIVIDUAL CHAPTERS OR SECTIONS SHOULD NOT BE COPIED INTO PROJECT SPECIFICATIONS SINCE THEIR MEANINGS WILL BE CHANGED BY TAKING THEM OUT OF CONTEXT. THE SPECIFICATIONS NEED TO BE SUPPLEMENTED BY DESIGNATING OR SPECIFYING INDIVIDUAL PROJECT REQUIREMENTS. A LIST IS PROVIDED INDICATING PLACES IN THESE SPECIFICATIONS AND ITEMS THAT WILL REQUIRE SPECIFIC TREATMENT BY THE SPECIFICATION WRITER. /AUTHOR/

Am Concrete Inst Journal & Proceedings Apr. 1969

2A 217019

RECOMMENDATIONS FOR CAST-IN-PLACE NONREINFORCED CONCRETE PIPE

A GENERAL VIEW IS GIVEN OF PRESENT KNOWLEDGE TOGETHER WITH RECOMMENDATIONS FOR DESIGN, CONSTRUCTION, AND TESTING PROCEDURES. CONSTRUCTION SPECIFICATIONS ARE CONTAINED IN "SPECIFICATIONS FOR CAST-IN-PLACE NONREINFORCED CONCRETE PIPE." /AUTHOR/

Am Concrete Inst Journal & Proceedings Apr. 1969

2A 217076

HAVE YOU CONSIDERED WOOD FOR PROCESS SERVICE?

BECAUSE OF NEW ENGINEERING SKILLS, NEW MANUFACTURING TECHNOLOGIES, AND NEW IMPREGNANTS, WOOD HAS BEEN REESTABLISHED AS AN IDEAL MATERIAL FOR MANY DEMANDING CHEMICAL INDUSTRY SERVICES. THE DEPENDABILITIES OF STEEL, CONCRETE, AND WOOD USED AS CONSTRUCTION MATERIALS ARE COMPARED, AND IT IS DEMONSTRATED THAT TREATED WOOD HAS ADVANTAGES IN CORROSIVE ENVIRONMENTS. /MPP/

Hoffman, CH *Materials Protection* Mar. 1971

2A 217092

GENERAL MATERIALS

LITTLE WORK HAS BEEN DONE ON THE DEVELOPMENT OF QUALITY ASSURANCE AND ACCEPTANCE PLANS FOR GENERAL HIGHWAY CONSTRUCTION MATERIALS, INCLUDING BITUMINOUS MATERIALS, HYDRAULIC CEMENTS, STRUCTURAL STEEL, PAINTS, PIPES, POSTS AND GUARDRAILS. A NEED EXISTS FOR SUITABLE ACCEPTANCE PLANS SUCH AS THE REDUCED SAMPLING PLAN OF ASTM AND AASHTO.

Adam, V *Highway Research Board Special Reports* 1971

2A 217143

PLASTICS-RECENT DEVELOPMENTS IN PLASTICS SCIENCE AND TECHNOLOGY ARE REVIEWED

THE ARTICLE IS AN ANNUAL REVIEW OF THE LITERATURE IN PLASTICS, CHIEFLY FROM THE YEAR 1969. ABOUT 500 REFERENCES ARE GIVEN. THE MAJOR SUBHEADINGS ARE AS FOLLOWS: EDUCATION IN POLYMER SCIENCE AND TECHNOLOGY, PLASTIC STRUCTURES, PLASTIC CONTAINERS AND VESSELS, POLYMER COMPOSITIES, SHEET AND FILM, CELLULAR PLASTICS, PLASTIC PIPE, POLYMER COATINGS

AND ADHESIVES, SYNTHETIC FIBERS, ELASTOMERS, POLYMERS VERSUS WEATHER, POLYMERS VERSUS FLAME, POLYMERS VERSUS HEAT, POLYMERS VERSUS CORROSIVES, CHARACTERIZATION AND TESTING OF POLYMERS, PROGRESS IN POLYMER SCIENCE (THERMOPLASTICS, POLYAMIDES, POLYOLEFINS, POLYSTYRENE, POLYVINYL HALIDES), AND ASPHALT-ELASTOMER BLENDS FOR HIGHWAYS.

Seymour, RB *Industrial & Engineering Chemistry* Sept. 1970

2A 217149

EXPERIMENTS USING INFRA-RED PHOTOGRAPHY FOR NON-DESTRUCTIVE TESTING

THE USE OF INFRARED PHOTOGRAPHIC TECHNIQUES FOR NON-DESTRUCTIVE TESTING DURING HIGHWAY CONSTRUCTION AS A SUPPLEMENT TO EXISTING METHODS IS ADVOCATED AND SUPPORTED BY EVIDENCE FROM LABORATORY TESTS WHOSE METHODOLOGY AND CONDUCT ARE DESCRIBED. THE PORTION OF THE IR SPECTRUM TO WHICH COLOR AND B/W FILMS ARE SENSITIVE LIES IN A NARROW BAND JUST OUTSIDE THE VISIBLE RANGE. WITHIN THIS BAND FOUR KINDS OF IR RADIATION CAN BE RECORDED: FROM THE OBJECT ITSELF, FROM AN OBJECT BENEATH OR WITHIN THE FIRST OBJECT (TRANSMITTED RADIATION), SURFACE REFLECTANCE, AND PHOSPHORESCENCE. TWO HYPOTHESES WERE TESTED: (1) FOR A GIVEN MATERIAL, THE AMOUNT OF IR RADIATION IS A FUNCTION OF THE DENSITY OF THE MATERIAL AND (2) SIMILAR BUT UNLIKE MATERIAL WILL TRANSMIT DIFFERENT AMOUNTS OF IR RADIATION. ("MATERIAL" MEANS A HOMOGENEOUS MIXTURE OF SEVERAL CHEMICALLY DIFFERENT SUBSTANCES, SUCH AS PCC, ASPHALTIC CONCRETE, AND SOILS.) THE FIRST SET OF TESTS WAS MADE WITH SOIL SAMPLES TAKEN FROM NEW MEXICO SITES THAT WERE SUBSEQUENTLY PHOTOGRAPHED IN AERIAL OVERFLIGHTS. A SECOND SET OF SOILS TESTS EMPLOYED MODIFIED "PROCTOR" (T-180) MOLDS. ADDITIONAL SETS OF TESTS WERE RUN WITH ASPHALT AND CONCRETE. RESULTS AND CONCLUSIONS ARE PRESENTED. THE HYPOTHESES SEEM SUFFICIENTLY DEMONSTRATED TO JUSTIFY CONTINUED RESEARCH, INCLUDING IMMEDIATE USE OF SUCH EQUIPMENT AS A BOOM TRUCK AND CAMERA ON A CURRENT HIGHWAY PROJECT.

Goodman, AF

New Mexico University pp 40-49, 1970

2A 217159

ENGINEERING PROPERTIES OF MINE TAILINGS

THE ENGINEERING PROPERTIES OF TAILING FROM NINE MINES ARE SUMMARIZED TO DEMONSTRATE THAT THESE ARE GOOD ENGINEERING MATERIALS. SUCH PROPERTIES AS GRADATION, SPECIFIC GRAVITY, MINERAL CONTENT, LABORATORY MAXIMUM AND MINIMUM DENSITY, IN-PLACE DENSITY AND MOISTURE, PERMEABILITY, TRIAXIAL SHEAR DATA, AND ONE-DIMENSIONAL COMPRESSION DATA ARE PRESENTED IN GRAPHICAL AND TABULAR FORM. PRESENTED IS AN EXAMPLE OF TAILING USAGE IN CONSTRUCTING A 4-MILE SECTION OF INTERSTATE 90 NEAR KELLOGG, IDAHO, PROVING THAT TAILINGS CAN BE USED TO CONSTRUCT A MODERN HIGH-CAPACITY FREEWAY. THE THEORETICAL DESIGN OF A SMALL EARTH DAM IS ALSO GIVEN AS AN EXAMPLE THAT TAILINGS COULD BE USED TO BUILD A DAM WITH ADEQUATE FACTORS OF SAFETY. IT IS STRONGLY FELT THAT THE MATERIAL PROPERTIES PRESENTED WILL PROMOTE INTEREST IN THE EMPLOYMENT OF MINE TAILINGS IN FUTURE CONSTRUCTION PROJECTS FOR BOTH STRUCTURAL AND ENVIRONMENTAL REASONS. /AUTHOR/

Pettibone, HC Kealy, CD *Am Soc Civil Engr J Soil Mech Div* Sept. 1971

2A 217181

CRITICAL DEGREE OF SATURATION: A TOOL FOR ESTIMATING THE FROST RESISTANCE OF BUILDING MATERIALS

BY USING THE CONCEPT OF DEGREE OF SATURATION, THE DEFECTIVE CORRELATION BETWEEN THE RESULTS OF LABO-

RATORY EXPERIMENTS AND THE BEHAVIOR OF THE TESTED MATERIAL IN PRACTICE AND THE DIFFICULTIES OF THE CHOICE BETWEEN DIFFERENT MATERIAL WITH REGARD TO FROST RESISTANCE CAN BE PREVENTED TO A GREAT EXTENT. IT IS ALSO SHOWN HOW THIS CONCEPT CAN BE USED IN DEALING WITH THE FROST RESISTANCE OF A LAYERED CONSTRUCTION. A LABORATORY TEST FOR DETERMINATION OF FROST RESISTANCE IS DESCRIBED. /AUTHOR/

Fagerlund, G *Matls & Structures, Res & Testing /Fr/* Oct. 1971

2A 217204

WASTED SOLIDS (SOLID WASTE) AND PAVEMENT DESIGN
FEASIBILITY STUDIES CONCERNING THE POSSIBLE USES OF WASTED SOLIDS FOR THE IMPROVEMENT OF HIGHWAY AND STREETS WERE CONDUCTED DUE TO THE GROWING SHORTAGE OF GOOD NATURAL AGGREGATES PLUS THE PROBLEMS OF DISPOSITION OF SOLID WASTES--PARTICULARLY NON-BIODEGRABLE PRODUCTS. ANOTHER CONSIDERATION WAS THAT THE ORIGINAL COSTS OF THESE WASTED PRODUCTS ARE CONSIDERABLY HIGH. OF CONCERN WAS THE PRESENT FLEXIBLE PAVEMENT DESIGN AND MIXTURES WHICH HAVE ONLY LED TO PAVEMENT CRACKING--A STRESS RELIEVING INTERFACE WAS NEEDED. THE PRINCIPLE OF SELECTIVE DEWETTING WAS IMPLEMENTED TO INCREASE THE STRAIN CAPACITY OF MIXTURES. AGGREGATE COATED WITH PAPER PULP IN A COLD MIX MIGHT BE USED FOR SUPERIOR PERFORMANCE. ALL TYPES OF PAPER SOLIDS COULD BE USED. BEER BOTTLE PAVEMENTS, RUBBERIZED PAVEMENT, SCRAP PLASTIC PAVEMENT AND DRIED HORSE MANURE (DHM) STUDIES WERE PERFORMED IN THE LABORATORY TO DECREASE CRACKING OF THE SURFACE COURSE DUE TO THERMAL DISTRESS AND BASE OR FOUNDATION MOVEMENTS. CONSIDERING THE VARIOUS NEW METHODS FOR UTILIZATION OF WASTED SOLIDS, THE STRESS RELIEVING INTERFACE WAS DEVELOPED USING DONATED GROUND TIRES, EMULSION, SAND, ETC., OVERLAYING BASE MATERIAL. USED IN THIS WAY, PAVEMENT ANALOGS SHOW THAT THE STRESS RELIEVING INTERFACE (SRI) WILL IMPROVE A PAVEMENT SYSTEM OVER 400 PERCENT. IT IS PRIMARILY APPLICABLE TO MAINTENANCE OPERATIONS. GREATER IMPROVEMENT MAY BE ACHIEVED BY THE USE OF A FOUNDATION CRACK ARRESTER IMPLEMENTING A RUBBER-SAND INTERLOCKING LAYER WHICH UTILIZES SIDEWALL SECTIONS FROM DISCARDED TIRES ARRANGED IN A GRID PATTERN BETWEEN THE BASE AND SUBBASE. SCRAP PLASTIC WAS ALSO EXPLORED TO IMPROVE ADHESION AND COHESION BETWEEN BINDER AND AGGREGATE IN ASPHALTIC CONCRETE. SCRAP GLASS AS AN AGGREGATE CAN REDUCE THERMAL DISTRESS BY A FACTOR OF 2 EXCEPT IN WARM CLIMATES AND THE USE OF GROUND TIRES ADDED TO THE SURFACE COURSE OF FLEXIBLE PAVEMENT IMPROVES THE MECHANICAL AGING INDEX. A MEMBRANE, USING GROUND TIRES, CAN REDUCE REFLECTION CRACKING DUE TO BASE MOVEMENTS BY OVER 400 PERCENT.

Bynum, D *Public Works* Vol. 102 No. 11, Nov. 1971, pp 56-60, 4 Fig, 4 Ref

2A 217273

PROTECTIVE COATINGS FOR STRUCTURAL SYSTEMS
A COMPREHENSIVE REVIEW IS PRESENTED OF CURRENTLY USED MATERIALS AND APPLICATIONS FOR STRUCTURAL COATINGS. COATINGS FOR STEEL ARE IN THE MAIN SOLVENT-BASED, BUT IT IS PREDICTED THAT A HIGH PERCENTAGE OF COATINGS WILL BE WATER-BASED WITHIN 5 YEARS. AN ADVANTAGE OF 100% SOLIDS PRODUCTS, WATER-BASED, AND POWDER COATINGS IS THAT NO SOLVENT IS LIBERATED AT APPLICATION: IT IS ESTIMATED THAT SOLVENT FROM PAINTS LIBERATED TO THE ATMOSPHERE ACCOUNTS FOR 240,000 TONS OF POLLUTION PER YEAR IN ENGLAND. THE OTHER TOPICS ADDRESSED IN THE REVIEW ARE BINDERS (ALKYDS, POLYURETHANES, CHLORINATED RUBBER, EPOXIES, ACRYLICS, UNSATURATED POLYESTERS, AND COPOLYMERS OF BUTADIENE), VINYL, ELASTOMERIC COATINGS,

MODIFICATION OF RESINS, PIGMENTS, SURFACE PREPARATION, APPLICATION OF PAINT, EMULSION PAINTS, COATINGS FOR CONCRETE ETC., USE OF POLYURETHANES FOR MORTARS, HIGH-BUILD COATINGS, ZINC-RICH PRIMERS, SPECIALTY-COATING SUPPLIERS, AND ECONOMICS.

Lowrey, KW *Civil Eng & Public Works Review /UK/* Vol. 67 No. 795, Oct. 1972, pp 1059-67, 3 Tab, 6 Ref

2A 217366

STUDIES OF THE POSSIBLE USES OF A NEW PIECE OF APPARATUS FOR MEASURING THE MOISTURE CONTENT OF MINERAL, GRANULAR CONSTRUCTION MATERIALS
EQUIPMENT FOR MEASURING MOISTURE CONTENT WAS TESTED IN THE LABORATORY AND IN SITU TO DETERMINE ITS POSSIBLE USES. THE APPARATUS IS BASED ON THE PRINCIPLE OF DETERMINING THE DIELECTRIC CONSTANTS AND HIGH-FREQUENCY DAMPENING OF MOIST, GRANULAR MATERIALS IN THE SHORT WAVE RANGE. /TRRL/

Leers, KJ Roeger, K *Tonindustrie Zeitung /Germany/* Vol. 96 No. 4, 1972, pp 92-7, 12 Fig, 9 Tab, 2 Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

2A 217394

COMPRESSIVE STRENGTH ASSESSMENT OF ROAD MATERIALS

THE ROLE OF COMPRESSION TESTING IN ASSESSING THE POTENTIAL THAT GRANULAR MATERIALS HAVE FOR SERVICE AT A GIVEN DEPTH BELOW THE SURFACE OF A SEALED, SO-CALLED FLEXIBLE, ROAD IS DISCUSSED. THIS APPROACH AFFORDS AN OPPORTUNITY TO INTEGRATE DESIGN AND CONSTRUCTION PROCEDURES WITH MATERIAL SELECTED DECISIONS SO THAT MORE EFFICIENT USE MAY BE MADE OF LOCALLY OCCURRING NATURAL MATERIALS. EXPERIENCE GATHERED BY THE MAIN ROADS DEPARTMENT OF WESTERN AUSTRALIA RELATING TO THE USE OF A TEXAS TRIAXIAL TEST PROCEDURE IS PRESENTED. PARTICULAR REFERENCE IS MADE TO THE UTILIZATION OF THIS TEST FOR ASSESSING THE POTENTIAL OF MATERIAL FOR USE IN THE BASE COURSE (PAVEMENT LAYER) OF SEALED, RURAL ROADS. THE EXTENT TO WHICH THE RESULTS FROM THIS COMPRESSION TESTING PROCEDURE MAY PRESENTLY INFLUENCE DESIGN DECISIONS AND CONSTRUCTION PRACTICES APPLICABLE TO BASE COURSE MATERIAL IS DETAILED.

Hamory, G Mcinnes, DB
Australian Road Research Board Vol. 6 No. pt5, 1972, pp 143-65

2A 217406

MATERIALS INFORMATION. TECHNICAL INFORMATION ON MATERIALS FOR BUILDING AND CONSTRUCTION-SOURCES AND PRESENTATION

THE COLLOQUIUM WAS IN TWO PARTS. THE FIRST WAS A FORUM SESSION ENTITLED "INFORMATION NEEDED," IN WHICH THE FOLLOWING PAPERS WERE PRESENTED: INFORMATION NEEDED BY MATERIALS PRODUCERS, C. E. HINGLEY; INFORMATION NEEDED BY BUILDERS MERCHANTS, E. M. TATLOW; INFORMATION NEEDED BY ARCHITECTS, H. V. LOBB; INFORMATION NEEDED BY GOVERNMENT, J. P. GRIFITHS; INFORMATION NEEDED BY LOCAL AUTHORITIES, A. T. MORRIS; INFORMATION NEEDED BY CONSULTING ENGINEERS, R. A. SEFTON-JENKINS; INFORMATION NEEDED BY CONTRACTORS, L. J. MURDOCK; THE SECOND HALF OF THE COLLOQUIUM WAS ENTITLED "INFORMATION PROVIDED: AND THE PAPERS PRESENTED WERE AS FOLLOWS: INFORMATION PROVIDED BY COLLEGES OF EDUCATION, F. GIBBONS; INFORMATION PROVIDED BY THE ROAD RESEARCH LABORATORY, P. E. MONGAR; INFORMATION PROVIDED BY THE BUILDING RESEARCH STATION; J. W. RICE; INFORMATION PROVIDED BY BUILDING CENTERS, G. GOULDEN; INFORMATION PROVIDED BY INFORMATION CONSULTANTS, E. CORKER. /TRRL/

Hingley, CE Tatlow, EM Lobb, HV Griffiths, JP
Proc Soc Chem Industry /UK/ Vol. 197 133 pp, 5 Fig, 7 Phot, 10 Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

2A 217423

MOISTURE MEASUREMENTS IN PAVEMENT USING ELECTRICAL RESISTIVITY METHODS

AN ELECTRICAL RESISTIVITY SOIL MOISTURE GAUGE HAS BEEN INVESTIGATED AS A MEANS FOR MEASURING MOISTURE VARIATIONS WITHIN PAVEMENTS. A DESCRIPTION OF THE GAUGE AND ASSOCIATED INSTRUMENTATION IS PRESENTED TOGETHER WITH AN EXAMPLE OF ITS USE IN EXAMINING THE WETTING OF MODELLED ROAD SHOULDERS BY WATER SHED FROM THE SEAL. CALIBRATION CURVES OF GAUGE RESPONSE WITH MOISTURE CONTENT SUGGEST THAT THE ELECTRICAL RESISTIVITY TECHNIQUES DESCRIBED ARE SUFFICIENTLY RELIABLE FOR MONITORING THIS VARIABLE UNDER CONTROLLED TEMPERATURE AND SALINITY ENVIRONMENTS. /AUTHOR/

McInnes, DB *Australian Road Research* Vol. 4 No. 10, Dec. 1972, pp 69-78, 4 Fig, 3 Tab, 1 Phot, 12 Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/IRRD 205 716, 2C34305716

2A 217426

REACTIONS OF AGGREGATES INVOLVING SOLUBILITY, OXIDATION, SULFATES, OR SULFIDES

THIS REPORT COVERS AVAILABLE INFORMATION ON REACTIONS INVOLVING SOLUBILITY OR OXIDATION OF AGGREGATES WHILE THEY ARE ENCLOSED IN CONCRETE AND REACTIONS INVOLVING RELEASE OF SULFATES OR SULFIDES FROM AGGREGATES ENCLOSED IN CONCRETE. EXPERIENCE INDICATES THAT THESE PHENOMENA MAY CREATE LOCAL PROBLEMS THAT USUALLY TAKE THE FORM OF UNSIGHTLY CONDITIONS ON CONCRETE CONSTRUCTION, SUCH AS STAINING OR SPORADIC SPALLING AND POP-OUT FORMATION. RELIABLE METHODS FOR DETECTING DELETERIOUSLY REACTIVE FORMS OF FERROUS SULFIDES IN MINERAL AGGREGATES WOULD BE A WORTHWHILE ADDITION TO TESTING PROCEDURES IN AREAS WHERE THESE MINERALS HAVE BEEN FOUND TO BE OF SIGNIFICANCE IN THE PERFORMANCE OF CONCRETE. /AUTHOR/

Mielenz, RC *Highway Research Record, Hwy Res Board* 1963

2A 217431

A DURABILITY TEST FOR AGGREGATES

A LABORATORY QUALITY CONTROL TEST HAS BEEN DEVELOPED TO MEASURE THE MECHANICAL DURABILITY OF CALIFORNIA AGGREGATES IN TERMS OF A DURABILITY INDEX. THE DEGRADATION TEST WAS DEVELOPED TO MEASURE THE BREAKDOWN OF AGGREGATE THAT WOULD OCCUR DURING CONSTRUCTION AND UNDER NORMAL TRAFFIC. THE EQUIPMENT AND PROCEDURES USED ARE SIMILAR TO THOSE OF THE SAND EQUIVALENT AND CLEANNESS VALUE TESTS. THE TEST RESULTS ARE CORRELATED WITH THE BEHAVIOR OF THE AGGREGATES IN THE FIELD.

Hveem, FN Smith, TW *Highway Research Record, Hwy Res Board* 1964

2A 217434

SYNTHETIC AGGREGATES FOR HIGHWAY CONSTRUCTION

A STUDY WAS MADE TO IDENTIFY EXISTING AND POTENTIAL MATERIALS SUITABLE FOR PRODUCING SYNTHETIC AGGREGATES, TO CONCEIVE NEW METHODS OF PRODUCING SUCH AGGREGATES, AND TO EVALUATE THE PRESENT AND FUTURE PROSPECTS FOR THEIR USE IN HIGHWAY CONSTRUCTION. A LARGE NUMBER OF EXISTING AND POTENTIAL SYNTHETIC AGGREGATES WERE IDENTIFIED. SEVERAL MANUFACTURED OR BY-PRODUCT MATERIALS, SUCH AS LIGHT-WEIGHT AGGREGATES AND BLAST-FURNACE SLAG, CURRENTLY ARE USED AS AGGREGATES. OTHER BY-PROD-

UCT OR WASTE MATERIALS THAT MIGHT BE USED AFTER MINOR MECHANICAL PROCESSING INCLUDE A NUMBER OF CERAMIC WASTES, VARIOUS INDUSTRIAL SLAGS AND CLINKERS DEMOLITION WASTES, AND SCRAP IRON OR STEEL. POTENTIAL METHODS WERE CONSIDERED FOR PRODUCING NEW SYNTHETIC AGGREGATES BY SINTERING OR FUSING SUCH FINE-GRAINED NATURAL MATERIAL AS SAND, CLAY, OR SOIL, OR SUCH WASTE MATERIALS AS STEEL-FURNACE DUSTS OR MINING WASTES, OR BY CHEMICAL OR THERMOCHEMICAL PROCESSING OF MIXTURES SUCH AS THOSE OF SAND AND LIME OR FLY ASH AND LIME. THE ANNUAL TOTAL CONSUMPTION OF AGGREGATES HAS NOW REACHED 1.5 BILLION TONS AND IS EXPECTED TO INCREASE AS MUCH AS 50 PERCENT IN THE NEXT TEN YEARS. THE MOST SIGNIFICANT FUTURE DEVELOPMENT MAY BE THE USE OF JOB-SITE MATERIALS FOR MAKING SYNTHETIC AGGREGATES IN VERSATILE AND PORTABLE PROCESSING EQUIPMENT OR THE ESTABLISHMENT OF A WIDESPREAD SYNTHETIC AGGREGATE INDUSTRY WHICH PROCESSES WIDELY AVAILABLE MATERIALS SUCH AS CLAYS AND SHALES.

Fondriest, FF Snyder, MJ *Highway Research Board Nchrp Reports* 1964

2A 217439

EFFECTS OF DIFFERENT METHODS OF STOCKPILING AGGREGATE INTERIM REPORT

THE EFFECTS OF DIFFERENT METHODS OF CONSTRUCTING AND RECLAIMING AGGREGATE STOCKPILES WERE MEASURED. ELEVEN FULL-SCALE STOCKPILES WERE CONSTRUCTED AND RECLAIMED BY METHODS COMMONLY USED BY THE INDUSTRY. THE OVERALL VARIANCE OF THE GRADATION OF THE AGGREGATE IN THE OUTPUT OF THESE STOCKPILES WAS MEASURED IN TERMS OF A SINGLE NUMBER RELATED TO THE SURFACE AREA AND VOIDAGE OF THE AGGREGATE AND EXPRESSES THE RELATIVE COARSENESS OF AN AGGREGATE GRADATION, AND THE PERCENTAGES PASSING THE STANDARD SIEVES. A SEGREGATION INDEX WAS OBTAINED BY DIVIDING THE OVERALL VARIANCE BY THE WITHIN-BATCH VARIANCE. IN GENERAL, IT IS REPORTED THAT SEGREGATION WAS MINIMIZED WHEN THE STOCKPILES WERE FORMED BY SPREADING AGGREGATES IN THIN LAYERS AND RECLAIMING THEM WITH A FRONT-END LOADER.

Highway Research Board Nchrp Reports 1964

2A 217449

SYNTHETIC AGGREGATES FROM CENTRAL ALABAMA

THIS REPORT IS CONCERNED WITH EVALUATING THE CLAY MINERALS IN THE PRAIRIE REGION OF ALABAMA AS POTENTIAL SOURCES OF MANUFACTURED OR SYNTHETIC LIGHT-WEIGHT AGGREGATES OF STRUCTURAL QUALITY FOR USE AS HIGHWAY, BRIDGE, AND BUILDING CONSTRUCTION MATERIALS. IT PRESENTS: /1/ A DISCUSSION OF THE GEOLOGY ASSOCIATED WITH THE PRAIRIE REGION OF THE STATE AND THE LOCATION AT WHICH EACH OF THE PRELIMINARY EVALUATION SAMPLES WAS OBTAINED. /2/ A DETAILED EXPLANATION OF THE TEST PROCEDURES USED IN EVALUATING THE SUITABILITY OF THESE RAW MATERIALS FOR ROTARY KILN PRODUCTION OF CONSTRUCTION AGGREGATES. /3/ A SUMMARY OF THE PRELIMINARY TEST DATA TOGETHER WITH AN EVALUATION FOR EACH OF THE 80 CLAY MINERAL SAMPLES INCLUDED IN THIS INVESTIGATION. /4/ A FURTHER EVALUATION OF NINE CLAY MINERAL SAMPLES SELECTED AS BEING AMONG THE MORE PROMISING FOR PRODUCING STRUCTURAL QUALITY AGGREGATES. /5/ A COMPREHENSIVE EVALUATION OF THE MOST PROMISING CLAY MINERAL, IDENTIFIED AS SUCARNOOCHEE /PORTERS CREEK/ CLAY, IN THE GENERAL AREA OF YORK, ALABAMA. THIS EVALUATION INCLUDES AN ECONOMIC STUDY OF THE FACTORS RELATING TO THE ESTABLISHMENT OF AN AGGREGATE PRODUCING PLANT AT YORK. A STUDY OF EXPANDED SUCARNOOCHEE /PORTERS CREEK/ CLAY FOR USE AS AN AGGREGATE IN PORTLAND CEMENT CONCRETE, ASPHALT

CONCRETE, AND SOIL-AGGREGATE BASE. IT IS CONCLUDED THAT THE PORTERS CREEK CLAY CAN BE USED TO MAKE A SATISFACTORY AGGREGATE FOR THE THREE PURPOSES STUDIED. /BPR/

Stephenson, HK Lawrence, JM Laney, CA Sellers, JD
Alabama University

ACKNOWLEDGMENT:

2A 217470

DURABILITY OF SHALES AS DETERMINED BY LABORATORY TEST

RESEARCH WAS CONDUCTED TO DETERMINE IF ANY OF THE SHALE DEPOSITS IN PENNSYLVANIA ARE SUITABLE FOR USE AS GRANULAR MATERIAL IN HIGHWAY CONSTRUCTION, AND (IF ANY ARE SUITABLE) TO DEVELOP A SIMPLE FIELD TEST FOR IDENTIFYING THESE SHALES. SAMPLES OF SHALES WERE SELECTED FROM SITES THROUGHOUT THE STATE. PHYSICAL TESTS WERE PERFORMED ON THE SHALES AND ON SELECTED SOUND AGGREGATES; THE TEST DATA INDICATE THREE OF THE SHALES MAY BE SUITABLE FOR USE AS GRANULAR MATERIAL IN HIGHWAY CONSTRUCTION. THE MOST DURABLE SHALES AS INDICATED BY THE TESTS, ARE THOSE THAT ARE DOLOMITIC, HAVE HIGH BULK SPECIFIC GRAVITY AND GENERALLY LOW ABSORPTION VALUES. FURTHER STUDY IS NEEDED TO OBTAIN SOME REALLY CONCLUSIVE RESULTS, THUS THERE WILL BE A SECOND PHASE TO THIS RESEARCH PROJECT. /AUTHOR/

Smith, RW Reidenover, DR Dishong, FG
Pennsylvania Department Highways Apr. 1967

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4653212 67)PB 176 983, 1C35021098

2A 217473

STABILIZATION OF POOR QUALITY AGGREGATE

THE DESIGN, CONSTRUCTION AND EVALUATION OF A 7 1/2 MILE PROJECT FEATURING PORTLAND CEMENT, LIME AND ASPHALT EMULSION STABILIZATION OF A POOR QUALITY AGGREGATE ARE DESCRIBED. BASE THICKNESSES OF 6, 8, AND 10 INCH STABILIZED BY 2, 4 OR 9 PERCENT CEMENT, 1.5, 2.5 OR 5.5 PERCENT ASPHALT EMULSION, OR 3 PERCENT LIME WERE STUDIED. THE EFFECTS OF DELAYED COMPACTION ON THE PERFORMANCE OF SEVERAL LIME TREATED AND CEMENT MODIFIED (2 OR 4 PERCENT CEMENT) AGGREGATE BASES WERE ALSO STUDIED. PERFORMANCE OF THE BASES WAS EVALUATED BY PLATE BEARING AND BENKELMAN BEAM TESTS, ROUGHOMETER TESTS, CRACK SURVEYS, AND MAINTENANCE REQUIRED. IT WAS CONCLUDED THAT: (1) CEMENT-TREATED POOR QUALITY AGGREGATE PRODUCES AN ADEQUATE BASE COURSE, (2) CEMENT MODIFIED BASES CONTAINING MORE THAN 4 PERCENT CEMENT, BUT NOT ENOUGH CEMENT TO PASS THE FREEZE-THAW TESTS, PERFORMED AS WELL AS SOIL-CEMENT BASES AND WERE LESS EXPENSIVE, (3) SOIL-CEMENT MIXTURES SHOULD BE COMPACTED IMMEDIATELY AFTER MIXING, (4) ASPHALT EMULSION PRODUCED NO APPRECIABLE BENEFITS AND (5) LIME, AT THE RATE OF 3 PERCENT, PRODUCED SIGNIFICANT BENEFITS WHEN USED IN A TEN INCH BASE. /BPR/

Korfhage, GR
Minnesota Department of Highways, Bureau of Public Roads /US/ Bpr
No 178, 1967

ACKNOWLEDGMENT: Bureau of Public Roads /US/

2A 217510

A CRITICAL STUDY OF THE QUALITY TESTING OF STONE USED IN ROAD CONSTRUCTION

TEST METHODS FOR DETERMINING THE QUALITY OF STONE USED IN HIGHWAY CONSTRUCTION ARE EXAMINED WITH A VIEW TO FINDING THE SIMPLEST AND MOST ADAPTABLE PROCEDURES FOR TESTS CARRIED OUT IN QUARRIES OR AT CONSTRUCTION SITES. TESTS ON THE ROCK ITSELF AND ON

THE CRUSHED MATERIAL ARE CONSIDERED. THE STUDY BEARS ON THE MAIN STANDARDIZED METHODS OF VARIOUS COUNTRIES, AND IN EACH CASE REFERENCES OF THE DOCUMENTS CONSULTED ARE GIVEN.

Dantinne, R Longueville, P
Memoires Du C.E.R.E.S., Liege /Belgium/ May 1965

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 217511

NEW SYNTHETIC AGGREGATES FOR ROAD CONSTRUCTION /IN RUSSIAN/

THE TECHNIQUE USED IN THE LABORATORY AND FACTORY IS DESCRIBED FOR PRODUCING A NEW SYNTHETIC AGGREGATES (KERAMDOR) MADE FROM NON-EXPANDED FIRED CAMBRIAN CLAY OR SANDY CLAYEY SILT. THE CHIPPINGS OBTAINED ARE NOT SUSCEPTIBLE TO FROST, ARE NON-POROUS, RESISTANT TO WEAR, AND HAVE A HIGH CRUSHING STRENGTH AND ADHERE WELL TO BITUMEN. BITUMINOUS MIXES CONTAINING 35 PERCENT CHIPPINGS, 45 PERCENT SAND, 20 PERCENT FILLER AND 6 PERCENT BITUMEN OFFER THE CHARACTERISTICS OF HIGH QUALITY ASPHALTIC CONCRETE, AND ARE MUCH QUICKER TO PREPARE. AND EXPERIMENTAL SECTION OF FLEXIBLE PAVEMENT WAS BUILT IN 1964 AND ITS PERFORMANCE IS STUDIED. THE COSTS OF PRODUCTION ARE MENTIONED. /LCPC/RRL/

Bukhaev, V *Avtomobil Nye Dorogi /Ussr/* Apr. 1966

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 217526

THE STABILITY OF AGGREGATES USED IN ROAD SUB-BASES
THE PROPERTIES OF ELEVEN TYPICAL AGGREGATES ECONOMICALLY AVAILABLE IN THE MIDLANDS FOR SUB-BASE CONSTRUCTION, ARE COMPARED WITH THE MINISTRY OF TRANSPORTS SPECIFICATION /1963/ FOR TYPE I GRANULAR SUB-BASE. IT IS SHOWN THAT CRUSHER RUN ROCK AGGREGATES GENERALLY DO NOT COMPLY WITH THE SPECIFICATION, BECAUSE THEIR FINES /NO. 200 B.S. SIEVE/ ARE PLASTIC. EXPERIMENTS INVESTIGATING THE INFLUENCE OF THE FINES CONTENT AND PLASTICITY ON THE STABILITY OF SOME CRUSHED STONE AGGREGATES ARE DESCRIBED. THE RESULTS INDICATE THAT A FINES CONTENT OF BETWEEN 4% AND 8% GIVES MAXIMUM STABILITY TO AGGREGATES COMPACTED TO DENSITIES ACHIEVED WITH MODIFIED A.A.S.H.O. COMPACTION. THIS, AND PRACTICAL CONSIDERATIONS SUGGEST THAT SUCH AGGREGATES ARE LIKELY TO PERFORM MOST SATISFACTORILY UNDER ADVERSE CONDITIONS, ALTHOUGH IT IS SHOWN THAT AGGREGATES HAVING NO FINES PASSING THE NO. 200 B.S. SIEVE MAY HAVE VERY HIGH STABILITY IF COMPACTED TO A HIGH DENSITY. TESTS ALSO INDICATE THAT THE HIGHEST STABILITY IS OBTAINED IF THE MATERIAL PASSING A NO. 36 SIEVE HAVE LOW PLASTICITY. IT IS SUGGESTED THAT THE MINISTRY OF TRANSPORT SPECIFICATION FOR TYPE I SUB-BASE MAY BE IMPROVED BY SPECIFYING A FINENESS INDEX /%PASSING NO. 200 PLASTICITY INDEX/ AS A MEANS OF CONTROLLING THE PROPERTIES OF THE FINES CONTENT. A VALUE OF 40 WOULD BE SUITABLE, AND CARRYING OUT PLASTICITY TESTS ON MATERIAL PASSING THE NO. 36 SIEVE INSTEAD OF ON FINES PASSING THE NO. 200 SIEVE. /RRL/

Dunn, CS *Roads & Road Construction, London /UK/* Mar. 1966

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 217557

IMPORTANCE OF PETROGRAPHIC ANALYSIS AND SPECIAL TESTS NOT USUALLY REQUIRED IN JUDGING QUALITY OF CONCRETE SAND

THE DIFFICULTIES ENCOUNTERED IN THE CONCRETE CONSTRUCTIONS OF A LARGE AND IMPORTANT HYDROELECTRIC PLANT ARE DESCRIBED. THE SAND AND GRAVEL AGGREGATES FROM AN APPROVED BUT PREVIOUSLY UNDEVELOPED

OPED DEPOSIT, WHEN PROPERLY PROCESSED, MET ASTM SPECIFICATION REQUIREMENTS. INVESTIGATIONS DISCLOSED THAT THE HIGH WATER REQUIREMENT AND VERY RAPID EARLY STIFFENING CHARACTERISTICS OF JOB CONCRETES WERE CAUSED BY THE SAND. DURING HANDLING AND TRANSPORTING THE SAND AND PLACING AND MIXING THE CONCRETE, THE SAND SUFFERED SEVERE DEGRADATION, THE VERY HIGH PERCENTAGE OF FINES THUS CREATED CONTAINED AN UNUSUALLY LARGE PROPORTION OF MONTMORILLONIOD /SWELLING/ CLAY MINERALS. IT APPEARS THAT SIMILAR DIFFICULTIES ON OTHER JOBS ARE NOT UNCOMMON. A SPECIAL ATTRITION TEST EMPLOYED IN A LATER VERY EXTENSIVE LABORATORY INVESTIGATION IS DESCRIBED. THIS TEST OR A SIMILAR ONE FOR SANDS IS RECOMMENDED, IN ADDITION TO THE STANDARD ASTM REQUIREMENTS. THE IMPORTANCE OF A THOROUGH PETROGRAPHIC EXAMINATION OF SAND FROM A POTENTIAL SOURCE OF CONCRETE AGGREGATES, INCLUDING THE NATURE OF THE FINES CREATED BY THE SPECIAL ATTRITION TEST, IS STRONGLY AFFIRMED. /AUTHOR/

Davis, RE Mielenz, RC Polivka, M *Journal Materials* Sept. 1967

2A 217559

AN IMPROVED PARTICLE INDEX TEST FOR THE EVALUATION OF GEOMETRIC CHARACTERISTICS OF AGGREGATES

PARTICLE INDEX TESTS ON FINE AGGREGATES HAVE INDICATED THAT THE RESULTS OF THESE TESTS REFLECT THE DISCERNIBLE GEOMETRIC CHARACTERISTICS OF THESE MATERIALS, AND THAT THE VALUES FOR THE NATURAL SANDS AND THE STONE SANDS ARE IN GOOD AGREEMENT, RESPECTIVELY, WITH THE GENERAL RANGES OF PARTICLE INDEX VALUES FOR THE GRAVEL AND CRUSHED STONE MATERIALS. THE RESULTS OF PARTICLE INDEX TESTS ON AGGREGATE MIXTURES INVOLVING PARTICLES OF DIFFERENT GEOMETRIC FEATURES HAVE SHOWN THAT THE INDEX VALUE OF A MIXTURE VARIES MORE OR LESS LINEARLY WITH THE PERCENTAGES OF THE TYPES OF PARTICLES IN THE MIXTURE, INDICATING THAT THE PARTICLE INDEX REFLECTS THE AVERAGE GEOMETRIC CHARACTERISTICS OF THE INDIVIDUAL PARTICLES COMPRISING THE THE SAMPLE. THE RESULTS OF THE ANGULARITY TEST, SHAPE FACTOR TEST, AND TIME INDEX TEST HAVE INDICATED THAT THEY ARE ALL RELATED TO THE PARTICLE INDEX VALUES OF THE AGGREGATE SAMPLES TESTED. HOWEVER, THE FACT THAT THE PARTICLE INDEX TEST MAY BE APPLIED TO A WIDER RANGE OF AGGREGATE MATERIALS THAN THE OTHER TESTS INDICATES ITS VERSATILITY AND SUPERIORITY AS A USEFUL TOOL FOR IDENTIFYING THE GEOMETRIC CHARACTERISTICS OF MINERAL AGGREGATES FOR PAVEMENT PURPOSES. /AUTHOR/

Huang, EY

Michigan Technological University 54 pp, July 1965

2A 217560

AN EXAMPLE OF THE USE OF AN INDUSTRIAL BY-PRODUCT: THE APPLICATION TO ROAD-MAKING TECHNIQUES OF THE REJECTS FROM THE ENRICHMENT OF CALCAEROUS IRON ORE AT METZANGE IN LORRAINE LORRAINE IRON ORE HAS AN IRON CONTENT OF AROUND 30 PER CENT. THE OPERATION OF ENRICHING BY MAGNETIC SEPARATION GIVES REJECTS OF GRANULARITY 0/2 MM., WHOSE WATER CONTENT IS NEGLIGIBLE. WORK HAS BEEN CARRIED OUT IN DIFFERENT LABORATORIES WITH A VIEW TO MAKING USE OF THESE REJECTS, AND THIS WORK HAS MADE IT POSSIBLE TO DETERMINE THE AVERAGE CHARACTERISTICS OF THIS MATERIAL. ITS USE FOR ROADMAKING PURPOSES SEEMS TO BE ESPECIALLY INDICATED, IN PARTICULAR IN THE FORM OF MIXTURES WITH GRANULATED SLAG (RECOMMENDED CATALYST : LIME). A SMALL EXPERIMENTAL WORKING SITE SET UP IN 1965 IN A STEEL WORKS AND IS THE SUBJECT OF A DETAILED REPORT. MEASUREMENTS OF

DEFLECTIONS, AND CORE SAMPLINGS, WERE FAVORABLE. /AUTHOR/

Ponteville, P *Bull Liaison Labs Routiers /France/* July 1967

2A 217576

CRUSHED STONE: PRODUCTION AND GRADATION

IT IS PREDICTED THAT A MILLION TONS PER DAY OF CRUSHED LIMESTONE AND DOLOMITE FOR ROADSTONE AND CONCRETE WILL BE REQUIRED TO SATISFY THE PROJECTED DEMAND FOR EACH OF THE NEXT SEVERAL YEARS. THE EQUIPMENT REQUIRED TO HANDLE THIS TERRIFIC AMOUNT OF CRUSHED MATERIAL IS DISCUSSED. THE INVESTMENTS IN PRODUCTION EQUIPMENT AND PLANT SITES NECESSARY TO MEET THE CURRENT DEMAND FOR CRUSHED STONE CAN BE ESTIMATED TO BE IN THE BILLIONS OF DOLLARS. IT IS POSSIBLE BY VARYING THE SIEVE SIZES AND THE AMOUNTS OF MATERIALS PASSING A GIVEN SIEVE TO OBTAIN EITHER AN AGGREGATE CONTAINING ESSENTIALLY A SINGLE SIZE OR ONE HAVING A BALANCED COMBINATION OF DECREASING SIZES WHICH IS COMMONLY TERMED DENSE GRADED, THE MOST COMMON TYPE OF CRUSHED STONE PRODUCED FOR CONCRETE OR HIGHWAY WORK. THE SIMPLIFIED PRACTICE RECOMMENDATION (SPR) WAS INITIATED IN 1948 BY THE BUREAU OF PUBLIC ROADS: (1) TO DEVELOP A MINIMUM NUMBER OF STANDARD AGGREGATE GRADATIONS THAT CAN BE UNIFORMLY ADOPTED NATIONWIDE FOR GENERAL USAGE, WHILE AT THE SAME TIME, RECOGNIZING THE NEED FOR SOME VARIATION BY SPECIAL PROVISIONS TO FIT LOCALLY AVAILABLE MATERIALS, (2) TO ACHIEVE UNIFORMITY IN THE NUMBER AND SIZES OF SIEVES TO BE USED IN SPECIFYING THE AGGREGATE GRADATIONS, AND (3) TO DEVELOP AND ADOPT A SIMPLE AND UNIFORM SYSTEM FOR IDENTIFICATION OF THE STANDARD AGGREGATE GRADATIONS. WITH THE ADDITION OF SAND SIZES AND MINERAL FILLERS, THE SPR COULD ADEQUATELY DESCRIBE THE MAJORITY OF CRUSHED AGGREGATES USED IN CONCRETE AND HIGHWAY CONSTRUCTION. PLOTS ARE PRESENTED OF GRADATION CURVES FOR DENSE GRADED BASE AGGREGATES FOR SEVERAL STATES. A UNIFORM METHOD OF DESCRIBING AGGREGATES HAS NOT BEEN ADOPTED AND THIS IS THE STUMBLING BLOCK IN THE PATH TO UNIFORMITY FOR AGGREGATE GRADATIONS.

Copas, TL

National Limestone Institute 1967

2A 217596

ENGINEERING AND RELATED PROPERTIES OF PULVERISED FUEL ASH

LABORATORY INVESTIGATIONS ARE DESCRIBED ON THE SELF-HARDENING CHARACTERISTICS OF ASHES FROM DIFFERENT SOURCES AND THE VARIATION OF THESE CHARACTERISTICS IN ASHES TAKEN FROM THE SAME SOURCE AT DIFFERENT TIMES. SELF-HARDENING HAS BEEN RELATED TO FREE LIME CONTENT. THE INFLUENCE OF DEGREE OF COMPACTION AND COMPACTING MOISTURE CONTENT ON SELF-HARDENING IS ALSO CONSIDERED. LABORATORY STUDIES ARE COMPARED WITH FIELD EXPERIENCE. LABORATORY INVESTIGATIONS OF THE STABILIZATION OF PULVERIZED FUEL (P. F.) ASHES WITH CEMENT AND LIME ARE DESCRIBED ALONG WITH A STUDY OF THE FROST SUSCEPTIBILITY CHARACTERISTICS OF UNSTABILIZED AND STABILIZED ASHES USING THE ROAD RESEARCH LABORATORY FROST TEST. A DESCRIPTION IS THEN GIVEN OF THE SUCCESSFUL USE OF FINE AND COARSE P. F. ASH IN ROAD CONSTRUCTION WORK IN WARWICKSHIRE. /AUTHOR/

Sutherland, HB Finlay, TW Cram, IA *Inst Hwy Engineers Journal, London /UK/* June 1968

2A 217604

THE RELATION BETWEEN LOS ANGELES ABRASION TEST RESULTS AND THE SERVICE RECORDS OF COARSE AGGREGATES

IN GENERAL, IT APPEARS THAT THERE IS A DEFINITE RELATION BETWEEN THE LOSS IN THE LOS ANGELES ABRASION TEST AND THE SERVICE RECORD OF MATERIALS USED IN CONCRETE, BITUMINOUS CONSTRUCTION, AND SURFACE TREATMENT. ON THE BASIS OF THE DATA AVAILABLE, THE FOLLOWING PERCENTAGES OF WEAR APPEAR TO BE SUITABLE FOR USE IN SPECIFICATIONS TO CONTROL THE QUALITY OF COARSE AGGREGATES: CONCRETE 50%, BITUMINOUS SURFACING 40%, SURFACE TREATMENT 40%. DEFINITE CORRELATIONS BETWEEN THE LOSS IN THE LOS ANGELES TEST AND THE STRENGTH OF CONCRETE ARE FOUND, NAMELY, THE LOWER THE PERCENTAGE OF WEAR, THE HIGHER THE CONCRETE STRENGTH. DEFINITE CORRELATIONS ARE ALSO FOUND WITH THE RESULTS OF A CIRCULAR TRACK ROLLER TEST AND A TEST FOR SOFT OR FRIABLE PIECES. IT APPEARS THAT THE LOS ANGELES TEST GIVES ACCURATE INDICATION OF THE QUALITY OF THE MATERIAL UNDER TEST, AND THAT ITS USE IN SPECIFICATIONS CONTROLLING THE ACCEPTANCE OF COARSE AGGREGATE IS WARRANTED. /AUTHOR/

Woolf, DO *Highway Research Board Proceedings* 1937

2A 217623

QUALITY MATERIALS FOR HIGHWAY CONSTRUCTION THE REASONS FOR HAVING SPECIFICATIONS ON AGGREGATES FOR HIGHWAY CONSTRUCTION ARE DISCUSSED AND IMPROVEMENTS FOR PRESENT SPECIFICATIONS ARE SUGGESTED.

Mather, B *Purdue University Road School Proc* Dec. 1958

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 217632

DISTRIBUTION, PRODUCTION, AND ENGINEERING CHARACTERISTICS OF AGGREGATES
THIS SECTION OF THE HANDBOOK DEALS WITH SUCH SUBJECTS ON AGGREGATES AS: TYPES AND DEFINITIONS OF RELATED TERMS, ORIGIN, DISTRIBUTION IN NORTH AMERICA, PROPERTIES, USES AND GENERAL REQUIREMENTS IN HIGHWAY CONSTRUCTION, PRODUCTION SPECIFICATIONS, AND METHOD OF TESTING.

Mc, LAUGHLIN JF Woods, KB Mielenz, RC Rockwood, NC *Highway Engineering Handbook* 1960

ACKNOWLEDGMENT: Highway Research Board, Annotated Bibliography

2A 217638

ASTM STANDARDS ON MINERAL AGGREGATES AND CONCRETE
ALL STANDARDS PREPARED BY COMMITTEE C-9 ARE INCLUDED FOR CONCRETE AND CONCRETE AGGREGATES, BUT ONLY THOSE FOR SELECTED NON-BITUMINOUS HIGHWAY MATERIALS, OR THOSE INVOLVING AGGREGATE GRADINGS OR TESTS, DEVELOPED BY COMMITTEE D-4. PERTINENT SPECIFICATIONS OF CEMENT ARE INCLUDED WHICH ARE UNDER THE JURISDICTION OF COMMITTEE C-1 ON CEMENT.

American Society Testing & Materials Dec. 1962

ACKNOWLEDGMENT: Highway Research Board, Annotated Bibliography

2A 217639

A CORRELATION OF PUBLISHED DATA ON LIME-POZZOLAN-AGGREGATE MIXTURES FOR HIGHWAY BASE COURSE CONSTRUCTION
ALL AVAILABLE INFORMATION PERTAINING TO LIME-FLY-ASH- AGGREGATE MIXTURES IS CORRELATED.

Hollon, GW Marks, BA *Illinois Univ Eng Exp Sta Circulars* 1962

ACKNOWLEDGMENT: Highway Research Board, Annotated Bibliography

2A 217640

A TEST FOR EVALUATING THE GEOMETRIC CHARACTERISTICS OF COARSE AGGREGATE PARTICLES
A TEST METHOD IS DESCRIBED BY WHICH THE GEOMETRIC CHARACTERISTICS, EMBRACING SHAPE, ANGULARITY, AND SURFACE TEXTURE OF COARSE AGGREGATES MAY BE QUANTITATIVELY EVALUATED. THE TEST HAS BEEN DEVELOPED AS AN OUTGROWTH OF AN EXTENSIVE INVESTIGATION IN WHICH AN ATTEMPT WAS MADE TO DEVISE A SIMPLE PROCEDURE FOR THE EVALUATION OF COARSE AGGREGATES FOR USE IN SOIL-AGGREGATE ROAD CONSTRUCTION. THE RESULTING TEST VALUE IS EXPRESSED AS THE PARTICLE INDEX OF THE AGGREGATE.

Huang, EY *American Soc Testing & Materials Proc* 1962

ACKNOWLEDGMENT: Highway Research Board, Annotated Bibliography

2A 217670

MECHANICALLY STABILIZED ROAD COURSES-FROST BLANKET COURSES-ROAD BASES /IN GERMAN/
CONTENTS: IMPORTANCE OF MINERAL CONCRETE IN ROAD CONSTRUCTION, A. BOHRINGER. TECHNOLOGY AND TESTING OF MINERAL CONCRETE, K.F. HENKE. MANUFACTURE AND USE OF MINERAL CONCRETE, A. SCHAFFER. MECHANICALLY STABILIZED ROADBASE IN ROAD CONSTRUCTION IN VIENNA, R. WRANA. THE PLACEMENT AND COMPACTION OF MINERAL MIXTURES IN ROAD CONSTRUCTION, E. SCHUTTE.

Schriften-reihe Naturstein Str /Ger/ 1967

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 217679

IN DEFENCE OF AGGREGATES /IN FRENCH/
THE IMPORTANCE IS EMPHASIZED OF AGGREGATE QUALITY IN ROAD CONSTRUCTION. THE COST OF IMPROVING AGGREGATES WOULD AFFECT ONLY VERY SLIGHTLY THE COST OF THE COMPLETED WORK AND WOULD INCREASE THE DURABILITY OF THE ROAD. THE FOLLOWING IMPROVEMENTS ARE RECOMMENDED: (1) HOMOGENEITY, RATIONALIZATION AND STANDARDIZATION OF AGGREGATE PRODUCTION TOGETHER WITH THOROUGH GRADING, (2) POSSIBILITY OF SELECTING CRUSHED SAND WITH HIGH CONTROLLED FINES CONTENT OR WASHED SAND WITH FILLER ADDED WHEN NECESSARY. (3) CONTROL AND CORRECTION OF MOISTURE CONTENT, ESPECIALLY IN SAND. PRELIMINARY TREATMENT WITH WATER-REPELLANT PRODUCTS AND PROTECTION OF SAND DURING STORAGE WITH PLASTIC FILMS ARE RECOMMENDED. AND (4) SYSTEMATIC SUPPLY OF AGGREGATES, ADEQUATELY LAID OUT STORAGE SPACE, AND EFFICIENT QUALITY CONTROL. /LCPC/RRL/

Durrieu, J *Bull Liaison Labs Routiers /France/* Aug. 1968

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 217683

RESULTS OF LABORATORY STUDIES ON THE USE OF FLY-ASH IN THE CONSTRUCTION OF PAVEMENT LAYERS /IN FRENCH/
AFTER BRIEFLY RECALLING THE ORIGIN AND PROPERTIES OF FLY-ASH, RESULTS ARE PRESENTED OF A STUDY PERFORMED IN 1963 AND 1964 AT THE LCPC CONCERNING: (1) THE USE OF THE POZZOLANIC PROPERTIES OF FLY-ASH FOR THE TREATMENT OF DUNE SAND AND SILT, AND (2) THE USE OF FLY-ASH AND AGGREGATE OR BASIC CONSTRUCTION MATERIAL. THE POZZOLANIC ACTION OF FLY-ASH RESULTS IN IMPROVED APPTITUDE FOR COMPACTION. ATTENTION IS DRAWN TO THE FACT THAT SINCE THE ABOVE TESTS WERE CARRIED OUT, THE USE OF FLY-ASH IN ROAD CONSTRUCTION HAS INCREASED CONSIDERABLY, AND FORMULAE FOR USE HAVE BECOME MORE NUMEROUS. SPECIAL MENTION IS MADE OF THE USE OF FAT LIME, IN PREFERENCE TO CEMENT, FOR THE TREATMENT OF FLY-ASH. /LCPC/RRL/

Legrand, JC Bonnot, J *Revue Gen Des Routes & Aerodr /France/* Jan. 1968

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 217684

A NEW CONSTRUCTION MATERIAL: SLAGGERAM A STRUCTURAL CLAY PRODUCT WITH A SLAG BASE. VISIT TO THE BISRA LABORATORIES /IN FRENCH/
RESEARCH CARRIED OUT IN GREAT BRITAIN INTO THE USE OF BLAST-FURNACE SLAG IN THE MANUFACTURE OF VIBRO-CRYSTALLINE MATERIALS UTILIZED IN THE CONSTRUCTION INDUSTRY IS REVIEWED. THE SLAGGERAM, FOR WHICH A PATENT HAS BEEN APPLIED IN FRANCE, IS OBTAINED BY FUSION AT 1500 DEGREES C AND THEN THERMAL TREATMENT OF A MIXTURE COMPOSED OF ABOUT 100 KG SLAG, AND 30 KG SAND, AND 1 TO 10 KG OXIDES WHICH FACILITATES DENITRIFICATION. ACCORDING TO THE TYPE OF FUSION, THE SLAGGERAM PRODUCED CAN BE COMPACT WITH A DENSITY OF 3.0 OR EXPANDED (DENSITY 1.0 TO 1.5). COMPACT SLAGGERAM CAN BE USED FOR SLABS, TILES, AND CHIPPINGS FOR HARD SURFACINGS. /LCPC/RRL/

Laitiers & Tarmacadam, Paris /Fr/ 1968

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 217685

NEW TRENDS IN THE USE OF GRANULATED SLAGS IN ROAD CONSTRUCTION /IN FRENCH/
SAND-GRAVEL-SLAG AND SAND-SLAG ARE DEFINED AS MIXTURES PREPARED IN THE MIXING PLANT WITH A HIGH PROPORTION OF FRESHLY MANUFACTURED GRANULATED SLAG ACTIVATED WITH FAT LIME. THE TREATMENT OF PAVEMENT LAYER AGGREGATES WITH BLAST-FURNACE SLAG MIXTURES RESULTS IN HIGH HOMOGENEITY DUE TO THE HIGH PROPORTION OF BINDER, GREAT ACCURACY IN THE GRADING AND ANGULARITY OF THE AGGREGATE, IMPERVIOUSNESS TO WATER AND FROST, VERY SLOW SETTING RATE DURING EARLY AGE, AND PROGRESSIVE HARDENING. A REVIEW IS PRESENTED OF THE VARIOUS PARAMETERS WHICH INFLUENCE THE COMPRESSIVE AND TENSILE STRENGTH OF THE MIXTURES: PROPORTIONING AND QUALITY OF GRANULATED SLAG, MINERALOGICAL COMPOSITION AND GRADING OF AGGREGATES, PROPORTIONING AND QUALITY OF THE FAT LIME, CURING TIME AND TEMPERATURE, AND DENSITY AND INTENSITY OF COMPACTION. THE TWO BASIC QUALITIES OF TREATMENT PAVEMENT LAYERS: HOMOGENEITY AND COMPACTION ARE EMPHASIZED TOGETHER WITH THE CONDITIONS NECESSARY FOR OBTAINING THEM: GOOD GRADING CURVE, SMALL MAXIMUM DIMENSION, ADEQUATE ANGULARITY AND HARDNESS OF THE SAND-GRAVEL, SELECTION OF GRANULATED SLAG WITH GOOD HYDRAULIC PROPERTIES, HIGH-QUALITY FAT LIME, TYPE OF MIXING PLANT AND WELL EQUIPPED COMPACTION PLANT. SOME TECHNICAL AND ECONOMIC RESULTS ARE QUOTED. /A/LCPC/RRL/

Prandi, ME *Ann Inst Tech Batiment Trav Publ /Fr/* Feb. 1968

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 217687

THE USE OF RESIDUE LEFT AFTER CURSHING IN QUARRIES IN ROAD CONSTRUCTION /IN RUSSIAN/
RESULTS OF INVESTIGATIONS INTO THE PETROGRAPHIC, CHEMICAL, AND PHYSICO-CHEMICAL PROPERTIES OF CRUSHED STONE SAND OBTAINED FROM VOLCANIC ROCK IN FINE CRUSHING PLANTS IN THE UKRAINE ARE PRESENTED. THIS TYPE OF SAND IS EITHER FLAT OR ANGULAR IN SHAPE, CONTAINS 10 TO 17 PER CENT OF CLAYEY-SILT (0.46 TO 2.80 PER CENT CLAY), AND CAN ONLY BE USED IN ROAD CONSTRUCTION, IF TREATED. EXPERIMENTAL RESULTS ARE GIVEN SHOWING THE POSSIBLE USE OF CRUSHED STONE SAND IN PAVEMENT LAYERS, IN CONCRETE, ASPHALTIC CONCRETE,

AND RAILWAY BALLAST. CRUSHED STONE SAND CAN BE USED IN CONCRETE IF MIXED WITH NATURAL SAND. THE GRADING OF CRUSHED STONE SAND/NATURAL SAND MIXTURES MUST COMPLY WITH GOST SPECIFICATIONS 10.268-62 FOR FINE AGGREGATES. IF PART OF THE FINE NATURAL SAND IN CONCRETE IS REPLACED BY COARSE CRUSHED STONE SAND, THE MECHANICAL STRENGTH OF 28-DAY-OLD CONCRETE INCREASES BY 10 TO 20 PER CENT. THE ECONOMIC ASPECT OF THE USE OF CRUSHED STONE SAND IS CONSIDERED. /LCPC/RRL/

Myshkovskaya, SA Musatova, MP *Trudy Soyuzdornii /Ussr/* 1967

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 217694

AN INVESTIGATION INTO THE METHODS OF SELECTING SHALES FOR PAVEMENT CONSTRUCTION
THE EXPERIMENTAL WORK COMPLETED IS SUMMARIZED IN A PROJECT INVESTIGATING THE BEHAVIOR OF 'LOW GRADE AGGREGATES', I.E. PRINCIPALLY SHALES, ON BEHALF OF THE DEPARTMENT OF MAIN ROADS IN NEW SOUTH WALES. SAMPLES WERE TAKEN FROM 50 SHALE DEPOSITS AS WELL AS FROM SECTIONS OF PAVEMENT IN WHICH THE MATERIALS WERE IN USE. THE SHALES WERE SUBJECTED TO DETAILED EXAMINATIONS, WHEREIN CORRELATIONS WERE SOUGHT BETWEEN THE MINERALOGICAL COMPOSITIONS, RESISTANCES TO CHEMICAL AND PHYSICAL WEATHERING AND MECHANICAL BREAKDOWN, AND PERFORMANCES OF THE PAVEMENTS. THE RESULTS WERE USED TO DEVELOP A LABORATORY TESTING PROCEDURE FOR DISTINGUISHING SOUND VARIETIES OF SHALE. STABILIZATION WITH CEMENT WAS SUGGESTED FOR CORRECTING HIGH PLASTICITY RESULTING FROM THE INCORPORATION IN THE PAVEMENTS OF SOIL AND WEATHERING MATERIALS FROM THE QUARRIES. /AUTHOR/RRL/

Croft, JB *Australian Road Research Board Proc* 1966

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 217702

SUITABILITY AND QUALITY TESTS FOR ROAD CONSTRUCTION AGGREGATES. PART 1-PROBLEMS AND REQUIREMENTS; PART 2- SAMPLING; PART 3-THE QUALITY CONTROL TEST METHODS /IN GERMAN/
A DISTINCTION IS MADE BETWEEN SUITABILITY TESTS, CARRIED OUT ON MATERIALS BEFORE APPLICATION, AND QUALITY TESTS TO DETERMINE PROPERTIES DURING AND AFTER APPLICATION. ALL THESE TESTS ARE BASED ON STANDARDS, GUIDES, RECOMMENDATIONS AND SPECIFICATIONS. AGGREGATES ARE TESTED FOR GRADING, PARTICLE SHAPE, PURITY AND STRENGTH. DETAILS ARE GIVEN OF PERTINENT QUALITY TESTING METHODS AND THESE ARE ILLUSTRATED BY EXAMPLES. /FG/RRL/

Schutte, E *Strassenbautechnik, Cologne /Ger/* 1968

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 217703

STRENGTH REQUIREMENTS OF AGGREGATES FOR ROAD CONSTRUCTION /IN GERMAN/
A PROPOSAL FOR THE STRENGTH REQUIREMENTS OF AGGREGATES IS PREPARED. IMPACT STRENGTH TESTS, TESTS OF RESISTANCE TO DYNAMIC STRESS IN THE TEST DRUM, AND RESISTANCE TO PRESSURE WERE RECOMMENDED AS TEST METHODS TO SUPPLEMENT THOSE ALREADY IN EXISTENCE. THESE TESTS WERE TO BE CARRIED OUT ON BOTH DENSELY GRADED MIXTURES AND THOSE HAVING A HIGH CONTENT OF VOIDS. DETAILED PROPOSALS ARE MADE REGARDING THE REQUIREMENTS OF AGGREGATES FOR ROAD CONSTRUCTION DEPENDING ON CLASS OF TRAFFIC LOADING, THUS ENABLING AVAILABLE MATERIAL TO BE MORE EXPERTLY EVALUATED THAN HITHERTO. /FG/RRL/

Kunath, H
Natursteinindustrie, Offenbach /Ger/ 1969

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 217715
BLAST FURNACE SLAG AGGREGATES FOR CONCRETE /IN FRENCH/

THIS BIBLIOGRAPHY DEALS WITH THE USE OF BLAST-FURNACE SLAG AGGREGATES FOR CONCRETE, USED ON THEIR OWN OR MIXED. APPLICATIONS TO THE BUILDING INDUSTRY AND ROAD CONSTRUCTION ARE LISTED. /LCPC/RRL/

D.G.R. Documentation /France/ Apr. 1969

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 217766
PRELIMINARY INVESTIGATIONS OF PERMACRETE
ULTIMATE FLEXURAL STRENGTH AND CERTAIN CREEP PROPERTIES OF SINGLE-SIZE SOIL-MATERIAL AGGREGATES CEMENTED BY ICE ARE INVESTIGATED. THE RELATION OF ULTIMATE STRENGTH TO PARTICLE SIZE AND TEMPERATURE IS GIVEN IN THE FORM OF GRAPHS. RULES FOR MIXING VARIOUS SIZES ARE ESTABLISHED, AND THEIR VALIDITY TESTED UNDER FIELD CONDITIONS. EXPERIMENTAL CONSTRUCTION IN PERMACRETE (ARTIFICIAL CONCRETE-AGGREGATE MIXTURES CEMENTED BY ICE) DISCLOSED THAT IT SHOULD BE APPLIED AND HANDLED LIKE CONCRETE, PROVIDING THE TEMPERATURE IS BELOW THE FREEZING POINT. PERMACRETE, ALTHOUGH DISSIMILAR TO CONCRETE IN MANY IMPORTANT PROPERTIES, MAY BE USED SUCCESSFULLY AS A BUILDING MATERIAL IN PLACE OF CONCRETE. ITS LOW COST AND THE AVAILABILITY OF INGREDIENTS CAN MAKE PERMACRETE AN IMPORTANT BUILDING MATERIAL IN PERMAFROST REGIONS. /AUTHOR/

Swinzow, GK *Crrrel Technical Reports, Army Dept /US/ 1965*

2A 217767
FLY ASH UTILIZATION-SYMPOSIUM
CONTENTS: OPENING REMARKS, GERARD C. GAMBS AVAILABILITY, QUALITY, AND PRESENT UTILIZATION OF FLY ASH, C. E. BRACKETT SPECIFICATIONS, LIMITATIONS, AND RESTRICTIONS, M. JACK SNYDER RAW MATERIALS FOR MANUFACTURE OF CEMENT, WILLIAM R. BARTON PRODUCING SPECIFICATION FLY ASH, HENRY C. SKAGGS PROBLEMS IN FLY ASH MARKETING, F. V. ZIMMER FLY ASH IN MASS CONCRETE, ROBERT E. PHILLEO FLY ASH IN READY-MIX CONCRETE, EDWARD J. HYLAND FLY ASH IN ROADWAY CONSTRUCTION, J. A. HESTER FLY ASH IN CONCRETE AND CONCRETE BLOCK MANUFACTURING, JOSEPH R. BELOT JR. FLY ASH IN CONCRETE MANUFACTURING, JOHN SEABRIGHT LIME-FLY ASH-AGGREGATE MIXTURES, ERNEST J. BARENBERG THE UNITED NATIONS ECONOMIC COMMISSION FOR EUROPE AND ITS WORK IN THE FIELD OF THE UTILIZATION OF ASH PRODUCED BY THERMAL POWER PLANTS, ZYGMUNT FALECKI AN ATTEMPT TO EXPLAIN FRENCH SUCCESS IN THE UTILIZATION OF FLY ASH, ADOLPHE JARRIGE THE COMMERCIAL UTILIZATION OF PULVERIZED FUEL ASH FROM POWER STATIONS OF THE CENTRAL ELECTRICITY GENERATING BOARD, HENRY W. G. DEDMAN ASH PRODUCTION AND UTILIZATION IN THE GERMAN FEDERAL REPUBLIC, HERMANN ERYTHROPEL PRODUCTION AND UTILIZATION OF FLY ASH IN POLAND, ANTONI PAPROCKI FLY ASH IN CEMENTS AND CONCRETES, DE. VLADIMIR V. STOLNIKOV EXPERIENCE IN PRODUCTION AND UTILIZATION OF LIGHTWEIGHT AGGREGATE AT CONSOLIDATED EDISON, ARTHUR S. PEARSON STATUS REPORT ON BRICKS FROM FLY ASH, H. E. SHAFER, JR. CONSUMER ECONOMICS: USE OF FLY ASH IN CONCRETE, LOU HOY FLY ASH IN AGRICULTURE, JOHN P. CAPP UTILIZATION OF FLY ASH IN THE CEMENTING OF WELLS, DWIGHT K. SMITH USE OF FLY ASH IN SPECIALIZED CONCRETE WORK, GEORG O. BERGEMANN, JR. FUTURE OF FLY ASH USE, GLYNN L. CORYELL ECONOMIC COMMISSION FOR EUROPE MEETING SUM-

MARY, HENRY W. G. DEDMAN NUCLEAR MEASUREMENT OF CARBON IN FLY ASH, ROBERT F. STEWART AND WILLIAM F. FARRIOR, JR. ASTM SPECIFICATIONS ON FLY ASH FOR USE IN CONCRETE, RICHARD C. MIELENZ REACTIONS ON HYDRATED LIME WITH PULVERIZED COAL FLY ASH, L. JOHN MINNICK FLY ASH AND THE ELECTRIC UTILITY INDUSTRY, JOHN A. TILLINGHAST THE PUBLIC CONCERN FOR ENVIRONMENTAL IMPROVEMENT, KENNETH HOLUM FLY ASH IN THE FUTURE, JOSEPH PURSGLOVE, JR.

Faber, JH Capp, JP Spender, JD
Interior Department /US/ Mar. 1967

2A 217798
AGGREGATES ON TIME, ALL THE TIME

A TECHNIQUE IS DESCRIBED IN WHICH ONE LARGE PORTABLE STONE PLANT IN WEST TEXAS, LAST YEAR CRUSHED A LARGE TONNAGE OF ROAD AGGREGATES, MAKING SIX MOVES, AND EVERY TON ON SCHEDULE. THE PLANT IS DESIGNED WITH A COMBINATION OF UNITS TO PROVIDE HIGH HOURLY TONNAGES AND FLEXIBILITY TO BEAT VARYING ROCK CONDITIONS WHILE DELIVERING ONE OR MORE GRADES OF TEXAS STATE HIGHWAY SPECIFICATION MATERIAL. THE CRUSHING PLANT ASSEMBLY IS PIECED TOGETHER TO MEET VARYING SPECIFICATIONS, USING A COMBINATION OF UNITS AVAILABLE TO GIVE THE CAPABILITY TO COPE WITH ALL TYPES OF CALICHE AND ANY OTHER ROCK TYPE. AT ALL LOCATIONS, THE 1968 PRODUCTION WAS KEPT CLOSE TO THE PLANT'S LIMIT, 5 DAYS A WEEK 10 HOURS DAILY, THE SIXTH DAY IS NORMALLY DEVOTED TO PLANT MAINTENANCE, BUT WAS AVAILABLE IN PART FOR CATCH-UP PRODUCTION IN THE EVENT OF BAD WEATHER OR BREAKDOWN. DIAGRAMMATIC SKETCHES ARE PRESENTED OF PLANT SET-UP. DAILY PRODUCTION WAS SCHEDULED TO BE 5 THOUSAND TONS OF 2-INCH MINUS FLEXIBLE BASE MATERIAL.

Williams, DM *World Construction* Sept. 1969

2A 217799
SYMPOSIUM ON THE SELECTION AND CONSTRUCTION OF BASE MATERIALS IN ROADS
CONTENTS: INTRODUCTORY REMARKS, SIR LOUIS LODER. DISCUSSION OF CURRENT CRITERIA AND SPECIFICATIONS. AN EVALUATION OF CRITERIA FOR SELECTION OF PAVEMENT BASE COURSE MATERIALS IN WESTERN AUSTRALIA, D.B. MCINNES, CONDENSATION OF R. J. JEWELL'S REPORT. REVIEW OF TESTS AND PROCEDURES, J. R. MORGAN. ENGINEERING SIGNIFICANCE OF RECENT STUDIES, H. M. BEAVIS. DISCUSSION NOTES ON THE MODIFIED TEXAS TRIAXIAL TEST METHOD, J. D. BUTORAC. GENERAL CRITERIA REQUIRED OF ROAD PAVEMENT MATERIALS, D. T. CURRIE. DISCUSSION, A. H. GAWITH CONCLUSION, SIR LOUIS LODER.

Australian Road Research Board Bulletin Oct. 1969

2A 217808
SYNTHETIC AGGREGATES FOR ASPHALT CONCRETE MIXES
THE FINDINGS REPORTED HEREIN FURNISH THE HIGHWAY CONSTRUCTION INDUSTRY WITH BASIC DESIGN CRITERIA FOR THE INCLUSION OF SYNTHETIC AGGREGATES IN ASPHALTIC CONCRETE MIXES AS WELL AS LABORATORY AND FIELD TEST DATA SUPPORTING FAVORABLE PERFORMANCE OF THIS NEW AGGREGATE USED AS A SUBSTITUTE FOR NATURAL AGGREGATES. THIS REPORT ALSO POINTS UP A VERY MEANINGFUL CHARACTERISTIC OF LIGHTWEIGHT SYNTHETIC AGGREGATES, NAMELY, THE FRICTION TEXTURED CHARACTERISTICS ARE SUPERIOR TO NATURAL AGGREGATES. EXTENSIVE FIELD DATA PRESENT AMPLE PROOF THAT LIGHTWEIGHT AGGREGATE USED AS THE COARSE AGGREGATE FRACTION IN BITUMINOUS MIXES PROVIDES LONG LASTING HIGH SKID RESISTANCE. /AUTHOR/

Hargett, ER Gallaway, BM Scott, WW
Texas Transportation Institute Oct. 1969

2A 217833

A RECOMMENDED SYNTHETIC COARSE AGGREGATE CLASSIFICATION SYSTEM (REVISED AUGUST, 1969)

RESEARCH WAS CONDUCTED ON SYNTHETIC AGGREGATES FOR HIGHWAY USE. A REVISION IS PRESENTED OF THE RECOMMENDED SYNTHETIC AGGREGATE CLASSIFICATION SYSTEM FOR HIGHWAY CONSTRUCTION, BASED ON THE RESULTS OF THE RESEARCH STUDIES. THIS CLASSIFICATION SYSTEM IS NOT INTENDED TO REPLACE OR SUPPLANT EXISTING REQUIREMENTS FOR SYNTHETIC AGGREGATES IN HIGHWAY CONSTRUCTION, BUT IS OFFERED AS A SUPPLEMENT TO EXISTING AGGREGATE REQUIREMENTS. THE DRY LOOSE UNIT WEIGHT IS USED AS A QUALITY ACCEPTANCE CRITERIA. IT IS RECOMMENDED THAT THE DRY LOOSE WEIGHT DETERMINATION BE MADE IN ACCORDANCE WITH TEX-404-A, EXCEPT THAT THE AGGREGATES SHALL BE TESTED IN AN OVEN-DRY CONDITION. THE SAMPLES SHALL CONSIST OF THE ONE-HALF TO NO. 4 FRACTION AND SHALL HAVE 30-70 PERCENT BY WEIGHT RETAINED ON THE 3/8 INCH SIEVE. EXAMINATION OF THE TEXAS HIGHWAY DEPARTMENT AGGREGATE GRADATION SPECIFICATIONS FOR PORTLAND CEMENT CONCRETE, SEAL COATS AND HOT MIX ASPHALT PAVEMENTS REVEALS THAT A MAJOR PORTION OF THE AGGREGATE SKELETON WILL BE INCLUDED WITHIN THIS SIZE RANGE. COARSE SYNTHETIC AGGREGATE IS DIVIDED INTO TWO CLASSES AND EACH CLASS IS SUBDIVIDED INTO THREE GROUPS OF DESCENDING PHYSICAL REQUIREMENTS. THE MAXIMUM UNIT WEIGHT VALUES USED FOR GROUP 1 (55 PCF) WERE TAKEN FROM ASTM DESIGNATION C330-64T. IN ORDER TO DELINEATE GROUP 2 FROM GROUP 1, THE MINIMUM UNIT WEIGHTS FOR GROUP 2 WERE SET AT 55 PCF. THE USE OF THE 35 PCF MINIAL WEIGHT FOR GROUP 1 IS TO ENSURE THAT ONLY STRUCTURAL QUALITY COARSE AGGREGATES WILL BE USED. A TABLE IS PRESENTED SHOWING THE PERMISSIBLE COARSE AGGREGATE GROUP DEFINED FOR EACH HIGHWAY FUNCTION, FROM SURFACE TREATMENT TO BASE MATERIALS.

Ledbetter, WB Galloway, BM Moore, WM Buth, E
Texas Transportation Institute Aug. 1969

2A 217840

THE PLACE OR POINT AND CONDITIONS OF ACCEPTANCE OF CONSTRUCTION AGGREGATES

THE PROBLEM OF THE ACCEPTANCE OF CONSTRUCTION AGGREGATES IS REVIEWED. PRODUCERS TAKE GREAT CARE TO MAINTAIN SEGREGATION OF AGGREGATES AT THEIR PLANT. ASSUMING THAT THE CONTRACTOR IS HANDLING THE TRANSPORTATION, THE QUARRY PRODUCERS' RESPONSIBILITY SHOULD END ONCE THE AGGREGATE IS PROPERLY LOADED FOR SHIPMENT FROM APPROVED PILES AND THE INSPECTION TICKET ISSUED AT THE QUARRY. CONTRACTORS MUST TAKE CARE TO AVOID SEGREGATION, DEGRADATION, AND CONTAMINATION AT THEIR PLANTS. CHANGES IN GRADATION CAN ALSO OCCUR WHEN AGGREGATES ARE ROLLED IN TO GRADE. DESPITE THE HIGH QUALITY OF AGGREGATE AS SHOWN BY THE LOS ANGELES ABRASION AND SOUNDNESS TEST MADE ON SAMPLES TAKEN AT THE SOURCE OF PRODUCTION, RESULTS OBTAINED ON SAMPLES FROM A STOCKPILE IN A COMMERCIAL PLANT YARD INDICATED AN AVERAGE OF OVER 9% PASSING THE SIEVE, RATHER THAN LESS THAN 3% AS SPECIFIED. SPECIFICATION REQUIREMENTS RELATIVE TO MATERIALS ARE GENERALLY TO BE CONSIDERED AS APPLYING TO THE MATERIALS IMMEDIATELY BEFORE THEY ARE MIXED WITH OTHER MATERIALS OR SO PROCESSED THAT THEIR CHARACTERISTICS ARE CHANGED. THE AASHO GUIDE SPECIFICATIONS FOR HIGHWAY CONSTRUCTION PROVIDES FOR THE ACCEPTANCE OF MATERIALS ON THE BASIS OF SAMPLES TAKEN AND TESTED DURING THE PRODUCTION, DELIVERY, AND IMMEDIATELY PRIOR TO INCORPORATION AND THE WORK. IT ALSO PROVIDES FOR ACCEPTANCE OF MATERIALS ON THE BASIS OF REASONABLY CLOSE UNIFORMITY.

Limestone, Nat Limestone Institute 1968

2A 217842

INVESTIGATION OF STRUCTURAL GRADE EXPANDED SUCARNOOCHEE (PORTER'S CREEK) CLAY AS HIGHWAY CONSTRUCTION AGGREGATE

AN INVESTIGATION WAS MADE OF THE PROPERTIES OF SOIL AGGREGATES BASE AND ASPHALT CONCRETE BASE USING EXPANDED CLAY AS THE COARSE AND FINE AGGREGATE. THE EXPANDED CLAY WAS MANUFACTURED IN A ROTARY KILN AT TEMPERATURES OF 1700 F, 1850 F, AND 1990 F. ABRASION AND SOUNDNESS TESTS, ALONG WITH COMPRESSIVE STRENGTH DETERMINATIONS, WERE PERFORMED ON AGGREGATES FIRED AT THESE TEMPERATURES. SOIL AGGREGATES BASE MIXES USING A TYPICAL LOCAL NATURAL BINDER WERE INVESTIGATED FOR CBR PROPERTIES. ASPHALT CONCRETE BASE MIXES WERE INVESTIGATED FOR MARSHALL STABILITY AND FLOW PROPERTIES, AMONG OTHERS. THE RESULTS OF THESE INVESTIGATIONS SHOWED THAT THE EXPANDED CLAY FIRED AT 1850 F HAD THE BEST STRUCTURAL PROPERTIES, AND THAT GOOD TO EXCELLENT CBR'S COULD BE OBTAINED FROM THE SOIL AGGREGATES BASE MIXES. MARSHALL STABILITY VALUES FOR THE ASPHALT CONCRETE MIXES WERE GENERALLY TWO TIMES THE VALUE FOR SIMILAR NATURAL HARD ROCK MIXES. THE OTHER MARSHALL PROPERTIES OF FLOW, AIR VOIDS, AND VMA WERE GENERALLY WITHIN SPECIFICATION LIMITS. ASPHALT CONTENTS ON A VOLUME BASIS WERE NEAR THE SAME OR SLIGHTLY HIGHER THAN THOSE OF SIMILAR NATURAL HARDROCK MIXES. /AUTHOR/

Karrh, JB Stephenson, HK
Alabama University Mar. 1968

2A 217845

RESEARCH NEEDS RELATING TO PERFORMANCE OF AGGREGATES IN HIGHWAY CONSTRUCTION

WITH THE USE OF CONVENTIONAL DESIGN PROCEDURES, AGGREGATES COMPRISE MORE THAN 90 PERCENT OF THE MATERIAL REQUIRED FOR THE CONSTRUCTION AND MAINTENANCE OF HIGHWAY PAVEMENTS. IN ORDER TO SUMMARIZE THE MOST IMPORTANT RESEARCH PROBLEMS, THE TOP TWO PROJECTS IN EACH OF THE STUDY AREAS ARE AS FOLLOWS: (1) UNDER PORTLAND CEMENT CONCRETE, THE ROLE OF AGGREGATES PARTICLE CHARACTERISTICS AND GRADATIONS ON PROPERTIES OF FRESH CONCRETE AND PERFORMANCE OF HARDENED CONCRETE ARE STUDIED, (2) IN RELATION TO BITUMINOUS CONCRETE AND RELATED MATERIALS, THE STRIPPING OF ASPHALT CEMENT IN BITUMINOUS MIXTURES AND IDENTIFICATION OF THE SIGNIFICANT AGGREGATE SURFACE PROPERTIES THAT INFLUENCE COATING AND ADHESION ARE STUDIED AS WELL AS THE SOUNDNESS OF AGGREGATE PARTICLES IN BITUMINOUS MIXTURES, (3) UNDER BASE COURSE AND SHOULDER MATERIALS, THE RELATIONSHIP OF AGGREGATE AND BASE COURSE PERFORMANCE UNDER VARYING TRAFFIC LOADS IS STUDIED AS WELL AS THE DETERMINATION OF THE CAUSES OF CHANGE IN GRADATION FOR AGGREGATES USED IN HIGHWAY BASE COURSE CONSTRUCTION, AND (4) AGGREGATE PROPERTIES ARE RELATED TO SKID RESISTANCE OF PAVEMENTS AND DETERMINATION IS MADE OF THE SURFACE CHARACTERISTICS OF AGGREGATES USED IN HIGHWAY CONSTRUCTION.

Walker, RD Larson, TD Cady, PD Highway Research Board Nchrp Reports 1970

2A 217849

QUALITY ASSURANCE IN HIGHWAY CONSTRUCTION

QUALITY ASSURANCE IS RELATED TO THE QUESTIONS WHAT TO DO, HOW TO ORDER IT, HOW TO ASSURE GETTING WHAT WAS ORDERED. SPECIFICATIONS WRITTEN TO ANSWER THE SECOND QUESTION HAVE HERETOFORE NOT PERMITTED THE THIRD TO BE ANSWERED QUANTITATIVELY. ENGINEERING JUDGMENT CAN USUALLY ASSURE A GOOD PRODUCT, BUT "SUBSTANTIAL COMPLIANCE" IS DIFFICULT TO DEFINE LE-

GALLY OR CONTRACTUALLY; FURTHERMORE, TRUE VARIATIONS IN MATERIALS OR CONSTRUCTION CAN REMAIN UNKNOWN WITHOUT PROPER SAMPLING AND INTERPRETATIVE METHODS. NEW TEST METHODS AVAILABLE FOR QUALITY CONTROL ARE SURVEYED. MEANS OF INCLUDING STATISTICAL QUALITY CONTROL IN SPECIFICATIONS AND TESTS, THE DIFFERENCES BETWEEN PRODUCTION AND ACCEPTANCE TESTING, AND FEDERAL AND STATE EFFORTS TO PROMOTE STATISTICAL CONCEPTS IN QUALITY CONTROL ARE DISCUSSED. THE IMPACT ON CONTRACTOR-STATE RELATIONS IS TREATED BRIEFLY. DETAILED TREATMENT IS GIVEN IN SEPARATE ARTICLES TO STATISTICAL QUALITY ASSURANCE FOR EMBANKMENTS AND BASE COURSES, PORTLAND CEMENT, BITUMINOUS CONSTRUCTION, AND HIGHWAY AGGREGATES.

McMahon, TL Halstead, WJ Baker, WM Granley, EC Kelley, JA
Public Roads, Us Bureau Public Roads 70

2A 217860

ASH FROM LIGNITE

UTILIZATION OF LIGNITE OR BROWN COAL ASH IN THE 20 MAJOR PRODUCING COUNTRIES IN 1967 WAS ABOUT 2,000,000 TONS, 4 PERCENT OF THE TOTAL PRODUCTION. IN ADDITION TO WORK BEING DONE BY THE AUTHOR, A SUMMARY IS GIVEN OF RESEARCH AND UTILIZATION OF LIGNITE ASH THROUGHOUT THE WORLD. LIGNITE ASH HAS MANY APPLICATIONS, INCLUDING AUTOCLAVED CELLULAR CONCRETE BLOCKS, CONCRETE ADDITIVE, SOIL STABILIZATION, CEMENT RAW MATERIAL, FILLER FOR CONSTRUCTION, BRICK, AND MINERAL FILLER. THE IMPORTANCE OF RESEARCH WITH LIGNITE ASH IS EMPHASIZED BY THE WIDE VARIATION IN CHEMICAL AND PHYSICAL PROPERTIES. /AUTHOR/

Manz, OE

Bureau of Mines /US/ 1970

2A 217873

HAWAIIAN VOLCANIC AGGREGATES

HAWAII IS A VOLCANIC ISLAND THAT IS STILL IN THE PROCESS OF BEING BUILT UP. RECENT LAVA FLOWS CAN BE OBSERVED SIDE BY SIDE WITH ANCIENT FLOWS AND ALSO ONE ON TOP OF ANOTHER. VARYING CONDITIONS AT TIME OF ERUPTION GIVE RISE TO DIFFERENT TYPES OF ERUPTED MATERIAL SUCH AS LAVA ROCK, CINDERS, ASH, ETC. VARIATIONS IN CLIMATE AND RAINFALL CAUSE DIFFERENCES IN WEATHERING AND SOIL FORMATION. VARIOUS TYPES OF VOLCANIC MATERIAL FOUND IN HAWAII AND THEIR USE AS AGGREGATES AND MATERIAL FOR HIGHWAY BUILDING ARE DESCRIBED. /AUTHOR/

Hirashima, KB *Highway Research Board Proceedings* 1949

2A 217887

REPORT ON THE FIRST PHASE OF THE LIGHTWEIGHT AGGREGATE RESEARCH

LIGHTWEIGHT AGGREGATE CURRENTLY PRODUCED IN PUERTO RICO WAS EVALUATED FOR USE IN HIGHWAY AND BUILDING CONSTRUCTION. EXPANDED CLAY AND SHALE LIGHTWEIGHT AGGREGATE WERE FOUND SUITABLE FOR SURFACE TREATMENTS, FOR HOT MIX SURFACE COURSES IN ASPHALT PAVEMENTS AND ALSO IN CEMENT CONCRETE FOR BUILDINGS. AS NATURAL SANDS ARE BECOMING SCARCE ON THE ISLAND, THE LIGHTWEIGHT AGGREGATE FINES MAY BE USED AS FINE AGGREGATE TO REPLACE SAND IN CEMENT CONCRETE MIXES. IN FUTURE PHASES OF STUDY SUITABLE SOURCES OF RAW MATERIALS ON THE ISLAND FOR THE PRODUCTION OF LIGHTWEIGHT AGGREGATES WILL BE SOUGHT, AND TESTING PROCEDURES AND STANDARDS FOR PROPER QUALITY CONTROL OF LIGHTWEIGHT PRODUCTS WILL BE DEVELOPED.

Gandhi, PM Santiago, ER

Puerto Rico University Oct. 1970

2A 217894

LOOK AT PROCESSED RUBBLE-IT'S A VALUABLE SOURCE OF AGGREGATES

RECYCLING PAVEMENT AND STRUCTURAL CONCRETE RUBBLE FROM OBSOLETE HIGHWAYS, DRIVEWAYS, CURBS, GUTTERS, SIDEWALKS, PIERS, ABUTMENTS, AND CULVERTS IS VERY ECONOMICAL. HOW THE TEXAS HIGHWAY DEPARTMENT HAS DEMONSTRATED THE TECHNICAL AND ECONOMIC FEASIBILITY OF TRANSFORMING SOLID WASTE INTO A USEFUL BUILDING MATERIAL FOR A HIGHWAY IS DESCRIBED. PROBLEMS ARE DISCUSSED FOR (1) PROCESSING, (2) RUBBLE PREPARATION, (3) EMBANKMENT PREPARATION, (4) ASPHALT-STABILIZED BASE, (5) SURFACE MIXTURES, AND (6) ECONOMICS.

Marek, CR Gallaway, BM Long, RE *Roads and Streets* Sept. 1971

2A 217904

BOTTOM ASH: AN ENGINEERING MATERIAL

THE PROPERTIES AND USES OF BOTTOM ASH, A BY-PRODUCT FROM BURNING COAL IN POWER PLANTS, ARE DISCUSSED. SELECTED SAMPLES OF BOTTOM ASH FROM THE STATE OF WEST VIRGINIA AND THE SURROUNDING AREA WERE SUBJECTED TO ENGINEERING IDENTIFICATION, CLASSIFICATION, AND PROPERTY TESTS. IDENTIFICATION TESTS THAT WERE CONDUCTED INCLUDED GRAIN SIZE DISTRIBUTION, SPECIFIC GRAVITY, AND CHEMICAL ANALYSES. TESTS CONDUCTED TO EVALUATE BOTTOM ASH AS AN AGGREGATE AND CONSTRUCTION MATERIAL INCLUDED SULPHATE SOUNDNESS, LOS ANGELES ABRASION, RELATIVE DENSITY, STANDARD PROCTOR COMPACTION, CONSTANT HEAD PERMEABILITY, ONE DIMENSIONAL COMPRESSION, AND SHEAR STRENGTH. IT WAS FOUND THAT BOTTOM ASH FROM SEVERAL OF THE SOURCES SATISFIED SPECIFICATIONS RELATED TO THE USE OF THE MATERIAL AS AN AGGREGATE. IN COMPARING THE BEHAVIOR OF BOTTOM ASH TO THAT OF SAND, IT WAS FOUND THAT THE CHARACTERISTICS WERE QUITE SIMILAR. /AUTHOR/

Seals, RK Moulton, LK Ruth, BE *Am Soc Civil Engr J Soil Mech Div*
Vol. 98 No. sm4, Apr. 1972, pp 311-25

2A 217911

DEGRADATION OF LIMESTONE AGGREGATES DURING CONSTRUCTION

THERE IS GROWING EVIDENCE THAT THE STABILITY OR STRENGTH OF GRANULAR BASES IS NOT DIRECTLY RELATED TO GRADATION, DENSITY, OR PERCENTAGE OF THEORETICAL SOLID VOLUME. UNDER THESE CIRCUMSTANCES, QUESTION ARISES AS TO THE IMPORTANCE OF CONTROLLING GRADATION AND COMPACTION IN CONSTRUCTION. THE SAME EVIDENCE INDICATES THAT THE HARDNESS OR STRENGTH OF THE AGGREGATE PARTICLES MAY BE THE CONTROLLING FACTOR. EVEN SO, IF OVERSTRESSED THE BEARING POINTS WILL CRUSH UNTIL SUFFICIENT BEARING AREAS ARE PRODUCED TO WITHSTAND THE STRESS; THIS IS ACCOMPANIED BY VOLUME CHANGE AND DEGRADATION. IT CAN BE INFERRED THAT LOAD-INDUCED DEGRADATION PROCEEDS TO A STABLE STAGE. IT HAS BEEN ARGUED AT TIMES THAT GRADATION AND DENSITY ARE REDUNDANT REQUIREMENTS, AND THAT GRADATION REQUIREMENTS SHOULD BE WAIVED IF THE DENSITY IS ACHIEVED IN THE END PRODUCT. INDEED, THE POINT OF TESTING AND ACCEPTANCE WITH RESPECT TO DENSITY IS ON THE ROAD FOLLOWING COMPACTION. IF GRADATION CONTROL IS DEFERRED TO THIS POINT AND DENSITY IS ACHIEVED, A DILEMMA EXISTS. IF NEITHER DENSITY OR GRADATION REQUIREMENTS ARE MET IN THE END PRODUCT, UPSTREAM CONTROL OF THE GRADATION WOULD HAVE FOREWARNED OF THE PROBLEM. THE PRESENT STUDY WAS UNDERTAKEN TO DETERMINE WHETHER AND TO WHAT EXTENT CERTAIN PROPERTIES (PARTICULARLY GRADATION) OF KENTUCKY LIMESTONES USED IN BASE CONSTRUCTION CHANGED DURING THE CONSTRUCTION PERIOD. TWELVE CONSTRUCTION

2A 218606

BITUMINOUS MATERIALS FOR SURFACE TREATMENT
MUCH INTEREST IS BEING EVIDENCED IN MATERIALS INVOLVED IN THE SURFACE TREATMENT OF GRAVEL AND EARTH TYPE ROADS. CORRELATED SERVICE AND LABORATORY TESTS ARE BEING CONDUCTED IN SEVERAL STATES, WITH BITUMENS OF WIDELY DIFFERENT CHARACTERISTICS EMPLOYED UNDER CONDITIONS OF THE GREATEST DISSIMILARITY. IN THE EASTERN AND CENTRAL STATES, THE USE OF TAR PRODUCTS FOR SURFACE TREATMENT IS WELL DEVELOPED AND A WIDE RANGE OF PRODUCTS IS AVAILABLE. IN STATES WEST OF THE ROCKY MOUNTAINS, HOWEVER, TAR HAS BEEN LITTLE USED IN ROAD CONSTRUCTION OR MAINTENANCE. THE TREATMENT OF EARTH ROADS WAS EXTENSIVELY STUDIED IN ILLINOIS. NORTH CAROLINA AND SOUTH CAROLINA HAVE DEVELOPED AN EXTENSIVE USE OF CARPET TREATMENTS OF TOP-SOIL IN SAND-CLAY SURFACES. WISCONSIN AND MINNESOTA ARE STUDYING GRAVEL ROAD TREATMENT BY APPLYING TAR OR BITUMINOUS MATERIALS. OREGON HAS HAD SUCCESS IN THE TREATMENT OF FINE CRUSHED ROCK AND GRAVEL SURFACING. OTHER WESTERN STATES ARE LOOKING AT THE SURFACE TREATMENT AS A PROMISING MEANS OF INCREASING THE SERVICE OF GRAVEL AND CRUSHED ROCK ROADS.

Anderton, BA *Highway Research Board Proceedings* 1927

2A 218778

MINNESOTA PRACTICES ON SALVAGING OLD PAVEMENTS BY RESURFACING
DETAILS OF TYPICAL SECTIONS, TYPES OF MATERIALS AND PROPORTIONS USED, SPECIFICATION REQUIREMENTS, TRAFFIC AND COST DATA ARE INCLUDED FOR THE MINNESOTA PRACTICES ON SALVAGING OLD PAVEMENTS BY RESURFACING. /AUTHOR/

Kipp, OL Preus, CK *Highway Research Board Proceedings* 1950

2A 219130

ECONOMICS OF VARIOUS TYPES OF HIGHWAY-RAILWAY GRADE INCNKING, SHALLOW BLACKTOP, FULL-DEPTH BLACK TOP (3 TO 6 INCHES BELOW TIE TO TOP OF RAIL), SHALLOW CONCRETE, FULL-DEPTH CONCRETE, CAST STEEL AND RUBBER
THE INFORMATION OBTAINED FROM A QUESTIONNAIRE SURVEY IS TABULATED AND DISCUSSED. THE REASONS FOR SELECTION OF A PARTICULAR TYPE OF CROSSING WERE BASICALLY ECONOMICAL. THE REMOVAL OF SURFACE MATERIAL IS NECESSARY BETWEEN PERIODS OF COMPLETE RECONSTRUCTION. THE ORGANIZATION OF CROSSING GANGS IS OUTLINED AND THE MACHINERY USED IN THE WORK IS LISTED. ALSO LISTED ARE SPECIFIC MAINTENANCE OPERATIONS REQUIRED FOR EACH PARTICULAR CROSSING. A TABLE HAS BEEN COMPILED TO INDICATE THE ECONOMICS OF VARIOUS CROSSING TYPES. RECOMMENDATIONS ARE MADE REGARDING CONSTRUCTION, DRAINAGE AND WORKMANSHIP.

Kendall, RA *Am Railway Engineering Assoc Bulletin* Vol. 72 Nov. 1970, pp 198-200, 3 Tab

2A 219143

TESTING IN THE FEDERAL REPUBLIC OF GERMANY
THE PAPER REPORTS TESTS DESIGNED TO FIND WAYS OF IMPROVING THE DURABILITY OF PAVEMENTS AS WELL AS TESTS FOR ASSESSING PAVEMENT WEAR. THE EXTENSIVE WORK TAKES INTO ACCOUNT MANY FACTORS THAT INFLUENCE PAVEMENT WEAR. THIS INCLUDES THE TYPE AND INTENSITY OF REQUIREMENTS AND DELETERIOUS EFFECTS, THE TYPE AND QUALITY OF CONSTRUCTION MATERIALS, LOCAL ENVIRONMENTAL CONDITIONS, MIX COMPOSITIONS, AND THE FABRICATION AND PLACING OF THE BITUMINOUS MATERIAL. GUIDELINES FOR LABORATORY TESTING ARE FORMULATED. RESEARCH IS UNDERWAY TO ASSESS THE SUITABILITY OF CURRENTLY USED TESTING TECHNIQUES.

FOUR TESTING SYSTEMS WHICH APPEAR SUITABLE ARE BRIEFLY DESCRIBED. TEST SECTIONS IN THE FEDERAL REPUBLIC OF GERMANY ARE REVIEWED.

Zichner, G *Statens Vegvesen Veglab, Oslo /Norway/* Vol. 45 Mar. 1973, pp 105-9, 8 Fig

2A 219247

SYMPOSIUM ON EARTH-MOVING MACHINERY. A SYMPOSIUM ARRANGED BY THE AUTOMOBILE DIVISION 16TH 17TH MARCH 1965
PAPERS WERE PRESENTED AT FOUR SESSIONS' INTRODUCTORY LECTURE. EARTH MOVING MACHINERY IN MOTORWAY CONSTRUCTION, F.H. ARCHER. SESSION 1' SOIL MECHANICS. PAPER 1' A REVIEW OF THE RELEVANCE OF SOIL MECHANICS IN EARTH-MOVING' P.C.J. PAYNE, D.W. TANNER AND G. SPOOR. PAPER 2' THE FUNDAMENTAL EQUATION OF EARTHMOVING MECHANICS' A.R. REECE. PAPER 3' SOIL MECHANICS IN RELATION TO EARTH-MOVING MACHINERY' J.R. O CALLAGHAN AND P.J. MCCULLEN. PAPER 4' MECHANICS OF EARTH- MOVING VEHICLES' L.F. LITTLE. PAPER 5 RESEARCH INTO THE EFFECT OF WET WEATHER ON THE CONSTRUCTION OF EARTH-WORKS' R. NORMAN. SESSION 2' MACHINERY. PAPER 6' THE DEVELOPMENT AND TESTING OF EARTH-MOVING MACHINERY' E.G. ROBSON. PAPER 7' SOME RECENT DEVELOPMENTS IN EXCAVATOR DESIGN' J.H. PAGE. PAPER 8' DUMPERS AND DUMP TRUCKS' E.B. WATKIN. PAPER 9' CRAWLER-MOUNTED TRACTORS AND ATTACHMENTS FOR SCRAPING AND DOZING' H.A. LAND. SESSION 3' POWER UNITS AND TRANSMISSIONS SESSION 4' OPERATION AND MAINTENANCE. A LIST OF DELEGATES, AUTHOR AND SUBJECT INDEXES AND DISCUSSIONS ON EACH SESSION ARE INCLUDED. /RRL/

Inst Mech Engineers Proc, London /UK/ 1965

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 219298

TRACTOR-MOUNTED VIBRATOR USED BY GERMAN TROOPS
CRAWLER-MOUNTED 'TANK' VIBRATOR IS USED EXTENSIVELY FOR COMPACTING SOIL-CEMENT MIXTURES IN ROAD CONSTRUCTION BECAUSE OF ITS ADVANTAGES OVER THE USUAL CYLINDRICAL ROLLER. THE STANDARD MACHINE IS EQUIPPED WITH A 9-HP. DIESEL ENGINE AND WORKS AT A SPEED OF 10 FT PER MIN OVER THE COMPARATIVELY NARROW WIDTH OF 3 FT 4 INCHES. VIBRATIONS AT THE RATE OF 1,500 PER MIN ARE TRANSFERRED TO THE CRAWLER TREADS, RESULTING IN COMPRESSION OF A 7 TO 8-IN. DEEP SOIL-CEMENT MIX BY MORE THAN 1 IN. UNDER TWO PASSES OF THE MACHINE.

Engineering News-record Apr. 1942

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 219303

PNEUMATIC-TIRED ROLLERS IN ROAD CONSTRUCTION
THE PROBLEM OF COMPACTING CARRIAGEWAY LAYERS WITH PNEUMATIC-TIRED ROLLERS IS USUALLY STUDIED BY MEANS OF EMPIRICAL METHODS. THE AUTHOR ATTEMPTS TO LOOK AT THIS PROBLEM IN A RATIONAL WAY, STARTING FROM KNOWN THEORIES AND EXPERIMENTAL RESULTS CONCERNING THE BEHAVIOUR OF SOIL UNDER STATIC LOADS. THE BEHAVIOUR OF SOIL UNDER LOADS APPLIED BY A COMPACTOR IS ANALYSED BY THE MOHR METHOD TO EXPRESS STRESSES, AND BY INTRINSIC STRAIGHT LINES TO EXPRESS SOIL CHARACTERISTICS. THE STUDY OF THE EQUILIBRIUM OF THE SOIL UNDER LOAD SHOWS THAT THE EQUILIBRIUM IS REACHED WHEN LIMIT CONDITIONS ARE EQUAL TO MAXIMA STRESS VALUES, THEREFORE WHEN THE INTRINSIC STRAIGHT LINE WHICH REPRESENTS SOIL CONDITIONS IS TANGENTIAL TO THE ENVELOPE OF THE MOHR CIRCLES REPRESENTING THE STRESSES CREATED BY THE COMPACTOR. THE SHAPE OF THIS ENVELOPE DEPENDS ON

THE CONTACT PRESSURE, AND ON THE SHAPE AND DIMENSION OF THE CONTACT AREA. BY THE USE OF NOMOGRAPHS, IT IS POSSIBLE TO ANALYZE THE INFLUENCE OF LOAD VARIATIONS ON EACH WHEEL AND THE EFFECT OF TYRE PRESSURE ON THE DENSITY REACHED AT VARIOUS DEPTHS. THE MAXIMUM COMPACTABLE DEPTH FOR A PRESCRIBED MINIMUM DENSITY CAN BE EVALUATED TOGETHER WITH THE MAXIMUM ACCESSIBLE DENSITY FOR A GIVEN LOAD. /L.C.P.C./R.R.L./

Simon, J *Bull Liaison Labs Routiers /France/* May 1966

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 219323

LONGITUDINAL AND TRANSVERSE CONTROL FOR BITUMINOUS PAVERS

PROJECTS AMOUNTING TO APPROXIMATELY 67 MILES OF ASPHALTIC CONCRETE ON NEW BASE, 92 MILES OF ASPHALTIC CONCRETE OVERLAY ON OLD SURFACE, AND 277 MILES OF BITUMINOUS MAT OVERLAY ON OLD SURFACE WERE PLACED UNDER CONTRACT IN KANSAS DURING 1958. THE MATERIALS FOR THESE PROJECTS WERE MIXED IN HOT-MIX PLANTS AND PLACED ON THE ROAD THROUGH BITUMINOUS PAVERS. BECAUSE OF THE LIMIT WHICH BITUMINOUS PAVERS CAN LEVEL OR SMOOTH A ROAD SURFACE, THE PROBLEM OF PLACING THE MIXTURE TO A SMOOTH GRADE LINE WITH A TRUE CROWN CONFRONTS BOTH THE ENGINEER AND THE CONTRACTOR ON EACH PROJECT, PARTICULARLY ON OVERLAYS. WITH MODERN HIGH-SPEED TRAFFIC A SMOOTH GRADE LINE AND TRUE CROWN ARE MUSTS IN PAVEMENT CONSTRUCTION. THE DEVELOPMENT OF TWO ATTACHMENTS IS DESCRIBED THAT HAVE BEEN PLACED ON THE LEADING MAKES OF BITUMINOUS PAVERS AND HAVE BEEN SUCCESSFUL IN AIDING THE OPERATORS TO CAUSE THE PAVEMENT SCREEDS TO FOLLOW A SMOOTH THEORETICAL GRADE LINE WITH A DEFINITE UNIFORM CROWN. THIS METHOD OF PAVING REQUIRES SEVERAL NORMAL OPERATIONS, SUCH AS ASCERTAINING A NEW GRADE LINE FROM THE ORIGINAL PROFILE AND THE USE OF PNEUMATIC-TIRED ROLLERS FOR COMPACTION. THIS METHOD OF PAVING REQUIRES LESS OVER-ALL WORK ON THE PART OF THE CONTRACTOR, BECAUSE THE SKIN PATCHING IN ALL CASES CAN BE REDUCED, AND IN SOME CASES ELIMINATED. /AUTHOR/

Drake, FM *Highway Research Board Bulletin* 1961

2A 219401

THE EVALUATION OF A RANGE OF VIBRATING ROLLERS IN COMPACTING SOILS

RESULTS ARE PRESENTED OF COMPACTION TESTS CARRIED OUT IN THIN LIFTS USING A RANGE OF VIBRATING ROLLERS ON THREE COMMON TYPES OF CONSTRUCTION MATERIALS. FIVE VIBRATING ROLLERS OF MEDIUM TO HEAVY WEIGHT (107 TO 285 LB. PER LINEAL INCH) WERE USED COMPRISING HIGH AND LOW FREQUENCY MACHINES. THE HEAVIEST ROLLER WAS ALSO USED NON-VIBRATING. ALL MACHINES WERE TOWED AT A CONSTANT SPEED OF 1.7 M.P.H. THE MATERIALS TESTED WERE A DOLOMITE CRUSHED ROCK, A SINGLE-SIZED SAND AND A MEDIUM CLAY. COMPACTION TESTING WAS CARRIED OUT UNDER CONTROLLED CONDITIONS OF MOISTURE CONTENT UNDER SHED-COVER AFTER 2, 4, 8 AND 16 PASSES. COMPACTION RESULTS AND OUTPUTS FOR THE VARIOUS MACHINES ARE COMPARED. THE IMPORTANCE OF CONTROL OF MOISTURE CONTENT IN THE COMPACTION OF CRUSHED ROCK WAS SHOWN TO BE OF MORE IMPORTANCE THAN FREQUENCY OF VIBRATION IN OBTAINING A HIGH DENSITY. HEAVY VIBRATING ROLLERS DID NOT APPEAR TO BE AN ADVANTAGE IN COMPACTING FINE SAND BUT PROVED AN ADVANTAGE OVER THE LIGHTER VIBRATORS IN COMPACTING CLAY. COMPARISONS ARE MADE THROUGHOUT USING THE NON-VIBRATING DRUM ROLLER. DISCUSSION BY VARIOUS ROAD AUTHORITIES AND ROLLER MANUFACTURERS IS INCLUDED. /AUTHOR/

Tynan, AE Morris, PO

Australian Road Research Board Paper No 441, 1968

2A 219403

EQUIPMENT FOR STABILIZED BASE CONSTRUCTION

EQUIPMENT AND TECHNIQUES ARE DESCRIBED FOR SOIL COMPACTION AND SOIL STABILIZATION OF THE ADDITIVE AND MECHANICAL TYPES. THE IMPORTANCE IS EMPHASIZED OF SEGREGATION DURING MATERIAL HANDLING AND DURING THE BLENDING AND MIXING OPERATION. THE FOLLOWING EQUIPMENT IS DESCRIBED AND PICTURED: MIXING AND BLENDING EQUIPMENT WITH ITS OWN FLUID HANDLING SYSTEM; A METERED FLUID DISTRIBUTOR WITH SPRAY BAR; MEANS OF RAPID DRYING OF OVER-WET MATERIALS BY AERATION; HIGH SPEED, OPEN SEGMENTED WHEEL, SHEEPS-FOOT ROLLER; A HIGH SPEED ROLLER EQUIPPED WITH PAD TYPE WHEEL; A PNEUMATIC ROLLER USED IN HIGHWAY CONSTRUCTION; A TANDEM STEEL WHEEL ROLLER USED PRIMARILY FOR SURFACE ROLLING OF ASPHALTIC CONCRETE; AND HEAVY CLAY PULVERIZED BY A PULVI-MIXER.

Trainor, MJ *Ohio Highway Engineering Conf Proc* Apr. 1967

2A 221292

BETTER TRAFFIC WITH BETTER ROAD SURFACES

BIBLIOGRAPHICAL STUDY IS MADE ABOUT THE RELATIONSHIP BETWEEN TRAFFIC SAFETY AND THE PAVEMENT SURFACE CHARACTERISTICS CONCERNING FRICTION, REFLECTIVITY, AND REGULARITY. THE FOLLOWING SUBJECTS ARE APPROACHED: (1) SKIDDING AND ACCIDENTS: RELATIONSHIP BETWEEN THE ACCIDENT RATE AND THE FRICTION COEFFICIENT. (2) FRICTION COEFFICIENT: DEFINITION AND EQUIPMENT FOR MEASUREMENTS. (3) SURFACE TEXTURE: MACRO AND MICRORUGOSITY; RELATIONSHIP BETWEEN THE SPEED AND THE FRICTION COEFFICIENT. (4) THE WEARING COURSE COMPONENTS: ASPHALT PAVEMENTS OPEN AND CLOSED; CONCRETE PAVEMENTS; AND THE IMPORTANCE OF RESISTANCE AGAINST POLISHING. (5) THE SUPERFICIAL HUMIDITY: THE DECREASE OF THE FRICTION COEFFICIENT WITH THE WATER ON THE SURFACE. (6) THE INFLUENCE OF THE TIRE AND THE VEHICLE: WORN TIRE AND BEADED TIRE; VEHICLE BRAKE SYSTEM. (7) THE REFLECTIVITY OF THE ROAD SURFACE: THE RELATIONSHIP BETWEEN THE REFLECTIVITY AND THE FRICTION COEFFICIENT; SURFACE OF LIGHT COLOR. (8) UNIFORMITY OF THE ROAD SURFACE. (9) CONSTRUCTION OF A PAVEMENT WITH A SAFE SURFACE: SUPERPOSITION OF COARSE AGGREGATE; SUPERFICIAL TREATMENT AND SEVERAL SPECIFICATIONS. (10) MAINTENANCE OF THE SAFE SURFACE: THE SUPERFICIAL TREATMENT; SLURRY SEAL; AND CONCRETE SURFACES' TREATMENT. THE CONCLUSION IS THAT SPECIAL ATTENTION SHOULD BE GIVEN TO THE QUALITY OF THE COMPONENTS OF THE ROAD SURFACING, TO OBTAIN AND MAINTAIN THE RUGOSITY, THE DIFFUSE REFLECTIVITY AND THE UNIFORMITY NEEDED FOR THE APPROPRIATE SAFETY OF THE USER. /RRI/

Larsen, J

Road Federal Institute /Brazil/ 1970

ACKNOWLEDGMENT: Road Research Institute /Brazil/

2A 222245

NEEDED RESEARCH IN THE ENGINEERING AND DESIGN OF TOLL FACILITIES

THOSE RESEARCH NEEDS THAT ARE COMMON TO BOTH TOLL FACILITIES AND NON-TOLL FACILITIES ARE DISCUSSED. SPECIFIC TOPICS COVERED ARE IN THE AREAS OF: (1) THE SAFETY OF THE DRIVER, PASSENGERS, CARGO, MAINTENANCE EMPLOYEES, AND RESIDENTS NEAR THE HIGHWAY; (2) THE CAPACITY OF THE FACILITY; (3) THE SOCIAL AND ENVIRONMENTAL EFFECTS OF HIGHWAYS; (4) INTERMODAL ACCOMMODATION; (5) BETTER QUALITY CONTROL OF MATERIALS AND OPERATIONS DURING CONSTRUCTION; AND (6) THE DEVELOPMENT OF TECHNIQUES AND STANDARDS TO MINIMIZE FUTURE MAINTENANCE REQUIREMENTS.

Cangiano, VM *Intl Bridge Tunnel & Turnpike Assoc Report* June 1972, pp 33-40

2A 226248

THE PARKING GARAGE: TONIC FOR DOWNTOWN DOLDRUMS

THE PLANNING, DESIGN, CONSTRUCTION MATERIALS, ARCHITECTURE, AND ECONOMICS OF DOWNTOWN PARKING GARAGES ARE DISCUSSED. A SET OF TWELVE DESIGN CONSIDERATIONS FOR MODERN GARAGES IS LISTED, COVERING SUCH SUBJECTS AS SELF-VERSUS ATTENDANT-PARKING, DRIVING PATTERNS, BAY DESIGN, LIGHTING, AND VENTILATION. CONSIDERABLE ATTENTION IS GIVEN TO GEOMETRIC DESIGN AND MATERIALS, AS WELL AS TO THE LIKELY COSTS OF A STALL.

Johnsen, EP *Public Works* Jan. 1972

2A 228555

EFFECT OF STRUCTURE ON RESILIENT REBOUND CHARACTERISTICS OF SOILS IN THE PIEDMONT PROVINCE OF VIRGINIA

THIS PAPER REPORTS THE RESULTS OF LABORATORY STUDIES CONDUCTED TO DETERMINE WHICH OF THE PIEDMONT SOILS WERE MORE RESILIENT AND THE CAUSE OF THIS RESILIENCE. THIS PROPERTY HAS, IN THE PAST, LED TO THE WASTING OF MUCH OF THIS MATERIAL IN HIGHWAY CONSTRUCTION WORK AND HAS OFTEN CAUSED FATIGUE-TYPE FAILURES ON PAVEMENTS UNDER WHICH IT HAS BEEN PLACED. REPEATED LOAD TRIAXIAL TESTS ON LABORATORY COMPACTED SAMPLE WERE EMPLOYED TO DETERMINE THE AMOUNT OF ELASTIC OR RESILIENT REBOUND FOR EACH SOIL. IN GENERAL IT WAS FOUND THAT AS THE PERCENT OF THE MINERAL MICA INCREASED THE RESILIENT REBOUND INCREASED, BUT AS THE PLASTICITY INDEX OF THE SOIL INCREASED THE RESILIENCY DECREASED. SOILS FROM THE C-HORIZON WERE MORE RESILIENT THAN THOSE FROM THE B-HORIZON. FOR SOILS FROM THE C-HORIZON THE RESILIENCY INCREASED WITH INCREASING GRAIN SIZE. STEREO-OPTICAL MICROSCOPE STUDIES OF SAMPLES BEFORE AND AFTER REPEATED TRIAXIAL TESTS SHOWED THAT SOIL STRUCTURE PLAYED A MAJOR ROLE IN CAUSING THE RESILIENCY IN THESE SOILS IT WAS CONCLUSIVELY SHOWN THAT SOILS WITH A DISPERSE-LIKE STRUCTURE WERE MUCH MORE RESILIENT THAN THOSE WITH A FLOCCULANT-LIKE STRUCTURE. BOTH SOIL STRUCTURE AND RESILIENCY WERE INFLUENCED GREATLY BY MOLDING MOISTURE CONTENT AND METHOD OF COMPACTION. /AUTHOR/

Tate, BD Larew, HG *Highway Research Record, Hwy Res Board*

2A 228582

THE STRAIN IN ROCKS IN RELATION TO HIGHWAY DESIGN
THE STABILITY OF ROCK IN HIGHWAY DESIGN IS DISCUSSED IN RELATION TO THE SITE SELECTION, THE ROCKS LEFT IN PLACE AFTER A CUT OR TUNNEL HAS BEEN EXCAVATED, ROCK FILL AND AGGREGATE SURFACING. METHODS TO DETERMINE THE MECHANICS OF SUCH ROCKS AND THEIR IMPORTANCE IN HIGHWAY DESIGN AND CONSTRUCTION ARE INCLUDED. REBOUND AND ROCK RELAXATION ARE RECORDED BY IN SITU MEASUREMENTS.

Emery, CL *Highway Research Record, Hwy Res Board*

2A 228606

ENGINEERING CLASSIFICATION OF GEOLOGIC MATERIALS
THE STUDY, ENGINEERING CLASSIFICATION OF GEOLOGICAL MATERIALS, WAS INITIATED IN 1961 TO PROVIDE A COMPREHENSIVE REFERENCE ON HIGHWAY ENGINEERING RELATED TO GEOLOGIC MATERIALS IN OKLAHOMA. THE CLASSIFICATION SYSTEM WILL ASSIST PERSONNEL IN DESIGN, CONSTRUCTION AND MAINTENANCE OF HIGHWAYS. THE CLASSIFICATION METHOD IS SIMPLIFIED AS PERSONS WITH LITTLE OR NO UNDERSTANDING OF GEOLOGY MAY IDENTIFY THE GEOLOGIC MATERIAL OR GROUND CONDI-

TION. GEOLOGIC MATERIALS ARE GROUPED INTO GEOLOGIC UNITS, RATHER THAN AGE, FORMATION, MEMBER, ETC. OF NORMAL GEOLOGIC DESCRIPTIONS. EACH UNIT REPRESENTS A SPECIFIC AREA OF LOCALE IN A COUNTY, AND FOR EACH UNIT, THE IDENTIFICATION AND DESCRIPTION OF THE GEOLOGIC MATERIALS AND ENGINEERING CHARACTERISTICS ARE GIVEN. THE SOIL SERIES ASSOCIATED WITH GEOLOGIC MATERIALS ARE DESCRIBED AND ILLUSTRATED, TOGETHER WITH THE FOLLOWING ENGINEERING CHARACTERISTICS' SEEPAGE CONDITION, MATERIAL SUITABILITY, RIPPABILITY, BLACKSLOPE INSTABILITY, AND LANDSLIDE SUSCEPTIBILITY. A TABLE OF ENGINEERING CHARACTERISTICS INCLUDES' GRAD- ATION, ATTERBERG LIMITS, AASHO SOIL CLASSIFICATION, OKLAHOMA SUBGRADE INDEX NUMBER, VOLUME CHANGE, POTENTIAL VERTICAL RISE, PERCENTAGE OF ASPHALT OR PORTLAND CEMENT FOR STABILIZATION, AND SUITABILITY FOR SUBGRADE MATERIAL. /BPR/

Buie, LD

Oklahoma Department of Highways

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4810002 65)

2A 228611

TERRAIN INVESTIGATION TECHNIQUES FOR HIGHWAY ENGINEERS

AIRPHOTO INTERPRETATION, GEOPHYSICAL METHODS OF SUBSURFACE EXPLORATION, AND DIRECT INVESTIGATIONS BY AUGER BORINGS, CORE BORINGS, ETC., ARE DISCUSSED AS TECHNIQUES FOR USE IN TERRAIN INVESTIGATIONS IN CONNECTION WITH HIGHWAY CONSTRUCTION. FIVE STEPS ARE DEFINED' /1/ AIRPHOTO INTERPRETATION TO DEFINE LAND FORMS, GENERAL SOIL BOUNDARIES AND REGIONAL DRAINAGE CHARACTERISTICS, /B/ GEOPHYSICAL TESTS, REFRACTION SEISMIC OR EARTH RESISTIVITY, TO VERIFY AND EXPAND THE INFORMATION OBTAINED FROM AIRPHOTO INTERPRETATION, /C/ DIRECT SAMPLING BY BORINGS OR DRILL HOLES TO VERIFY AND EXPAND THE RESULTS OF THE FIRST TWO STEPS, /D/ FINAL AIRPHOTO INTERPRETATION TO CORRELATE BORING AND GEOPHYSICAL DATA AND ESTABLISH THE SURFACE AND SUBSURFACE EXTENT OF SOIL AND ROCK BOUNDARIES, AND /E/ FORMULATE ENGINEERING SOILS MAP AND SOIL PROFILE. SIX COMBINATIONS OF TECHNIQUES ARE ADAPTED TO VARYING TERRAIN CONDITIONS, /1/ PHOTOINTERPRETATION, ELECTRICAL RESISTIVITY AND CORE BORINGS FOR UPLAND-THIN RESIDUAL SOILS, /2/ PHOTOINTERPRETATION, ELECTRICAL RESISTIVITY AND POWER-AUGERED SOIL SAMPLES FOR UPLAND, PLAINS, MORAINES-GLACIAL DRIFT GREATER THAN 25 FEET, /3/ PHOTOINTERPRETATION, ELECTRICAL RESISTIVITY, SEISMIC REFRACTION, AND DIRECT SAMPLING-UPLAND, LAKE PLAINS AND MORAINES-GLACIAL DEPOSITS LESS THAN 25 FEET, /4/ PHOTOINTERPRETATION, SEISMIC REFRACTION AND CORE BORINGS-UPLAND RESIDUAL SHALES, /5/ PHOTOINTERPRETATION, ELECTRICAL RESISTIVITY AND CORE BORINGS -LAND-SLIDE SUSCEPTIBLE SLOPES AND /6/ PHOTOINTERPRETATION, ELECTRICAL RESISTIVITY AND PRESS-SAMPLES SOFT SOILS AND SUBSOILS /PEAT MUCK, ETC./ . GENERAL CONCLUSIONS SHOW THE RESISTIVITY TEST APPLIED TO 5 OF THE 6 TERRAIN TYPES MENTIONED. THE SEISMIC TEST WAS APPLIED TO TWO TERRAINS. THE TECHNIQUE COMBINATION METHOD OF SOILS INVESTIGATION WAS FOUND TO COST ABOUT ONE-THIRD THE COST OF THE CONVENTIONAL METHOD USING AUGER BORINGS, CORE BORINGS, ETC.

Mintzer, OW Struble, RA

Ohio State University Ees 196, Oct. 1965

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4712064 66)1C61021165, 1C61020135, 1C61020397, 1C61020428, PB 169 868 \$3.00

2A 228614

EXPLORATION OF METHODS TO DETERMINE THE OPTIMUM USE OF INDIGENOUS MATERIALS FOR HIGHWAY CONSTRUCTION

A BRIEF REVIEW OF THE VARIOUS SOIL CLASSIFICATION SYSTEMS IS GIVEN AS WELL AS A REVIEW OF TERRAIN EXPLORATION METHODS. THE AASHO TEST METHODS ARE LISTED FOR MEASURING PHYSICAL AND STRENGTH PROPERTIES OF SOILS. METHODS OF ALTERING OR STABILIZING SOILS ARE BRIEFLY EXAMINED. SEVERAL PROPOSALS FOR FURTHER RESEARCH IN THE OPTIMUM USE OF INDIGENOUS MATERIALS ARE PRESENTED. /BPR/

Mullen, WG Gray, EW Chen, CF
North Carolina State University

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4814376 66)1C33020480, 1C61020578, PB 174 131 \$3.00

2A 228628

THE REPEATABILITY OF TEST RESULTS USING VARIOUS CALIFORNIA BEARING RATIO PROCEDURES AND THE RESISTANCE R-VALUE

THIS STUDY WAS CONDUCTED TO COMPARE AND EVALUATE FOUR OF THE STANDARD METHODS FOR DETERMINING THE BEARING CAPACITY OF SOILS FOR HIGHWAY CONSTRUCTION AND, IF POSSIBLE, DRAW A CORRELATION BETWEEN THEIR RESULTS. EVALUATION OF THE METHODS WAS BASED UPON STATISTICAL CONCEPTS, USING THE COEFFICIENT OF VARIATION, STANDARD DEVIATION AND MEAN VALUES. STANDARD DEVIATION AND MEAN VALUES. STANDARD TEST PROCEDURES USED WERE THE STATIC AND DYNAMIC CBR, AASHO 3-POINT CBR AND R-VALUE. FOUR SOIL TYPES, RANGING FROM CLAY THROUGH SANDY GRAVEL, WERE TESTED BY THE STANDARD METHODS. FROM THE DATA AVAILABLE IT APPEARS THAT THE R-VALUE TEST PROCEDURE GIVES THE MOST SATISFACTORY RESULTS. THE NEED FOR ADDITIONAL TESTING OF THOSE SOILS NOT INCLUDED IN THIS STUDY IS INDICATED. TESTING OF ADDITIONAL SOIL TYPES WOULD ENHANCE THE KNOWLEDGE ALREADY GAINED FROM THIS STUDY AND ALLOW A CLOSER CORRELATION OF THE DIFFERENT TESTING METHODS. /AUTHOR/

Sorbe, VK
Utah State Department Highways, Bureau of Public Roads /US/

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4653304 68)PB 179860, 3C61021214

2A 228657

ROCK RIPPABILITY STUDY

THE FEASIBILITY OF PREDICTING QUANTITIES OF RIPPABLE AND NON-RIPPABLE ROCK ON PROPOSED CONSTRUCTION PROJECTS WAS DETERMINED USING SEISMIC SOUNDINGS SUPPLEMENTED BY TEST BORINGS AND ELECTRICAL RESISTIVITY MEASUREMENTS. SIX PROJECTS SCHEDULED FOR CONSTRUCTION IN DIFFERENT GEOLOGIC SETTINGS WERE SELECTED FOR INVESTIGATION AND FIELD WORK HAS BEEN COMPLETED ON ALL SIX. TO DATE, ONLY THREE OF THE PROJECTS HAVE BEEN CONSTRUCTED. NON-RIPPABLE MATERIAL WAS ENCOUNTERED ON ONLY TWO OF THE PROJECTS CONSTRUCTED, AND IT WAS FOUND THAT THE DISTRIBUTION OF THIS MATERIAL WAS ERRATIC DUE TO THE GEOLOGIC CONDITIONS PRESENT. IT ALSO BECAME APPARENT DURING THE COURSE OF THE STUDY THAT THE DEPTH CAPABILITY OF THE SEISMOGRAPH USED, A SOILTEST TERRA-SCOUT, WAS TOO LIMITED TO PERMIT ADEQUATE INVESTIGATION OF CUTS AS LARGE AS THOSE ENCOUNTERED ON THE PROJECTS INVESTIGATED. UNDER THESE CIRCUMSTANCES, IT WAS FELT THAT THE COMPARISON OF PREDICTED AND ACTUAL QUANTITIES OF NON-RIPPABLE MATERIAL ORIGINALLY PROPOSED WOULD BE LESS MEANINGFUL THAN A COMPARISON OF PREDICTED AND ACTUAL DEPTHS TO NON-RIPPABLE MATERIAL, AND THE RESULTS OF THE STUDY HAVE THEREFORE BEEN EVALUATED ON THIS BASIS. /AUTHOR/

Colorado Department Highways, Bureau of Public Roads /US/

ACKNOWLEDGMENT: Bureau of Public Roads /US/REPORT PENDING, HRIS 61021202, 1C61022061

2A 228699

PROCEEDINGS OF WORKSHOP ON EXPANSIVE CLAYS AND SHALES IN HIGHWAY DESIGN AND CONSTRUCTION

THESE PROCEEDINGS ARE COMPRISED OF TECHNICAL PAPERS, REPORTS REMARKS AND DISCUSSIONS PRESENTED AT THE WORKSHOP ON "EXPANSIVE CLAYS AND SHALES IN HIGHWAY DESIGN AND CONSTRUCTION," IN DENVER, COLORADO. THE PROCEEDINGS COVER THE STATE OF THE ART ON HIGHWAY DESIGN AND CONSTRUCTION ON EXPANSIVE CLAYS AND SHALES. VOLUME 2 CONTAINS PAPERS, REPORTS AND DISCUSSIONS REGARDING: (1) METHODS OF MODIFYING OR TREATING EXPANSIVE CLAYS AND SHALES TO PREVENT DETRIMENTAL VOLUME CHANGE, (2) FACTORS AND CHARACTERISTICS OF EXPANSIVE CLAYS USED IN HIGHWAY DESIGN ON, IN OR WITH EXPANSIVE CLAYS AND SHALES, AND (3) SELECTED STATE SUMMARIES ON PROBLEMS WITH EXPANSIVE CLAYS, AND DESIGN OR TREATMENT METHODS, INCLUDING CASE HISTORIES. THESE PROCEEDINGS ARE COMPLETE IN TWO VOLUMES. A 22-PAGE CONDENSATION OF THE PROCEEDINGS IS BEING PUBLISHED AS FEDERAL HIGHWAY ADMINISTRATION REPORT FHWA-RD-73-72, ENTITLED "SUMMARY OF PROCEEDINGS OF WORKSHOP ON EXPANSIVE CLAYS AND SHALES IN HIGHWAY DESIGN AND CONSTRUCTION," BY D. R. LAMB AND S. J. HANNA. THE SUMMARY IS AVAILABLE THROUGH THE SAME AGENCIES AS THE COMPLETE PROCEEDINGS.

Lamb, DR Hanna, SJ
Wyoming University Proceeding Vol. 2 FHWA-RD-73-72, May 1973, 318 pp

ACKNOWLEDGMENT: Federal Highway Administration

PB-225844

2A 228744

SUB-SURFACE SOIL EXPLORATION

THE USE OF GEOPHYSICAL TESTING EQUIPMENT IN ROAD CONSTRUCTION IS REPORTED, BASICALLY, THERE ARE TWO TYPES OF THESE INSTRUMENTS USED FOR SHALLOW /100 FT OR LESS/ SUBSURFACE INVESTIGATION' REFRACTION SEISMOGRAPHS AND ELECTRICAL EARTH RESISTIVITY UNITS, THE OPERATIONAL TECHNIQUES OF BOTH ARE DESCRIBED. /RRL/

Thompson, SV *Rural and Urban Roads*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 228804

GEOPHYSICAL METHODS IN HIGHWAY ENGINEERING

PRECISE INFORMATION REGARDING CERTAIN ENGINEERING PROPERTIES OF SOIL AND ROCK ARE NECESSARY TO THE DESIGN PHASE OF HIGHWAY CONSTRUCTION. THIS INFORMATION INCLUDES: /1/ THE AMOUNT OF SOIL AND ROCK TO BE REMOVED ALONG EACH PROPOSED CUT, /2/ THE RELATIVE EASE OF REMOVAL, AND /3/ DEFINITION OF THE ENGINEERING PROPERTIES OF THE BEDS WHICH WILL SERVE AS THE IMMEDIATE UNDERLAYERS OF THE HIGHWAY. ANSWERS TO THESE PROBLEMS CAN BE PROVIDED BY GEOPHYSICAL TECHNIQUES. THIS PAPER SURVEYS THE CURRENT STATE OF KNOWLEDGE OF GEOPHYSICAL TECHNIQUES AND EMPHASIZES SOME OF THE PROBLEMS THAT MAY BE ENCOUNTERED. NEW TECHNIQUES AS WELL AS METHODS OF INTERPRETATION ARE MENTIONED. /CGRA/

Paterson, NR Meidav, T *Canadian Good Roads Association Proc*

2A 228810

A MODERN APPROACH TO HIGHWAY MATERIALS SAMPLING

HIGHWAY ENGINEERING, PARTICULARLY IN DEVELOPING COUNTRIES WITH INADEQUATE STAFF, CAN BENEFIT CON-

SIDERABLY BY MAKING FULL USE OF ALL AVAILABLE TECHNIQUES. TWO SUCH TECHNIQUES, AIR-PHOTO INTERPRETATION APPLIED TO HIGHWAY MATERIALS AND STATISTICAL CONTROL OF SAMPLING AND TESTING, HAVE BEEN USED WITH SUCCESS IN SOUTH AFRICA. THE AUTHORS DESCRIBE THE BASIC PRINCIPLES INVOLVED IN THE ADOPTION OF THESE TOOLS AND QUOTE SOME EXAMPLES TO INDICATE THE BENEFITS THAT CAN BE DERIVED/ /AUTHOR/

Kantey, BA Morse, RK *Intl Conf Soil Mech & Fdn Eng Proc*

ACKNOWLEDGMENT: Canadian Good Roads Association

2A 228826

SPECIAL TESTS FOR DESIGN OF HIGH EARTH EMBANKMENTS ON US 101

THE TEST DATA NECESSARY FOR THE DESIGN OF HIGH EMBANKMENTS IN THE CALIFORNIA MOUNTAINS CANNOT BE OBTAINED WITH CONVENTIONAL TRIAXIAL EQUIPMENT. LARGE-SCALE TRIAXIAL TESTS WERE PERFORMED ON 12-IN. DIAMETER BY 28-IN. HIGH SPECIMENS OF LESS THAN 3-IN. MATERIAL AT CONFINING PRESSURES UP TO 125 PSI IN AN ATTEMPT TO SIMULATE EMBANKMENT STRESS CONDITIONS ON MATERIALS THAT WERE OF THE SAME TYPES AND SIZES AS THOSE CONTEMPLATED FOR THE ACTUAL EMBANKMENTS. HIGHER CONFINING PRESSURES, 550 PSI, WERE ALSO USED BUT THE SPECIMEN SIZES WERE REDUCED TO 6-IN. DIAMETER BY 14-IN. HEIGHT, AND THE MAXIMUM PARTICLE SIZE WAS REDUCED TO 1 1/2-IN. TESTS WERE CONDUCTED TO OBTAIN BOTH TOTAL AND EFFECTIVE STRESSES. DEGRADATION OF THE MATERIALS UNDER COMPACTION, CONSOLIDATION AND SHEARING WAS DETERMINED. THE TEST DATA HAVE BEEN USED FOR THE DESIGN OF THE 384-FT HIGH EMBANKMENT ACROSS SQUAW CREEK IN MENDOCINO COUNTY. CONSTRUCTION OF THE SQUAW CREEK EMBANKMENT WAS BEGUN ON JUNE 1, 1966. THIS EMBANKMENT WILL CONTAIN THREE DISTINCT TYPES OF MATERIAL, (A) SELECTED ROCKY MATERIAL FOR TOW SUPPORT; (B) SELECTED GRANULAR MATERIAL, CONTAINING ONLY A MINOR QUANTITY OF SHALE, CLAY, SOIL OR VEGETABLE MATTER, WHICH WILL BE COMPACTED TO 93 PERCENT RELATIVE COMPACTION AT A MOISTURE CONTENT OF 1 TO 3 PERCENT LESS THAN OPTIMUM; AND (C) RANDOM ROADWAY EXCAVATION BY NORMAL CONSTRUCTION PROCEDURES AT 90 PERCENT RELATIVE COMPACTION. PLATFORMS AND GAGES WILL BE INSTALLED TO OBSERVE THE BEHAVIOR OF THE EMBANKMENT DURING AND AFTER CONSTRUCTION. ADDITIONAL TESTING WILL BE DONE TO COMPLEMENT THE TESTING PROGRAM DESCRIBED AND TO CHECK ON THE ORIGINAL DESIGN OF THE EMBANKMENT. /AUTHOR/

Hall, EB Smith, TW
California Division Highways

ACKNOWLEDGMENT: Highway Res Abstracts Hwy Res Board

2A 228830

MOLE VERSUS CONVENTIONAL: A COMPARISON OF TWO TUNNEL DRIVING TECHNIQUES

IN NORTHWEST NEW MEXICO THE U.S. BUREAU OF RECLAMATION IS BUILDING THE NAVAJO INDIAN IRRIGATION PROJECT. AS A PART OF THE WATER CONVEYANCE SYSTEM, TWO TUNNELS WERE BUILT. TUNNEL 1, 2 MI LONG, WAS DRIVEN WITH A HUGHES TUNNELING MACHINE. ONE-QUARTER MILE AWAY IS TUNNEL 2, WHICH WILL EVENTUALLY BE 5 MI LONG /ONLY 2 MI HAD BEEN EXCAVATED AT THE TIME OF THIS WRITING/. THE SECOND TUNNEL IS BEING DRIVEN BY CONVENTIONAL METHODS. BOTH TUNNELS ARE IN THE SAN JOSE FORMATION CONSISTING OF SANDSTONE, SILTSTONE, AND SHALE. THE AUTHOR PRESENTS OBSERVATIONS MADE WHILE WORKING IN BOTH TUNNELS. COMPARISONS ARE MADE OF ROCK BEHAVIOR, SUPPORTS, TECHNIQUES, PERSONNEL, AND ADVANTAGES AND DISADVANTAGES OF USING A MOLE. A TUNNELING MACHINE OFFERS THE FOLLOWING ADVANTAGES' NEAR- CONTINUOUS OPERATION,

HIGH DAILY FOOTAGE, MINIMUM OVERBREAK RESULTING IN A NEARLY 50 PERCENT REDUCTION IN CONCRETE, LESS PERSONNEL, SAFER OPERATION, LESS SUPPORTS REQUIRED, MINIMUM CLEANUP OPERATIONS, DYNAMITE NOT REQUIRED RESULTING IN INCREASED SAVINGS. DISADVANTAGES ARE' NEEDS LONG SECTION TO PAY FOR ITSELF, CIRCULAR SECTION ONLY, SPECIALIZED OPERATOR REQUIRED, SUPPORTS DIFFICULT TO INSTALL, LONG WAIT FOR DELIVERY, LARGE INITIAL INVESTMENT, MACHINE HAS TO BE DESIGNED FOR TUNNEL BECAUSE OF DIFFERENT DIAMETERS AND GEOLOGIC CONDITIONS, LIMITED TO SOFTER MATERIALS, NEEDS LARGE VENTILATION SYSTEM. /AUTHOR/

Bennett, NB *Highway Research Record, Hwy Res Board*

2A 228871

COMBINED TECHNIQUES FOR TERRAIN INVESTIGATION

THE COMBINED TECHNIQUE METHOD IS DESCRIBED AND DEMONSTRATED FOR TERRAIN INVESTIGATION AT TEST SITES IN OHIO. THIS METHOD IS DEFINED AS AN ECONOMIC COMBINATION OF INDIRECT AND DIRECT METHODS OF PROCURING THE SURFACE AND SUBSURFACE INFORMATION CONCERNING SOILS AND ROCKS THAT ENGINEERS AND CONTRACTORS REQUIRE FOR ESTABLISHING THE BEST LOCATION OF A CONSTRUCTION PROJECT OR FOR LOCATING NATURAL RESOURCES SUCH AS UNDERGROUND WATER, SAND AND GRAVEL AGGREGATES OR MINERALS. THE COMBINATIONS OF TECHNIQUES DESCRIBED ARE GENERALLY USEFUL FOR DEFINING AREAL EXTENT, DEPTH AND STRATIFICATION OF SOIL, SOIL AGGREGATE COMPOSITIONS AND ROCK LAYERING SYSTEMS TO DEPTHS OF 100 TO 200 FEET. THERE ARE TEN STEPS IN COMBINED-TECHNIQUES METHOD. PHOTO INTERPRETATION, UTILIZING PANCHROMATIC, COLOR AND INFRARED PHOTOGRAPHY AT APPROPRIATE SCALES AND FILM-FILTER COMBINATIONS, IS INITIALLY PROGRAMMED FOR A PROPOSED HIGHWAY ALIGNMENT SEGMENT. THIS PORTION OF THE PROCEDURE IS THEN COMPLEMENTED BY EITHER ELECTRICAL-RESISTIVITY OR SEISMIC- REFRACTION SURVEYS OR BOTH, AS DICTATED BY THE TERRAIN. LIMITED BORING DATA ARE UTILIZED FOR CALIBRATION NEEDS, AND ADDITIONAL BORINGS ARE OBTAINED WHERE NECESSARY TO VERIFY AND COMPLEMENT THE PHOTO INTERPRETATION AND GEOPHYSICAL ANALYSIS OF THE SUBSURFACE.

Mintzer, OW Struble, RA *Highway Research Record, Hwy Res Board*

2A 228879

TWIN BORES AT GREEN RIVER

A ROCK MECHANICS INVESTIGATION WAS CONDUCTED CONCURRENTLY WITH THE CONSTRUCTION OF TWIN TUNNELS ON THE GREEN RIVER MARGINAL ROUTE. THIS INVESTIGATION WAS CONDUCTED TO DETERMINE' /1/ THE ACTUAL SUPPORT REQUIREMENTS BY MEASUREMENT OF THE TIME-STRAIN-LOAD PROPERTIES OF THE TUNNEL ROCK AND /2/ THE MODE OF LOADINGS /THE PROCESS BY WHICH ROCK STRAIN IS TRANSLATED INTO LOAD IN THE SUPPORT SYSTEM/. FOUR INSTRUMENT STATIONS EACH CONSISTING OF FOUR LOAD MEASURING INSTRUMENTS /PROP LOAD CELLS WHICH MEASURE THE AMOUNT OF STRAIN ON THE INITIAL STEEL STRUCTURE/ AND THREE DISPLACEMENT MEASURING INSTRUMENTS WERE INSTALLED. THE INVESTIGATION WAS DESIGNED TO PROVIDE A CONTINUING REVIEW OF ORIGINAL DESIGN ASSUMPTIONS DURING ACTUAL TUNNEL EXCAVATIONS, TO DEVELOP RECOMMENDATIONS FOR MODIFICATION OF THE ORIGINAL STEEL DESIGN TO CONFORM MORE CLOSELY WITH MEASURED ROCK CONDITIONS, AND TO PROVIDE QUANTITATIVE DATA FOR THE CONTROL OF THE TUNNEL SUPPORT SYSTEM COSTS. THE RESULTS ACHIEVED PROOF THAT ROCK MECHANICS INSTRUMENTATION CAN BE SUCCESSFULLY APPLIED TO REDUCE TUNNEL CONSTRUCTION COSTS AND INCREASE SAFETY.

Wyoming State Highway Department 1 Fig, Aug, 1966

2A 228975

FIELD INVESTIGATION OF SOIL COMPACTION

A FULL SCALE FIELD RESEARCH STUDY WAS UNDERTAKEN TO INVESTIGATE THE EFFECTIVENESS OF VARIOUS METHODS OF COMPACTING SOIL FOR HIGHWAY CONSTRUCTION AND TO DETERMINE THE RESULTING SOIL PROPERTIES USING RAPID FIELD METHODS FOR MEASUREMENT OF MOISTURE, DENSITY, STRENGTH AND STIFFNESS. THE MEASUREMENTS INCLUDED MOISTURE AND DENSITY WITH A PORTABLE BACK-SCATTER NUCLEAR DEVICE, MOISTURE AND DENSITY WITH SAND CONE APPARATUS, PENETRATION RESISTANCE WITH A CONE PENETROMETER, CALIFORNIA BEARING RATIO, STIFFNESS WITH A 6- IN. BEARING PLATE AND SEISMIC VELOCITY WITH A PORTABLE SEISMOGRAPH.

Selig, ET *World Highways*

ACKNOWLEDGMENT: Intl Road Fedn World Meetings Proc

2A 229052

PROCEEDINGS OF THE THIRD ASIAN REGIONAL CONFERENCE ON SOIL MECHANICS AND FOUNDATION ENGINEERING

CONTENTS: AEOLIAN SOILS-PROPERTIES AND ENGINEERING PROBLEMS, CONSTRUCTION ON LOESS SOILS OF SMALL THICKNESS, A. M. DRANNIKOV, BEARING CAPACITY OF PILES IN SUBSIDENT LOESS SOILS, I. V. FINAEV, PREDICTION OF DEFORMATION OF LOESS SOILS UNDER BUILDING AND STRUCTURE FOUNDATIONS, A. A. GRIGORIAN, ENGINEERING AND PHYSICO-CHEMICAL PROPERTIES AFFECTING PIPING FAILURE OF LOW LOESS DAMS IN THE NEGEV, G. KASSIFF AND E. N. HENKIN, CONSOLIDATION PROPERTIES OF ARID-REGION SOILS, Y. KLAUSNER AND I. SHAINBERG, FOUNDATION ENGINEERING PROBLEMS IN LOESS SOILS, H. LEHR, ON SOME COMPARATIVE STUDIES OF LAND LOESS AND SWAMP LOESS, D. MILOVIC, SETTLEMENT OF LOESS FOUNDATIONS UNDER CANAL EMBANKMENTS, A. I. PITYUGIN, LATERITIC SOILS-PROPERTIES AND ENGINEERING PROBLEMS THE USE OF TROPICALLY-WEATHERED SOILS IN THE CONSTRUCTION OF EARTH DAMS, A. L. LITTLE, CEMENT STABILIZATION OF LATERITIC SOILS, Z. C. MOH, Y. P. CHIN AND S. C. NG, THE BILATERAL LOAD TEST AND ITS APPLICATION TO LATERITIC SOILS, R. C. VOLD, PROBLEMS IN THE USE OF IRON- RICH LATERITES IN THE ROADWAY STRUCTURE-S. E. THAILAND, W. B. WIGGINTON.

Israel Soc Soil Mechanics & Fdn Eng

3P61088051, 3P61088053, 3P61088054, 3P61088003, 3P63088052

2A 229134

SUBSURFACE EXPLORATION: ORGANIZATION, EQUIPMENT, POLICIES AND PRACTICES

A SURVEY WAS CONDUCTED TO COLLECT AND DISSEMINATE INFORMATION CONCERNING THE ORGANIZATION, EQUIPMENT, POLICIES AND PRACTICES EMPLOYED BY THE VARIOUS STATES IN PERFORMING SUBSURFACE INVESTIGATIONS FOR THE DESIGN AND CONSTRUCTION OF HIGHWAYS. A QUESTIONNAIRE WAS SENT TO 52 STATES AND TERRITORIES IN SEPTEMBER, 1960. REPLIES WERE RECEIVED FROM ALL BUT 5 STATES. THE QUESTIONNAIRE CONSISTED OF THE FOLLOWING PARTS: (1) STATE ORGANIZATION AND ADMINISTRATION, (2) ORGANIZATIONAL STRUCTURE, (3) SUBSURFACE INVESTIGATIONS BY CONTRACT, (4) METHODS OF SUBSURFACE INVESTIGATION, AND (5) 1959 CALENDAR YEAR VOLUME OF SUBSURFACE EXPLORATION WORK. THE TABULATION OF INFORMATION PRESENTED INDICATES THAT THE ORGANIZATIONS EMPLOYED BY THE VARIOUS STATES TO PERFORM SUBSURFACE INVESTIGATIONS RANGE FROM RUDIMENTARY UNITS SCATTERED THROUGHOUT THE HIGHWAY DEPARTMENT TO UNITS STAFFED AND EQUIPPED TO FURNISH COMPLETE AND COMPREHENSIVE SERVICES IN THE FIELD OF SOIL AND FOUNDATION ENGINEERING AND ENGINEERING GEOLOGY. SOME STATES, BY PROVIDING WELL-STAFFED AND EQUIPPED SUBSURFACE INVESTIGA-

TION ORGANIZATIONS, DO HAVE A PROPER UNDERSTANDING OF THE IMPORTANCE OF ADEQUATE AND THOROUGH SUBSURFACE INVESTIGATION INFORMATION ON THE COST AND PERFORMANCE OF THEIR HIGHWAY SYSTEMS.

Highway Research Board Bulletin

2A 229143

THE ENGINEERING SIGNIFICANCE OF SOIL PATTERNS

THE TERM SOIL PATTERN IS USED IN THE COMPREHENSIVE SENSE THAT INCLUDES NOT ONLY THE COLOR PATTERN OF SOILS BUT THE NUMEROUS OTHER FACTORS RECORDED IN AN AERIAL PHOTOGRAPH THAT ARE INFLUENCED BY THE SOIL. WHEN PROPERLY EVALUATED THEY INDICATE THE ENGINEERING PROPERTIES OF THE SOIL. THIS WORK STEMS, IN A LARGE MEASURE, FROM AN ENGINEERING EVALUATION OF PEDOLOGY-THE SCIENCE OF SOIL FORMATION-AND ITS APPLICATION TO THE PROBLEMS OF HIGHWAY DESIGN, CONSTRUCTION, AND MAINTENANCE. ITS SUBSEQUENT USE IN AIRPORT SITE SELECTION HAS PERMITTED AN ANALYSIS OF THE SOIL PATTERNS AND THEIR SIGNIFICANCE IN AREAS EXISTING UNDER A WIDE RANGE OF SOIL, PARENT MATERIAL, AND CLIMATIC CONDITIONS. INASMUCH AS PEDOLOGY IS AN IMPORTANT PHASE OF PHOTO-INTERPRETATION, A SIMPLIFIED FORM THAT MAY BE TERMED ENGINEERING PEDOLOGY IS DISCUSSED FROM THE STANDPOINT OF SUBGRADE PROBLEMS. SINCE THIS SOILS ENGINEERING TECHNIQUE APPLIES TO LARGE AREAS, A NUMBER OF EXTENSIVE SOIL AREAS DESCRIBED IN DETAIL AND TEST DATA SHOWING THEIR UNIFORMITY ARE PRESENTED. THESE HAVE BEEN CHOSEN TO ILLUSTRATE THE SIMILARITY OF SOILS HAVING A COMMON ORIGIN REGARDLESS OF GEOGRAPHIC LOCATION. THE INDIVIDUAL SOIL AREAS HAVE PATTERNS THAT INDICATE THEIR PROPERTIES. LACKING ANY INFORMATION OTHER THAN THAT SHOWN IN THE PHOTOGRAPH, THE OBSERVER MAY STUDY EACH OF THE ELEMENTS THAT MAKE UP THE SOIL PATTERN. THESE ELEMENTS, CONSISTING OF EROSION CHARACTERISTICS, SOIL COLOR, SURFACE DRAINAGE, AND NUMEROUS OTHERS, REFLECT THE NATURE OF THE PROFILE. GULLIES ASSUME VARIOUS SHAPES AND THEREBY REVEAL CERTAIN PROPERTIES OF THE SOIL SUCH AS TEXTURE AND CLAYPAN DEVELOPMENTS; SURFACE DRAINAGE IS A FUNCTION OF SLOPE AND POROSITY OF THE SOIL; WHILE COLOR PATTERNS OFTEN REFLECT GROUND WATER CONDITIONS. THE ELEMENTS OF THE SOIL PATTERN CHANGE AND THEIR SIGNIFICANCE VARIES IN DIFFERING CLIMATIC ZONES. THE EFFECT OF CLIMATE IS TO CHANGE THE TYPE OF VEGETATIVE COVER AND THE SIGNIFICANCE OF SOIL COLOR. HOWEVER, THE SOIL PATTERN EMPHASIZES THE SIGNIFICANCE OF LAND FORMS AND WEATHERED SLOPES. EVALUATION OF THE PEDOLOGIC CLASSIFICATION OF THE GREAT SOIL (CLIMATIC) GROUPS INDICATES THAT IT IS OF LITTLE VALUE IN ENGINEERING WORK. THIS ASSESSMENT IS NECESSARY SINCE IN SOME WESTERN STATES AND IN MANY FOREIGN AREAS, THIS IS THE ONLY TYPE OF SOIL INFORMATION AVAILABLE. THEREFORE, RELIANCE MUST BE PLACED ON THE INTERPRETATION OF THE SOIL PATTERN AND ITS ENGINEERING IMPLICATIONS. A GROUP OF PHOTOGRAPHS SHOW THE BASIC SOIL PATTERNS, GEOLOGIC PATTERNS, AND THE OCCURRENCE OF GRANULAR DEPOSITS. THE GEOLOGIC PATTERN IS CONSIDERED IN ITS RELATION TO PROBLEMS OF LOCATION AND GRADING. BY EXAMPLE AND TEST RESULTS THE PROPERTIES OF VARIOUS STRATA VISIBLE IN PHOTOGRAPHS ARE SHOWN. THE DATA SHOW THAT THE SOIL PATTERN HAS ENGINEERING SIGNIFICANCE AND THAT IT INDICATES THE CONDITIONS THAT AFFECT THE LOCATION AND CONSTRUCTION OF HIGHWAYS AND AIRPORTS. /AUTHOR/

Belcher, DJ Highway Research Board Proceedings

2A 229149

APPLICATION OF GEOLOGY TO ENGINEERING PRACTICE

CONTENTS: CHARLES PETER BERKEY, JOHN L SAVAGE, ROGER RHOADES THE GEOLOGIST IN THE ENGINEERING ORGA-

NIZATION, EDWARD B. BURWELL, JR., GEORGE D. ROBERTS GEOLOGY IN DAM CONSTRUCTION, EDWARD B. BURWELL, JR., BERLEN C. MONEYMAKER ENGINEERING GEOLOGY IN THE DESIGN AND CONSTRUCTION OF TUNNELS, JAMES F. SANBORN MECHANICS OF LANDSLIDES, KARL TERZAGHI FAULTS AND ENGINEERING GEOLOGY, GEORGE D. LOUDERBACK GEOLOGY AND ENGINEERING IN THE PRODUCTION AND CONTROL OF GROUND WATER, O.E. MEINZER ENGINEERING GEOLOGY OF HIGHWAY LOCATION, CONSTRUCTION, AND MATERIALS, E.F. BEAN GEOLOGICAL ASPECTS OF BEACH ENGINEERING, W.C. KRUMBEIN PETROLOGY OF CONCRETE AFFECTED BY CEMENT-AGGREGATE REACTION, DUNCAN MCCONNELL, RICHARD C. MIELENZ, WILLIAM Y. HOLLAND, KENNETH T. GREENE GEOLOGY ENGINEERING IN THE PETROLEUM INDUSTRY, K.C. HEALD GEOLOGY IN THE DISCOVERY, DEVELOPMENT, AND EXPLOITATION OF MINERAL DEPOSITS, MURL H. GIDEL MILITARY GEOLOGY, CHAS. B. HUNT

Geological Society of America Bulletin

2A 229203

SOIL DESCRIPTION

THESE REFERENCES ON SOIL DESCRIPTION INCLUDE SELECTIONS ON SOIL CLASSIFICATION SYSTEMS, LATERITE SOILS AND THEIR STABILIZATION, RELATION BETWEEN CHEMICAL COMPOSITION AND PHYSICAL CHARACTERISTICS OF SOME SOILS, WEATHERING OF VOLCANIC ASH AND PUMICE, GLAZES FROM VOLCANIC ASH, SOILS OF CUBA, WELDED TUFTS AND FLOWS IN A RHYOLITE PLATEAU, PILLAN BRECCIAS AND THEIR AGUAGENE TUFTS, IWO JIMA SOILS, USE OF LATERITES IN ROAD CONSTRUCTION, SOIL SURVEY OF HAWAII, VOLCANIC RAW MATERIALS IN WEST INDIES, BEHAVIOR OF VOLCANIC SOILS IN HIGHWAY CONSTRUCTION, TESTING QUALITY OF CALICHE, ESTIMATING BEARING CAPACITY OF ROAD CRUSTS, SOILS OF EQUATORIAL REGIONS, MICACEOUS SOIL, VOLCANIC CINDER CONCRETE, RADIOACTIVITY OF VOLCANIC SEDIMENTS, BERYLLIUM-BEARING TUFF, AND CLAY MINERALS IN SOIL.

Highway Research Information Service

2A 229204

SURVEY & TREATMENT OF MARSH AND MUSKEG DEPOSITS
THESE REFERENCES ON SURVEY & TREATMENT OF MARSH AND MUSKEG DEPOSITS INCLUDE SELECTIONS ON ENGINEERING PROPERTIES OF MUSKEGS RELATIVE TO ROAD CONSTRUCTION, SOIL MECHANICS BIBLIOGRAPHY, HYDRAULIC FILL CAUSEWAY, CONSOLIDATION OF ALLUVIAL CLAY, CONSOLIDATION OF SOILS BY DRAIN WELLS, UNSTABLE SUBGRADE, STABILIZATION BY SAND DRAINS AND BY BLASTING, BLASTERS HANDBOOK, FILL SETTLEMENT USING EXPLOSIVES, ROAD CONSTRUCTION OVER ORGANIC TERRAIN, CONSOLIDATION CHARACTERISTICS OF ORGANIC SOILS, METHODS AND COSTS OF FILLING OF HIGHWAY OVER SWAMPS, DITCHING AND DRAINAGE IN MUSKEG AREAS, CLASSIFICATION OF ORGANIC SOILS, PAVEMENT PERFORMANCE OVER MUSKEG, CORROSION IN MUSKEG, EMBANKMENT CONSTRUCTION IN MUSKEG, EQUIPMENT FOR TESTING STABILITY AND STRENGTH OF SUBGRADE AND SOIL FOUNDATIONS, INTERPRETATION OF MUSKEG AND PERMAFROST CONDITIONS FROM AERIAL PHOTOGRAPHS, FILL SETTLEMENT BY SURCHARGING, LABORATORY TESTS ON PEAT, AERIAL SURVEYS OVER ORGANIC TERRAIN, DENSITY AND WATER MEASUREMENTS IN PEAT, TREATMENT OF SOFT FOUNDATIONS, AND STABILIZATION OF MARSH DEPOSITS.

Highway Research Information Service

2A 229239

GEOLOGY SAND AND ROAD CONSTRUCTION (2)

METHODS OF CLASSIFYING AND GRADING SANDS ARE DISCUSSED. SPECIAL ATTENTION IS PAID TO A NEW AND RAPID METHOD FOR THE DETERMINATION OF THE SAND EQUIVALENT AND ITS SIGNIFICANCE IN RESPECT TO CURRENT

METHODS. A SURVEY IS MADE OF THE PROPERTIES THAT DETERMINE WHETHER SAND CAN BE USED FOR ROAD CONSTRUCTION AND FOR BITUMINOUS MIXTURES. /RRL/ REFERENCES: GEOLOGY, SAND, AND ROAD CONSTRUCTION, H WIEGERS, POLYTECHNISCH TIJDSCHRIFT, VOL 22 NO 7, PP 269-279, 1967. IRRD ABSTRACT NO 26310.

Wiegiers, H *Polytechnisch Tijdschrift /Neth/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 229260

SOIL INVESTIGATIONS FOR ENGINEERING CONSTRUCTION (IN GERMAN)

A COMPREHENSIVE INSTRUCTION MANUAL DEALING WITH THE FOLLOWING SUBJECTS: (1) INVESTIGATIONS BEFORE THE START OF CONSTRUCTION; (2) WORKING PROGRAM AND PROGRESS OF INVESTIGATIONS; (3) SOIL TYPES AND THEIR DESCRIPTION AND CLASSIFICATION FOR CONSTRUCTIONAL PURPOSES, (4) FIELD TESTS OF THE SURFACE AND SUBSOIL; (5) LABORATORY TESTS; (6) CONDITION DESCRIPTION, (7) BEHAVIOR UNDER LOADING AND CHEMICAL BEHAVIOR. (8) SPECIAL INVESTIGATIONS (MICROSCOPIC, X-RAY, COLLOIDAL-ELECTRONIC, THERMOCHEMICAL)-TESTS ON THE FINISHED STRUCTURE, (9) OBSERVATIONS AND MEASUREMENTS OF EARTHWORK, (10) TESTS OF COMPACTION, SETTLEMENT, DEFORMATION, SLIPPING, (11) OBSERVATIONS AND MEASUREMENTS OF STONE, CONCRETE, WOOD OR STEEL STRUCTURES, AND (12) STANDARDS AND SPECIFICATIONS. /FG/RRL/

Schultze, E Muhs, H
Springer Verlag /Germany/

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 229263

APPARATUS FOR THE RAPID DETERMINATION OF FINE-GRAIN PARTICLES IN COURSE-GRAINED SOILS AND CONSTRUCTION MATERIALS (IN GERMAN)

THE NEW METHOD WAS DEVELOPED IN THE CENTRAL LABORATORY OF STRABAG BAU AG, AND PERMITS THE MEASUREMENT OF FINE GRAINS IN COARSE-GRAINED SOILS AND MATERIALS WITH AN ACCURACY EQUAL TO THAT OF THE COMBINED SIEVE AND SLURRY ANALYSIS. THE MAIN FEATURES OF THE METHOD ARE AS FOLLOWS: THE WEIGHTS OF THE MATERIALS UNDER WATER ARE DETERMINED INSTEAD OF THE DRY WEIGHTS OF BOTH FRACTIONS; THE SAID WEIGHTS ARE DETERMINED BY MEANS OF CALIBRATED CONTAINERS WHICH SINK INTO THE WATER AND INDICATE THE WEIGHT ON A SCALE; AND THE SAMPLE IS NOT DIVIDED INTO FINE AND COARSE FRACTIONS BEFORE SEDIMENTATION, BUT TAKEN AS A WHOLE. /FG/RRL/

Haas, H *Strasse Und Autobahn /Germany/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 229282

THE PH OF FRESH AND WEATHERED DOLERITE AS AN INDICATOR OF DECOMPOSITION AND OF STABILIZATION REQUIREMENTS

WEATHERED DOLERITE WHICH JUST PASSES THE ROUTINE SELECTION TESTS CONTINUES TO DECOMPOSE AFTER BEING LAID IN A ROAD FOUNDATION, AND THIS HAS BEEN THE CAUSE OF MANY FAILURES, OF THE BASE-COURSE IN PARTICULAR. THE PH OF A FRESH BASIC IGNEOUS ROCK HAS BEEN FOUND ALWAYS TO BE IN THE VICINITY OF 8 AND IT CHANGES TOWARDS NEUTRAL WHEN DECOMPOSITION REACHES THE MONTMORILLONITE STAGE AND EVEN INTO THE ACIDIC RANGE WHEN KAOLINITE, AND FINALLY BAUXITE ARE FORMED. LABORATORY INVESTIGATIONS WERE CARRIED OUT IN WHICH DOLERITE SAMPLES WERE IMMERSSED IN DIFFERENT PH MEDIA. IT WAS FOUND THAT MAINLY IRON WAS MOBILISED IN THE ACIDIC, AND CALCIUM IN THE ALKALINE RANGE. THESE INVESTIGATIONS SHOWED

FURTHER THAT THE DETERMINATION OF THE PH OF A SINGLE SAMPLE TAKEN FROM A WEATHERING SUCCESSION HAS NO PRACTICAL SIGNIFICANCE BUT THAT THE COMPARISON OF THE PH OF AT LEAST TWO SUCH SAMPLES, EACH FROM A DIFFERENT LAYER IN THE WEATHERING SUCCESSION, PROVIDES INFORMATION ON EITHER LOSS OR PRECIPITATION OF DISSOLVED MATERIAL. IT HAS PROVED POSSIBLE TO DEFINE A NUMBER OF TYPICAL PH DEVELOPMENTS OF WEATHERING SUCCESSIONS. ALTHOUGH WORK IN THIS FIELD IS STILL FUNDAMENTAL, IT CAN ALREADY BE CONCLUDED THAT SATURATING THE MOISTURE IN THE ROAD FOUNDATION WITH CALCIUM, THUS RAISING THE ALKALINITY, MIGHT PREVENT FURTHER MOBILISATION AND RETARD DECOMPOSITION. THIS CAN BE ACHIEVED WITH THE USUAL CHEMICAL STABILISERS BUT ALSO WITH GROUND LIMESTONE OR DOLOMITE. IT CAN FURTHER BE EXPECTED THAT SIMPLE PH MEASUREMENTS MAY BE SUFFICIENT TO DETERMINE THE OPTIMUM CHEMICAL STABILISATION REQUIREMENTS. SHORT DEFINITIONS OF TECHNICAL TERMS USED ARE GIVEN IN THE APPENDIX. /RRL/AUTHOR/

Clauss, KA *Soil Mech & Fdn Eng Proc /South Africa/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 229293

ROAD CONSTRUCTION IN WEATHER-SENSITIVE LOESS DURING THE RECONSTRUCTION OF THE EB51 AT BOCHUM IN THE RUHR /IN GERMAN/
DIFFICULTIES WHICH WERE DURING THE CONSTRUCTION OF THE ROAD DUE TO THE DENSITY OF CONSTRUCTION AND TO GEOLOGICAL CONDITIONS ARE OUTLINED. THE 15M DEEP LAYERS OF LOESS AND LOESS-LOAM SOIL DIRECTLY BENEATH THE SURFACE, WHICH HAD A NATURAL WATER CONTENT OF 23%, REQUIRED EXTREMELY CAREFUL DRAINAGE, THE USE OF LIME FOR STABILIZATION, AND MADE THE CONSTRUCTION OF CUTTINGS AND EMBANKMENTS DIFFICULT. DETAILS ARE GIVEN OF THE INCORPORATION OF THE FROST BLANKET COURSE AND TOTAL COSTS OF CONSTRUCTION. /FG/RRL/

Hackelberg, F Knop, F *Strassen Und Tiefbau /Germany/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 229336

NEW REQUIREMENTS CONCERNING STONE MATERIALS WITH A VIEW TO DRAWING UP SNIP SPECIFICATIONS /IN RUSSIAN/
THE IMPROVEMENT OF SPECIFICATIONS FOR STONE MATERIALS IS DISCUSSED. BY INCREASING THE LIFE-TIME OF ROAD SURFACINGS AND WIDENING THE FIELD OF APPLICATION OF NATURAL AND SYNTHETIC STONE MATERIALS, LOWER CONSTRUCTION COSTS COULD BE ACHIEVED. THESE NEW SPECIFICATIONS WOULD BE IN AGREEMENT WITH THOSE USED IN OTHER COUNTRIES. /LCPC/RRL/

Polyakova, AI Kurdenkov, BI *Avtomobil Nye Dorogi /Ussr/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 229344

FORECASTING THE SUSCEPTIBILITY OF CIVIL ENGINEERING MATERIALS TO WEATHERING /IN FRENCH/
THROUGH CHANGES IN THEIR ENVIRONMENT, NATURAL ROCK MATERIALS USED IN CIVIL ENGINEERING CONSTRUCTION CAN ALTER, ENDANGERING THE STABILITY OF STRUCTURES. THIS PROCESS, DIFFERENT FROM WEATHERING IN GEOLOGY, GEOMORPHOLOGY, OR PEDOLOGY, IS CONNECTED WITH THE SPECIFIC CONDITIONS OF EACH STRUCTURE AND IS VERY RAPID. TO FORECAST WEATHERING AT THE PROJECT STAGE AND ON THE SITE, THE PROPERTIES OF THE MATERIALS AND THEIR CONDITIONS OF USE MUST BE TAKEN INTO ACCOUNT, AND SIMPLE AND RAPID QUANTITATIVE TESTS MUST BE CONDUCTED. A STUDY IS MADE OF THE MECHANISM OF WEATHERING, AND THE CRITERIA USED

FOR PREDICTING THE MAIN CAUSES OF DISORDER IN NATURAL ROCKS USED IN CIVIL ENGINEERING ARE LISTED: (1) DECREASE IN STRENGTH AND DISINTEGRATION OF ROCKS CONTAINING ACID FELDSPAR BY DISSOLUTION OF LEACHING BY- PRODUCTS IN COMPOSITE, BASIC, ACID, OR LATERIC MEDIA; (2) DECREASE IN STRENGTH AND DISINTEGRATION BY SWELLING OF CLAYEY MINERALS OR HYDROXIDES; (3) SLAKING; (4) FROST; (5) CRYSTALLIZATION OF EVAPORATES; (6) FORMATION OF WATER VAPOR IN HOT-COATED AGGREGATES; (7) SUPERFICIAL PROGRESSIVE ACIDIFICATION OF AGGREGATES SUBJECTED TO LEACHING, AND (8) PRECIPITATION OF IRON HYDROXIDE ON THE SURFACE OF STORED AGGREGATES. SIMPLE AND RAPID TESTS ARE PROPOSED FOR EACH OF THESE PHENOMENA. /LCPC(A)/RRL/

Struillou, R *Bull Liaison Labs Routiers /France/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 229352

FRICION BETWEEN SANDS AND CONSTRUCTION MATERIALS /IN ITALIAN/

AFTER REVIEWING RECENT TRENDS IN THE STUDY OF SURFACE FRICTION, THIS ARTICLE EXAMINES THE RESULTS OF (AND THE APPARATUS USED IN) A SERIES OF TESTS, CONCERNING THE FRICTION BETWEEN SANDS OF TWO DIFFERENT GRAIN SIZES AND CONCRETE SURFACES OF DIFFERENT ROUGHNESS, OR STEEL. THE PRIMARY AIM OF THIS RESEARCH IS TO SHOW THE DEPENDENCE OF THE FRICTION COEFFICIENT VALUE ON THE RELATIVE SLIDING MANIFESTED. /RRL/

Berardi, G
Pisa University /Italy/

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 229353

SOIL VARIABILITY AND ITS EFFECTS ON FLEXIBLE PAVEMENT DESIGN

A STUDY WAS MADE OF SOIL VARIANCE AS IT PERTAINS TO DESIGN OF FLEXIBLE TYPE PAVEMENTS. THE RESULTS SHOWED THAT SOIL VARIANCE IS A FUNCTION OF THE PROPERTY BEING MEASURED AND THAT, IN SO FAR AS DESIGN OF PAVEMENTS IS CONCERNED, ITS SIGNIFICANCE IS DEPENDENT ON TRAFFIC AND ENVIRONMENTAL CONDITIONS AT THE SITE. A METHOD FOR SELECTING A DESIGN VALUE FROM AN ARRAY OF SOIL DATA IS PRESENTED. THIS ANALYSIS INDICATED THAT THE OPTIMUM DESIGN VALUE IS GENERALLY, BUT NOT ALWAYS, LESS THAN THE MEAN TEST VALUE AND THAT IT IS DEPENDENT ON TRAFFIC, ENVIRONMENTAL CONDITIONS, SOIL VARIABILITY, CONSTRUCTION VARIABILITY AND PAVEMENT COSTS. GUIDE LINES FOR SAMPLING AND SELECTION OF SOIL STRENGTH VALUES ARE PRESENTED. THESE ARE BASED ON THE FACTORS OF TRAFFIC, ANTICIPATED DEGREE OF SATURATION, AND SOIL VARIANCE. /RRL/A/

Yoder, EJ *Rhodesian Engineer /Southern Rhodesia/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 229368

PORTUGUESE STUDIES ON ENGINEERING PROPERTIES OF LATERITIC SOILS

THE FREQUENT OCCURRENCE OF LATERITIC MATERIALS IN THE PORTUGUESE OVERSEAS PROVINCES AND THE NEED TO USE THEM IN ROAD CONSTRUCTION MADE IT NECESSARY TO CARRY OUT STUDIES IN ORDER TO IMPROVE THEIR TECHNICAL AND ECONOMICAL CONDITIONS OF USE. AN UP TO DATE ACCOUNT OF THE STATE OF THESE STUDIES AND CONCLUSIONS REACHED, WITH PARTICULAR REFERENCE TO ROAD SPECIFICATIONS FOR THE MECHANICAL STABILIZATION OF LATERITIC MATERIALS, IS GIVEN. A NEW PARAMETER-SWELLING-WAS INTRODUCED IN THESE SPECIFICATIONS AND A PROPOSAL PRESENTED FOR THE ACCEPTANCE OF

LATERITIC MATERIALS WITH CONSISTENCY LIMITS HIGHER THAN THOSE RECOMMENDED IN CURRENT SPECIFICATIONS (AASHO:M 145-49 AND ASTM:D 1241-55T) AS LONG AS SWELLING DOES NOT EXCEED 10 PERCENT. /RRL/

Soil Mech & Fdn Eng Conf Proc /Mexico/

ACKNOWLEDGMENT: Transport Road Research Lab /UK/

2A 229369

A SWELLING TEST FOR THE STUDY OF LATERITIC SOILS
THE POSSIBILITY OF SAFELY EXCEEDING THE RECOMMENDED LIMITS IN CURRENT SPECIFICATIONS CONCERNING THE USE OF LATERITIC SOILS IN ROAD CONSTRUCTION WAS INVESTIGATED. CONSISTENCY LIMITS WERE INVESTIGATED IN RELATION TO SWELLING, AND DETAILS ARE GIVEN OF A NEW SOIL SWELLING TEST AND RESULTS OBTAINED. /RRL/

De, CASTRO E *Soil Mech & Fdn Eng Conf Proc /Mexico/*

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

2A 229376

UTILIZATION OF LATERITIC SOILS FOR CONSTRUCTION PURPOSES

AN INVESTIGATION IS MADE INTO THE SUITABILITY OF LATERITIC SOILS FOUND IN THE PHILIPPINES FOR ROAD CONSTRUCTION. THE CHEMICAL PROPERTIES, GRADING, CONSISTENCY LIMITS, COMPACTION, UNCONFINED COMPRESSION AND CALIFORNIA BEARING RATIO OF RAW LATERITIC SOIL SAMPLES AND OF MIXTURES OF LATERITIC SOIL WITH VOLCANIC CINDER, HYDRATED LIME AND PORTLAND CEMENT WERE STUDIED IN THE LABORATORY. TESTS ON THE MIXTURES SHOW AN INCREASE IN STRENGTH AS MEASURED BY UNCONFINED COMPRESSION TESTS AND CBR TESTS COMPARED TO RESULTS OBTAINED WITH RAW LATERITIC SOIL. LABORATORY DATA WERE USED DURING THE CONSTRUCTION OF 4 EXPERIMENTAL ROAD SECTIONS, EACH SECTION CONTAINING A PARTICULAR SOIL MIXTURE USED FOR THE SURFACING COURSE. OBSERVATIONS ARE BEING CARRIED OUT WITH A VIEW TO EVALUATING THE PERFORMANCE OF EACH MIXTURE. /RRL/

Santos, JC *Soil Mech & Fdn Eng Conf Proc /Mexico/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 229377

THE USE OF LATERITIC SOIL IN ROAD CONSTRUCTION-GABON /IN FRENCH/

DETAILS ARE GIVEN OF THE GEOGRAPHY, CLIMATE AND VEGETATION OF GABON, AND TYPES OF LATERITIC SOIL FOUND IN THE COUNTRY. A COMPARATIVE STUDY IS MADE OF CBR TEST AND CLASSIFICATION TEST RESULTS WITH A VIEW TO DRAWING UP SPECIFICATIONS CONCERNING THE USES OF LATERITIC SOIL. THE MAJORITY OF THE NETWORK IN GABON CONSISTS OF LIGHTLY-TRAFFICKED EARTH ROADS. DATA ON THE DESIGN OF A NEW ROAD UNDER CONSTRUCTION AND METHODS OF STABILIZATION USED FOR ITS BASECOURSE ARE PRESENTED. /RRL/

Mellier, G Philipponnat, G *Soil Mech & Fdn Eng Conf Proc /Mexico/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 229386

THE ENGINEERING SIGNIFICANCE OF PLEISTOCENE STRATIGRAPHY IN THE SASKATOON AREA, SASKATCHEWAN, CANADA

IT WAS RECOGNIZED THAT REPEATED STAGES AND SUBSTAGES OF GLACIATION IN SASKATCHEWAN DURING THE PLEISTOCENE EPOCH PRODUCED A SERIES OF OVERLAPPING SEDIMENTS. IT WAS SHOWN THAT THESE SEDIMENTS COULD BE ANALYZED FOR ENGINEERING PURPOSES WITHIN A THREE-DIMENSIONAL STRATIGRAPHIC FRAMEWORK. PRELIMINARY FIELD INVESTIGATIONS INDICATED THAT A

STRATIGRAPHIC ANALYSIS COULD BE RELATED TO CONSTRUCTION PROBLEMS FOUND ON HIGHWAY EMBANKMENT CONSTRUCTION, GRAVEL LOCATION, AND TUNNEL EXCAVATION. FIELD STUDIES ESTABLISHED THAT IT IS PRACTICAL FOR THE FIELD ENGINEER TO ANALYZE AND INTERPRET THE STRATIGRAPHY IN THE FIELD. FURTHERMORE, LABORATORY STUDIES INDICATED THAT THERE WERE SIGNIFICANT DIFFERENCES IN THE ENGINEERING PROPERTIES OF DIFFERENT DRIFT-STRATIGRAPHIC UNITS. IT WAS SHOWN THAT THE BEHAVIOR OF THE TILL UNITS DURING CONSTRUCTION COULD BE EXPLAINED IN TERMS OF THE FUNDAMENTAL ENGINEERING PROPERTIES OF SOILS SUCH AS SHEAR STRENGTH PARAMETERS AND COMPRESSIBILITY. FINALLY, IT APPEARED TO BE PROBABLE THAT THE BASIC CONCEPTS DEVELOPED IN THIS STUDY WOULD APPLY TO OTHER AREAS COVERED BY GLACIAL SEDIMENTS. /RRL(A)/

Macdonald, AB Sauer, EK *Canadian Geotechnical Journal*

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

2A 229443

INTRODUCTION TO THE REFRESHER COURSE ON HIGHWAY GEOTECHNICS /IN FRENCH/

THIS ARTICLE CONSIDERS THE SPECIFIC CHARACTERISTICS OF HIGHWAY GEOTECHNICS, THEIR RELATION WITH SOIL HETEROGENEITY, AND THEIR VARIATION AS A FUNCTION OF COMPACTION AND MOISTURE CONTENT. /TRRL/

Pasquet, A *Revue Gen Des Routes & Aerodr /France/* No. 461, Jan. 1971, 1 Fig, 7 Phot, 12 Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

2A 229533

AN ENGINEERING GROUPING OF NEW YORK STATE SOILS
DURING THE PAST YEAR THE BUREAU OF SOIL MECHANICS HAS PREPARED FOR THE NEW YORK STATE DEPARTMENT OF PUBLIC WORKS ENGINEERING SOIL MAPS FOR CURRENT PROJECTS COVERING A TOTAL OF 3,360 SQUARE MILES. A DISCUSSION IS PRESENTED OF THE ENGINEERING SOIL GROUPING USED IN NEW YORK STATE, THE DEVELOPMENT OF SOIL MAPS, AND THE APPLICATION OF THE MAPS AS AIDS IN PRESENTING THE SOIL INFORMATION FOR HIGHWAY DESIGN AND CONSTRUCTION. THE ENGINEERING GROUP OF NEW YORK STATE SOILS IS BASED UPON THE FOLLOWING: (1) THE DIVISION OF THE STATE INTO ITS PHYSIOGRAPHIC PROVINCES WITH ANALYSES OF THE GEOLOGIC HISTORY, TOPOGRAPHY, SOIL, ROCKS, AND HIGHWAY PROBLEMS ASSOCIATED WITH EACH PROVINCE, AND (2) A GROUPING OF THE SOILS ON THE BASIS OF THEIR DEPOSITION, PARENT MATERIAL, SOIL AND ROCK PROFILE, LAND FORM AND DRAINAGE CHARACTERISTICS AS THESE FACTORS AFFECT HIGHWAY PROBLEMS. THE ENGINEERING SOIL MAPS ARE PREPARED TO SHOW THE AREAL DISTRIBUTION OF SOILS TO BE ENCOUNTERED IN THE PARTICULAR REGION. THE MAPS ARE ASSEMBLED ON THE BASIS OF EXISTING SOIL AND GEOLOGIC INFORMATION AND WITH THE AID OF AERIAL PHOTOGRAPHS. SOIL DEPOSITS, ARE GROUPED AS GLACIAL AND POST-GLACIAL AND ARE FURTHER DIVIDED INTO GLACIAL ICE DEPOSITS, GLACIAL STREAM DEPOSITS, GLACIAL LAKE DEPOSITS, GLACIAL MARINE DEPOSITS, WEATHERED BED ROCKS, RECENT STREAM DEPOSITS AND ORGANIC DEPOSITS. THE GROUPING AT THE PRESENT TIME CONSISTS OF THE FOLLOWING: THICK TILL, THIN TILL, DRUMLINS, MAJOR MORAINES, OUTWASH, KAME FIELDS, ESKERS, LAKE BOTTOM SEDIMENTS, DELTAS, BARS AND BEACHES, MARINE BOTTOM SEDIMENTS, RESIDUAL, ALLUVIAL, MUCK AND PEAT, MEADOW, AND MUCK OVER MARL. THE ENGINEERING SOIL MAPS FORM A PART OF BOTH THE PRELIMINARY AND FINAL SOIL REPORT FOR EACH PROJECT AND CONSTITUTE A BASIS FOR THE PLANNING, CONTROL AND REVIEW OF SOIL WORK IN THE DESIGN AND CONSTRUCTION OF HIGHWAYS. /AUTHOR/

Bennett, EF Mcalpin, GW *Highway Research Board Bulletin*

2A 229534

GEOLOGIC METHODS AND INTERPRETATIONS

TOPOGRAPHIC CHARACTERISTICS OF TERRAINS, AND THE PHYSICAL PROPERTIES AND STRUCTURES OF THE UNDERLYING MATERIALS MUST BE CONSIDERED IN THE DESIGN AND CONSTRUCTION OF MODERN MAJOR HIGHWAYS. THE PHYSICAL FEATURES OF THE TERRAIN SUCH AS THE TOPOGRAPHY, ROCKS, AND SOILS, ARE ELEMENTS THAT MAY BE ANALYZED BY THE SPECIAL TECHNIQUES OF THE GEOLOGIST AND THE SOIL SCIENTIST. THE MASSACHUSETTS GEOLOGIC PROGRAM HAS CONDUCTED FOUR SPECIAL GEOLOGIC STUDIES: (1) GRAVEL AND SAND RESOURCES OF PARTICULAR AREAS, (2) RECONNAISSANCE GEOLOGY, (3) GROUND-WATER INVESTIGATIONS, AND (4) SEISMIC STUDIES. STUDY METHODS AND FINDINGS ARE PRESENTED.

Currier, LW *Highway Research Board Bulletin*

2A 229542

HOW TO CALCULATE A CALCULATED RISK. AN ENGINEERING APPRAISAL OF LIMESTONE LANDFORMS

LANDFORMS ARE LAND UNITS IN WHICH THE GEOLOGY, SOILS, AND TOPOGRAPHY ARE GENERALLY THE SAME. WITH THESE OFT-REPEATED CONDITIONS WITHIN THE LANDFORM OF TOPOGRAPHY, SOIL MATERIAL AND DRAINAGE COME THE REPETITION OF CONDITIONS THAT AFFECT DESIGN, CONSTRUCTION, AND MAINTENANCE OF STRUCTURES AND PAVEMENTS. THE LIMESTONE LANDFORM IS AN ILLUSTRATION OF ONE OF THESE ROCK LANDFORMS. FACTORS OF TERRAIN AND DRAINAGE ARE DISCUSSED. LIMESTONE SOILS RANGE FROM SILTY CLAYS TO FAT CLAYS AND VARY IN COLOR FROM YELLOW TO DEEP RED. TERRAIN SURFACE CONDITIONS AND BEDROCK CONFORMATION ARE REVIEWED. EACH LANDFORM HAS ITS STRENGTH AND WEAKNESSES, AND BY IDENTIFYING THE LANDFORM AND KNOWING ITS TRAITS, A BETTER JOB OF ENGINEERING CAN BE DONE.

Belcher, DJ *Highway Research Board Bulletin*

2A 229548

USE OF SOILS MAPS IN OPERATION AND PLANNING OF COUNTY HIGHWAY ACTIVITIES

A DETAILED SOIL SURVEY WAS CONDUCTED ON INGHAM COUNTY, MICHIGAN. RESULTS OF THE SURVEY WERE PUBLISHED WITH A SOILS MAP ADEQUATE TO PROVIDE CONSIDERABLE DETAILED INFORMATION. THIS MAP AND THE REPORT ARE USED EXTENSIVELY AS A REFERENCE IN SOLVING CONSTRUCTION AND MAINTENANCE PROBLEMS. WHEN A ROAD IS TO BE RECONSTRUCTED, SOIL MAPS ARE CONSULTED AND CONFERENCES HELD BETWEEN THE ENGINEERS, THE MAINTENANCE FOREMAN, AND THE CONSTRUCTION SUPERINTENDENT. COUNTY SOIL MAPS AND AERIAL PHOTOGRAPHS ARE USED TO MAKE A SURVEY AND MAP VARIOUS POTENTIAL LOCATIONS FOR SAND AND GRAVEL DEPOSITS AVAILABLE FOR UP-GRADING OR RECONSTRUCTION OF ROADS. USE OF THE COUNTY SOIL MAPS HAS MADE REAL PROGRESS IN PROVIDING THE PEOPLE WITH BETTER ROADS AT LOWER COST. A SUMMARY OF MAINTENANCE COSTS FOR ROAD SURFACES SHOWS THE ECONOMICS OF USING SOIL MAPS DURING A PERIOD WHEN LABOR, MATERIALS AND EQUIPMENT COSTS INCREASED.

Evans, FK *Highway Research Board Bulletin*

2A 229561

GEOPHYSICS, A DIAMOND IN THE ROUGH, PRESENTS SEVERAL FACETS USEFUL TO THE GEOLOGIST AND ENGINEER

THE EXPANDING USE OF GEOPHYSICS IN SHALLOW SUBSURFACE INVESTIGATIONS FOR HIGHWAY AND OTHER ENGINEERING PROJECTS IS EVIDENCED BY THE WEALTH OF PUBLISHED PAPERS NOW AVAILABLE DESCRIBING SUCH WORK. USE OF THE EARTH RESISTIVITY TEST IS ESPECIALLY NOTED WHEN APPLIED TO SUBSURFACE INVESTIGATIONS

DEALING WITH SLOPE DESIGN, STRUCTURE FOUNDATIONS, AND LANDSLIDE PROBLEMS. FURTHER STUDY OF THE POSSIBLE USE OF NATURAL POTENTIALS, GENERALLY PRESENT IN THE EARTH, TO FURTHER EVALUATE LANDSLIDE CONDITIONS IS WARRANTED. THE REFRACTION SEISMIC TEST CONTINUES TO HAVE USEFUL APPLICATIONS IN SUBSURFACE EXPLORATIONS FOR HIGHWAY CONSTRUCTION. SMALL-SCALE REFRACTION SEISMIC TESTS SHOW PROMISE AS A NEW, ECONOMICAL, AND RAPID MEANS OF EVALUATING THE STABILITY OF COMPACTED SOIL LAYERS ALONG WITH THE CURRENTLY USED PROCEDURES. /AUTHOR/

Moore, RW *Eng Geol & Soils Eng Symp Proc, Boise* pp 41-64, 1965

ACKNOWLEDGMENT: Geophysical Abstracts

2A 229566

SIGNIFICANCE OF THE SOIL SURVEY REPORT IN THE SELECTION AND PRELIMINARY ASSESSMENT OF SITES FOR AIRPLANE LANDING STRIPS

COMPARISONS WERE MADE BETWEEN CONDITIONS PREDICTED FROM INDEPENDENT INTERPRETATION OF SOIL SURVEY REPORTS AND ACTUAL ENGINEERING EXPERIENCE, FOR FIVE AIRPLANE LANDING STRIPS IN CALIFORNIA. IT WAS CONSIDERED NECESSARY THAT THE SOILS OF THE PARTICULAR LOCALITIES CHOSEN FOR EXAMINATION FULFILLED THESE REQUIREMENTS: (1) THEY MUST HAVE BEEN INCLUDED IN SOIL SURVEYS FOR WHICH MAPS AND DESCRIPTIVE REPORTS EXIST, (2) THEY MUST BE SUFFICIENTLY REPRESENTATIVE OF A RANGE OF DIFFERENCES IN SOIL PROPERTIES THAT THEY WILL PROVIDE A REASONABLY SIGNIFICANT SAMPLE FOR CONSIDERATION, (3) THEY MUST HAVE BEEN USED AS THE ACTUAL MATERIALS OF SUBGRADE CONSTRUCTION FOR AIRPLANE RUNWAYS, AND (4) THEY MUST HAVE BEEN SUBJECTED TO QUANTITATIVE PHYSICAL EXAMINATION AND TESTING IN AN ENGINEERING LABORATORY FOR THE PURPOSE OF GUIDING CONSTRUCTION DESIGN. IN ORDER TO DETERMINE THE VALUE OF SOIL SURVEY REPORTS IN THE SELECTION AND PRELIMINARY ASSESSMENT OF AIRFIELD SITES, ESTIMATES WERE MADE OF THE ENGINEERING PROPERTIES AND CONSTRUCTION PROBLEMS OF CERTAIN SOIL TYPES IN CENTRAL CALIFORNIA, UPON WHICH AIRFIELD RUNWAYS HAD BEEN CONSTRUCTED FOR ARMY USE. NUMERICAL ESTIMATES WERE MADE ONLY FOR RANGES IN VALUES OF PLASTIC LIMIT, PLASTICITY INDEX AND BEARING RATIO, AS WELL AS FOR EXPANSION AND SHRINKAGE, QUANTITATIVE MEASUREMENTS HAD BEEN MADE IN THE ENGINEERING LABORATORY. IT IS CONCLUDED THAT THE PROPER INTERPRETATION OF INFORMATION CONTAINED IN AGRICULTURAL SOIL SURVEY REPORTS CAN BE USED TO EXCELLENT ADVANTAGE IN THE SELECTION AND PRELIMINARY ASSESSMENT OF SITES PRIOR TO ENGINEERING CONSTRUCTION.

Bodman, GB *Highway Research Board Bulletin*

2A 229570

MAPS FOR CONSTRUCTION MATERIALS

THE GEOLOGIST SHOULD BE USED IN PREPARING MATERIAL MAPS FOR CONSTRUCTION MATERIALS. THIS WILL RESULT IN CONSIDERABLE REDUCTION IN THE COST OF ENGINEERING CONSTRUCTION. THREE PRINCIPLE KINDS OF CONSTRUCTION MATERIAL MAPS ARE DISCUSSED: MATERIAL-SITE, MATERIAL DISTRIBUTION, AND SURFACE GEOLOGY. THE MATERIAL-SITE MAP IS AN INVENTORY OF MATERIALS THAT HAVE ALREADY BEEN FOUND AND TESTED. THE MATERIAL-DISTRIBUTION MAP IS BASED ON THE GEOLOGIC MAPS AVAILABLE FOR THE REGION. THE SURFACE-GEOLOGY MAP COMBINES MANY OF THE USEFUL FEATURES OF THE OTHER TWO KINDS. IT IS CONSTRUCTED TO A RELATIVELY LARGE SCALE, SHOWING THE OUTCROP AREAS OF ALL GEOLOGIC FORMATIONS AND THE LOCATIONS OF EXISTING PITS AND QUARIES IN THE AREA. THE SURFACE-GEOLOGY MAP, ALTHOUGH EXPENSIVE TO PREPARE, IS THE MOST SATISFACTORY SINCE IT PROVIDES COMPLETE INVENTORY OF ALL

AVAILABLE CONSTRUCTION MATERIAL AND THE BEST POSSIBLE BASIS FOR THE SEARCH FOR A MATERIAL TO MEET CERTAIN SPECIFICATIONS. IT IS ALSO USEFUL FOR ESTIMATING AVAILABLE QUANTITIES OF MATERIAL, THE CHARACTER AND THICKNESS OF OVERBURDEN, THE EXISTENCE OF POSSIBLE CAUSES OF FAILURES OF CONSTRUCTION, AND THE KIND OF EXCAVATION TO BE EXPECTED AT ANY ONE PLACE.

Byrne, FE *Highway Research Board Bulletin*

2A 229571

DEVELOPMENT OF GEOPHYSICAL METHODS OF SUBSURFACE EXPLORATION IN THE FIELD OF HIGHWAY CONSTRUCTION

A STUDY WAS MADE OF GEOPHYSICAL METHODS OF EXPLORING THE SUBSTRATA AS APPLIED TO HIGHWAY ENGINEERING PROBLEMS, INCLUDING THE DEVELOPMENT OF INSTRUMENTS AND METHODS OF INTERPRETATION OF THE DATA OBTAINED. EARTH RESISTIVITY AND REFRACTION SEISMIC APPARATUS WERE ADAPTED OR DEVELOPED FOR USE IN THE SHALLOW SUBSURFACE EXPLORATIONS. DATA WERE COLLECTED ON APPLICATION OF THIS EQUIPMENT TO SUCH PROBLEMS AS SLOPE DESIGN, CLASSIFICATION OF EXCAVATION MATERIALS ON GRADING PROJECTS, FOUNDATION STUDIES FOR BRIDGES, BUILDINGS AND OTHER STRUCTURE, INVESTIGATION OF TUNNEL SITES, LOCATION OF SAND, GRAVEL, SOLID ROCK AND SPECIAL SOILS FOR USE IN CONSTRUCTION, DETERMINATION OF DEPTH OF PEAT AND MUCK IN SWAMPY AREAS, AND STUDIES OF EXISTING AND POTENTIAL SLIDE AREAS. THE GEOPHYSICAL METHODS OF TEST UNDER CONSIDERATION DEFINITELY ESTABLISHED THEIR VALUE IN CONNECTION WITH HIGHWAY WORK, PARTICULARLY FOR USE IN PRELIMINARY SURVEYS. DATA OBTAINED SHOWED THAT BOTH THE SEISMIC AND THE RESISTIVITY METHODS OF TEST HAD MERIT, PARTICULARLY AS RAPID AND RELATIVELY INEXPENSIVE METHODS OF EXPLORATION FOR USE IN PRELIMINARY SURVEYS.

Moore, RW *Highway Research Board Bulletin*

2A 229626

SOIL SERIES AS A BASIS FOR DETERMINING CEMENT REQUIREMENTS FOR SOIL-CEMENT CONSTRUCTION

ONE OF THE MOST IMPORTANT TOOLS OF THE SOILS ENGINEER IS A GOOD METHOD OF IDENTIFYING SOILS. THIS PERMITS PROPER CLASSIFICATION AND COMPARISON OF SOILS FOR ENGINEERING PURPOSES. PROPER IDENTIFICATION MAKES CLASSIFICATION WORK SIMPLER WHENEVER THE SAME SOILS ARE ENCOUNTERED ON FUTURE PROJECTS. AN EXCELLENT SOIL IDENTIFICATION METHOD IS THE PEDAGOGICAL SYSTEM DEVELOPED BY THE U.S. DEPARTMENT OF AGRICULTURE. THIS METHOD PROVIDED THE BASIS FOR THE PROJECT DESCRIBED IN THIS PAPER. IT HAS BEEN KNOWN FOR SOME TIME THAT SOILS OF THE SAME SERIES AND HORIZON, AS IDENTIFIED BY THE DEPARTMENT OF AGRICULTURE'S SYSTEM REQUIRE THE SAME CEMENT FACTOR FOR SOIL-CEMENT CONSTRUCTION. ONCE THE CEMENT FACTORS FOR A GIVEN SOIL SERIES ARE ESTABLISHED IT IS UNNECESSARY TO CONDUCT TESTS FOR SOIL-CEMENT CONSTRUCTION INVOLVING THE SAME SERIES NO MATTER WHERE IT IS ENCOUNTERED. SINCE IT IS NOT UNCOMMON FOR SOME SOIL SERIES TO COVER LARGE AREAS, SOMETIMES HUNDREDS OF SQUARE MILES, THE IMPORTANCE OF THIS RELATIONSHIP IS OBVIOUS. FIRST, THIS PAPER REVIEWS BRIEFLY THE DEPARTMENT OF AGRICULTURE'S IDENTIFICATION SYSTEM. IT THEN DESCRIBES THE RESULTS OF A PROJECT TO DETERMINE CEMENT REQUIREMENTS FOR SOIL-CEMENT CONSTRUCTION FOR 43 MAJOR SOIL SERIES OCCURRING IN SEVERAL GREAT PLAINS STATES, THE EASTERN HALF OF WASHINGTON AND THE NORTHERN PART OF IDAHO. DEPARTMENT OF AGRICULTURE SOIL MAPS SHOWING THE LOCATION AND EXTENT OF THE SOIL SERIES WERE USED TO DETERMINE SAMPLING LOCATIONS. IN SEVERAL CASES SAMPLES OF THE SAME SERIES WERE TAKEN AT 3 OR

4 WIDELY SEPARATED AREAS. BOTH SOIL AND SOIL-CEMENT TESTS WERE MADE ON THE SAMPLES. INCLUDED IN THE PAPER ARE MAPS SHOWING THE AREAS SAMPLED AND TABLES LISTING THE CEMENT REQUIREMENTS FOR SOIL-CEMENT CONSTRUCTION FOR THE 43 SOIL SERIES. THE PHYSICAL PROPERTIES OF THE SOIL SAMPLES TAKEN FROM WIDELY SEPARATED AREAS BUT REPRESENTING THE SAME HORIZON OF A SPECIFIC SOIL SERIES WERE GENERALLY SIMILAR, REFLECTING THE ACCURACY OF THE U.S. DEPARTMENT OF AGRICULTURE SOIL MAPS. THE CEMENT REQUIREMENTS OF THE DUPLICATE SAMPLES WERE CONSISTENTLY THE SAME. THESE RESULTS PROVE THE USEFULNESS OF THE PEDAGOGICAL SYSTEM OF SOIL IDENTIFICATION IN SOIL-CEMENT WORK. /AUTHOR/

Leadabrand, JA Norling, LT Hurlless, AC *Highway Research Board Bulletin*

2A 229632

TECHNIQUES OF ENGINEERING GEOLOGY IN EVALUATION OF ROCK CORES FOR CONSTRUCTION MATERIALS SOURCES

ONE OF THE PRIMARY AIMS OF THE ENGINEERING GEOLOGISTS IS IDENTIFY AND EVALUATE THE VARIOUS ROCK BEDS EXPOSED ON OR NEAR THE SURFACE IN A GIVEN AREA. CORES DRILLED BY COMMERCIAL MATERIALS PRODUCERS IN THEIR EXPLORATORY PROGRAMS MAY BE SUBMITTED TO THE IOWA STATE HIGHWAY COMMISSION FOR EVALUATION. MOST OF THESE SEDIMENTARY ROCK CORES ARE LOGGED BY SUITES USING AN AREA GENERALIZED GEOLOGIC COLUMN. BEDS ARE SEPARATED INTO WORKABLE 'LEDGES' AND SAMPLES FOR PHYSICAL AND CHEMICAL TESTS ARE TAKEN ACCORDINGLY. CROSS SECTIONS ARE DRAWN USING CORE LOCATIONS, RELATIVE ELEVATIONS, AND OVERBURDEN THICKNESSES. TEST DATA ARE SUPERIMPOSED ON THE CROSS SECTIONS TO GIVE AN OVERALL PICTURE OF THE FORMATION'S POTENTIAL IN REGARD TO CONSTRUCTION MATERIALS. AFTER PROSPECTS ARE OPENED INTO QUARRIES, FOLLOW-UP CORRELATIONS ARE MADE BETWEEN CORE EVALUATIONS AND ACTUAL LEDGE CONDITIONS AND PRODUCTION DATA. THESE METHODS ENABLE THE IDENTIFICATION OF MATERIALS FOR HIGHWAY CONSTRUCTION, LOWER CONSTRUCTION COSTS, AND CONTINUANCE OF A HIGH QUALITY OF PRODUCT.

Michael, RD *Highway Geology Symposium, Iowa State U*

2A 229633

THE EFFECTS OF PEAT DEPOSITS ON HIGHWAY DESIGN IN IOWA

PROBLEMS ENCOUNTERED IN IOWA IN HIGHWAY DESIGN WITH THE PEAT DEPOSITS ARE REVIEWED. INTERSTATE HIGHWAY CONSTRUCTION IN NORTHERN IOWA HAS MADE IT NECESSARY TO LOCATE HIGHWAYS OVER ADVERSE SOIL CONDITIONS. DETAILED STUDIES OF INDIVIDUAL PEAT DEPOSITS ARE NECESSARY FOR HIGHWAY LOCATION, AND A REASONABLE CLASSIFICATION MUST BE ADOPTED. CLASSIFICATION METHODS FOR PEAT DEPOSITS USED IN IOWA ARE REVIEWED. A SOILS ENGINEER AVOIDS PEAT DEPOSITS WHEN POSSIBLE BECAUSE OF THE NECESSARY TREATMENT PLUS A DELAY IN CONSTRUCTION THAT MAY BE NECESSARY. IT IS CAUTIONED THAT PEAT DOES NOT HAVE TO BE EXCEPTIONALLY DEEP TO CAUSE CONCERN TO HIGHWAY DESIGNERS. IT IS CONCLUDED THAT DETAILED STUDIES OF THE INDIVIDUAL PEAT DEPOSITS ARE NECESSARY FOR HIGHWAY LOCATION.

Blattert, RE *Highway Geology Symposium, Iowa State U*

2A 229647

USE OF SOIL SURVEY DATA BY THE SMALL HIGHWAY ORGANIZATION

THE SMALL STATE OR COUNTY HIGHWAY ORGANIZATION IS OFTEN RELUCTANT TO ADOPT METHODS BEING USED BY HIGHLY TRAINED TECHNICIANS IN LARGE HIGHWAY ORGA-

NIZATIONS. USUALLY BENEFITS CAN BE DERIVED IN THE SMALL ORGANIZATION SIMPLY BY CHANGING FROM NEGATIVE TO POSITIVE THINKING AND 'GETTING STARTED.' IT IS PRACTICAL TO ENTER INTO THE USE OF SOME OF THESE METHODS WITH EXISTING PERSONNEL AND VERY LITTLE INITIAL INVESTMENT. THE PURPOSE OF THIS ARTICLE IS TO SHOW THAT A START CAN BE MADE BY ANY INDIVIDUAL OR SMALL ORGANIZATION AND THAT EVEN THE RELATIVELY INEXPERIENCED CAN MAKE PRACTICAL APPLICATION WITH GRATIFYING RESULTS. WYOMING SENT ONE EMPLOYEE TO THE 'AIRPHOTO SHORT COURSE' AT PURDUE UNIVERSITY IN LAFAYETTE, INDIANA IN APRIL OF 1948. THIS COURSE WAS FOR THE DURATION OF ONE WEEK, AND WAS DESIGNED TO PROVIDE INSTRUCTION IN THE TECHNIQUES OF INTERPRETING SOILS AND ENGINEERING PROBLEMS FROM AERIAL PHOTOGRAPHS. SINCE THAT TIME, MUCH INTEREST HAS BEEN AROUSED AMONG THE PROJECT ENGINEERS, DUE PRIMARILY TO THE TIME BEING SAVED BY DETERMINING DRAINAGE AREAS ON AIRPHOTOS INSTEAD OF THE CONVENTIONAL TRAVERSE METHOD, WITH COSTS DROPPING AS MUCH AS 80 PERCENT. SOME ENGINEERS HAVE OBSERVED EXAMPLES OF POOR ALIGNMENT AFTER HAVING PURCHASED AIRPHOTOS FOR DRAINAGE AREA DETERMINATION, AND NOW INSIST ON THE PURCHASE OF AIRPHOTOS PRIOR TO LOCATION, THEREFORE THEIR USE IS GRADUALLY BEING ENLARGED TO INCLUDE ALIGNMENT, SELECTION OF STREAM CROSSINGS, LOCATION OF LAND TIES, DETERMINATION OF DRAINAGE AREAS, LOCATION OF GRANULAR MATERIALS, SOIL SURVEY, ETC. USE OF AIRPHOTOS HAS DEVELOPED AN INTEREST IN GEOLOGY AND AGRICULTURAL SOIL MAPS. GEOLOGIC MAPS, AGRICULTURAL SOIL MAPS, OR AERIAL PHOTOGRAPHS OFTEN POINT OUT PERTINENT DATA, TO THE INTERESTED (ALTHOUGH RELATIVELY UNTRAINED) STATE OR COUNTY HIGHWAY ENGINEER THAT ARE APPLICABLE TO LOCATION, SOIL SURVEY, LOCATION OF CONSTRUCTION MATERIALS, DESIGN, AND MAINTENANCE. SOME OF THESE DATA ARE OFTEN OVER-LOOKED DURING ON-THE-GROUND STUDIES, AND USE OF THESE AIDS USUALLY RESULTS IN LESS FIELD WORK, MORE SATISFACTORY RESULTS, AND REDUCED COSTS. WHERE PURCHASE OF MAPS OR PHOTOGRAPHS IS NOT POSSIBLE, DUE EITHER TO TIME OR MONEY, IT IS SOMETIMES POSSIBLE TO SECURE THEM ON LOAN FROM OTHER LOCAL STATE OR GOVERNMENT AGENCIES. INTERESTED ENGINEERS WILL IMPROVE THEIR TECHNIQUES WITH EXPERIENCE AND OCCASIONAL ASSISTANCE. MISTAKES WILL BE MADE, LIMITATIONS WILL BE REACHED, BUT THE OVERALL LEVEL OF EFFICIENCY WILL CONTINUE UPWARD, AND THE ENTIRE ORGANIZATION WILL GAIN A FEELING OF SATISFACTION FROM THE ACCOMPLISHMENTS MADE. /AUTHOR/

Olinger, DJ *Highway Research Board Bulletin*

2A 229665

SURFACE AND SUBSURFACE EXPLORATION BY INFRARED SURVEYS

SOME OF THE BASIC PRINCIPLES ARE SUMMARIZED RELATING TO INFRARED RADIOATION (IR) VARIOUS APPLICATIONS OF INFRARED PHOTOGRAPHY AND IMAGERY TO SURFACE AND SUBSURFACE EXPLORATION AND TERRAIN ANALYSIS FOR HIGHWAY CONSTRUCTION AND OTHER ENGINEERING PROJECTS. MAJOR CONCLUSIONS FROM THIS STUDY ARE THE FOLLOWING: (1) IR PHOTOGRAPHY AND IMAGERY HIGHLIGHT VARIATIONS IN SOIL TEXTURE, COMPOSITION, AND MOISTURE THAT MAY NOT USUALLY BE RECORDED BY CONVENTIONAL PHOTOGRAPHY, (2) THE CHLOROPHYLL EFFECT ALLOWS IR PHOTOGRAPHY TO ASSIST IN THE APPRAISAL OF CULTIVATED LAND FOR RIGHT-OF-WAY ACQUISITIONS, AND (3) HIDDEN SUBSURFACE CONDITIONS AND GEOLOGICAL FEATURES THAT ARE OF GREATEST IMPORTANCE DURING HIGHWAY SITE SELECTION AND DESIGN CAN BE EXPOSED WITH IR INSTRUMENTATION-FEATURES SUCH AS MUCK POCKETS, UNDERGROUND CAVITIES, VOLCANIC AND HYDROTHERMAL ACTIVITIES, SUBSURFACE DRAIN-

AGE SYSTEMS, AND BURIED UTILITIES AND CONDUITS. WITH FURTHER RESEARCH IN THE TECHNIQUES USED FOR REMOTE SENSING IN THE INFRARED, SURFACE AND SUBSURFACE EXPLORATION AND DRAINAGE STUDIES FOR CONSTRUCTION OF HIGHWAYS, AIRPORTS, AND OTHER PROJECTS MAY BE GREATLY FACILITATED. /AUTHOR/

Matalucci, RV Abdel-hady, M *Highway Research Board Special Reports*

2A 229687

THE TREND TOWARD A GREATER UTILIZATION OF SPECIALISTS IN THE HIGHWAY ENGINEERING FIELD

THE NEED FOR, AND THE GROWING TREND TOWARD, THE UTILIZATION OF SPECIALISTS IN THE FIELDS OF CIVIL ENGINEERING AND GEOLOGY ARE DISCUSSED. THE SUCCESS OF ANY HIGHWAY ENGINEERING CONTRACT IS DEPENDENT, NOT ONLY ON HOW WELL EACH INDIVIDUAL UNIT DOES ITS JOB, BUT ON HOW WELL THE SEPARATE AND DISTINCT FUNCTIONS ARE COORDINATED. FOR EXAMPLE, THE DESIGN PEOPLE SHOULD NEVER BE SADDLED WITH A LOCATION THAT HAS NOT BEEN COMPLETELY AND THOROUGHLY INVESTIGATED WITH REGARD TO SOIL AND GEOLOGICAL CONDITIONS. CONSTRUCTION PEOPLE SHOULD NOT BE HANDED A DESIGN THAT IS NOT COMPATIBLE WITH THE SOIL AND GEOLOGICAL CONDITIONS AT THE CONSTRUCTION SITE. THE INABILITY TO RECOGNIZE THE DIFFERENCES BETWEEN RESIDUAL AND ALLUVIAL OR COLLUVIAL SOILS, MAY RESULT IN THE FAILURE TO UNDERCUT OR UNDERBENCH TO AN EFFECTIVE DEPTH. THIS MAY RESULT IN AN EMBANKMENT FAILURE. COORDINATION IS THE KEY AND IT IS FELT THAT WE MUST RELY MORE ON SPECIALISTS TO COORDINATE THESE FUNCTIONS. THE GAPS MUST BE BRIDGED THAT EXIST BETWEEN LOCATION, DESIGN AND CONSTRUCTION.

Royster, DL *Tennessee Highway Conference Proc*
Tennessee Department of Highways

2A 229698

DISCUSSION OF EMBANKMENT PORE PRESSURES DURING CONSTRUCTION

MR. DE OLIVEIRA CALLS THE AUTHOR'S ATTENTION TO A PAPER BY GIBSON IN WHICH THE THEORETICAL ANALYSIS OF THE CONSOLIDATION OF A CLAY LAYER INCREASING IN THICKNESS WITH TIME IS EXTENDED TO PARTLY SATURATED SOILS BY INTRODUCING SKEMPTON'S PORE PRESSURE PARAMETER. THIS METHOD TAKES INTO ACCOUNT THE RATE OF CONSTRUCTION AND ALSO ALLOWS THE PREDICTION OF THE DISSIPATION OF PORE PRESSURES DURING CONSTRUCTION AND THOSE OCCURRING DURING SEASONAL SHUTDOWNS. HE ALSO POINTS OUT THAT THE AVAILABLE METHODS DO NOT CONSIDER THE NEGATIVE PORE PRESSURES ALWAYS PRESENT IN COMPACTED COHESIVE SOILS. MR. RAO CONGRATULATES THE AUTHORS ON THEIR EXCELLENT REVIEW WORK ON THE DEVELOPMENT OF PORE PRESSURES DURING THE CONSTRUCTION OF EARTH DAMS. WHILE MENTIONING THE VARIOUS FACTORS THAT INFLUENCE THE MAGNITUDE OF THE PORE-PRESSURE RATIO AT THE END OF CONSTRUCTION, THE AUTHORS HAVE INDICATED UNDER THE SUBHEADING COMPACTION EFFECT, THAT WATER CONTENT HAS A GREATER EFFECT ON THE DEVELOPMENT OF PORE PRESSURES, EVEN WHEN COMPACTION EFFORT IS RELATIVELY HIGH. MR. RAO FEELS THAT THE DEVELOPMENT OF PORE PRESSURES WILL ALWAYS BE GREATER WHEN COMPACTION EFFORT IS HIGH. HE ALSO POINTS OUT OBSERVED CORRELATIONS BETWEEN SOIL TYPE AND PORE PRESSURE RATIO. THE TYPE OF EQUIPMENT USED FOR HAULING AND COMPACTING FILL MATERIAL ALONG WITH THEIR DYNAMIC EFFECT PLAY A LEADING ROLE IN DEVELOPING CONSTRUCTION PORE PRESSURES. MR. LITTLE POINTS OUT TWO ERRORS IN THE PAPER. THE DRAINAGE BLANKETS AT USK WERE PLACED IN THE SHOULDERS AND NOT IN THE IMPERVIOUS CORE WHICH WAS OF THE OLD FASHIONED PUDDLE CLAY VARIETY. ALTHOUGH PORE PRESSURES IN THE CORE WERE NOT MEASURED DIRECTLY, IT WAS INFERRED THAT THEY

WERE HIGH. A GRAPH IS PRESENTED OF TYPICAL PORE PRESSURES IN THE CORE AT DIDDINGTON DAM, MANGLA DAM AND AYER ITAM DAM. MR. LITTLE AGREES WITH MOST OF THE AUTHORS' CONCLUSIONS BUT HE HAS NOT SO FAR MET HIGH PORE PRESSURES IN A FILL OF HEAVILY OVERCONSOLIDATED CLAY NOR WITH THE TYPE OF FILL USED AT SHEK PIK DAM, EVEN AT WATER CONTENTS APPRECIABLY ABOVE OPTIMUM. REFERENCES: EMBANKMENT PORE PRESSURES DURING CONSTRUCTION, WALTER C. SHERMAN, GERALD W. CLOUGH, ASCE PROC. PAPER 5867, MARCH, 1968.

De, OLIVEIRA HG Rao, KK Little, AL *Am Soc Civil Engr J Soil Mech Div*

2A 229712

TERRAIN EVALUATION FOR ROAD ENGINEERS IN DEVELOPING COUNTRIES

EXISTING ROAD-LOCATION AND MATERIALS SURVEYS ARE OFTEN CARRIED OUT WITHOUT REFERENCE TO VARIATION IN TERRAIN CONDITIONS. TERRAIN EVALUATION RELATES THE SOIL'S PROPERTIES AND THE ASSOCIATED ENGINEERING PROBLEMS AND SOLUTIONS TO A LAND-CLASSIFICATION SCHEME, THUS ESTABLISHING A SYSTEM FOR STORING AND RELATING INFORMATION FROM ONE PROJECT TO ANOTHER. THE BASIC UNIT OF THE CLASSIFICATION IS THE LAND FACET WHICH BY DEFINITION IS REASONABLY UNIFORM IN PROPERTIES AND BEHAVIOR IN ROAD ENGINEERING. LAND FACETS RECUR TOGETHER IN LARGER UNITS CALLED LAND SYSTEMS WHICH ARE USUALLY IDENTIFIED ON AIR-PHOTO PRINT LAY-DOWNS AT SCALES ABOVE 1:80,000. AT THIS LEVEL THE LAND SYSTEM CAN STORE MORE GENERAL INFORMATION RELATING TO AVAILABILITY OF MATERIALS, SUITABLE CONSTRUCTION METHODS AND COSTS OF CONSTRUCTION OR MAINTENANCE. A TERRAIN EVALUATION CAN LEAD TO A MORE LOGICAL SOIL-SURVEY PROCEDURE, CONCENTRATING EFFORT ON PROBLEMS RELEVANT TO THE PROJECT. THIS CAN OFTEN LEAD TO A DECREASE IN THE AMOUNT OF SURVEY WORK, TOGETHER WITH AN INCREASE IN ITS EFFECTIVENESS. THE PAPER IS ILLUSTRATED BY EXAMPLES OF TERRAIN-EVALUATION STUDIES FROM NORTHERN NIGERIA AND WESTERN MALAYSIA. /AUTHOR/

Dowling, JW Beaven, PJ *Inst Hwy Engineers Journal, London /UK/*

2A 229729

A DROP HAMMER PENETROMETER FOR DETERMINING THE DENSITY OF SOILS AND GRANULAR MATERIALS

THE APPLICATION OF A DROP HAMMER PENETROMETER WAS INVESTIGATED AS A RAPID METHOD FOR DETERMINING THE DENSITY OF SOILS AND BASE MATERIALS USED IN HIGHWAY CONSTRUCTION. DESCRIPTION IS GIVEN OF THE DROP HAMMER PENETROMETER, SAMPLE PREPARATION AND TEST PROCEDURE, CALIBRATION PROCEDURE AND PRACTICAL APPLICATIONS OF THE DROP HAMMER PENETROMETER. RESULTS INDICATE THAT THE DROP HAMMER PENETROMETER CAN BE USED TO ESTIMATE RAPIDLY THE DRY DENSITY OF SANDY SOILS AND CRUSHED GRANITE GNEISS. TO MAKE THIS DETERMINATION FOR MATERIALS WHICH HAVE BEEN CALIBRATED, THE MOISTURE CONTENT AS WELL AS THE PENETRATION RESISTANCE IS REQUIRED. IT IS ANTICIPATED THAT THE USE OF THE PENETROMETER IN THE FIELD WOULD BE RESTRICTED TO THOSE SOILS FOR WHICH GOOD CORRELATION HAD BEEN ESTABLISHED AND, IT IS RECOMMENDED THAT BECAUSE OF POSSIBLE THIXOTROPIC BEHAVIOR, THE TIME LAG BETWEEN COMPACTION AND PENETROMETER READINGS BE KEPT TO A MINIMUM. THE OVERALL STANDARD ERROR OF THE PROCEDURE FOR ALL MATERIALS TESTED WAS FOUND TO BE 2.2 PCF. THE TOTAL TIME REQUIRED TO DETERMINE THE UNIT WEIGHT OF A CALIBRATED SOIL OR BASE MATERIAL BY THE USE OF THE DROP HAMMER PENETROMETER (AND THE SPEEDY MOISTURE TESTER TO MAKE THE NECESSARY MOISTURE DETERMINATION) WAS APPROXIMATELY 15 MINUTES.

Rostron, JP Schwartz, AE Gioiosa, TE *Highway Research Record, Hwy Res Board*

2A 229737

SOILS AND ROCK INFORMATION: SYSTEMS FOR STORAGE AND RETRIEVAL

THE WEALTH OF INFORMATION IN THE HIGHWAY RESEARCH FIELD, IN RESPECT PARTICULARLY TO THE SOIL MECHANICS OR GEOTECHNICAL FIELD IS DESCRIBED. TYPES OF INFORMATION STORAGE AND RETRIEVAL SYSTEMS AVAILABLE TO PROCESS THESE DATA ARE OUTLINED AND DISCUSSED FROM ANNUAL SYSTEMS TO COMPUTER-BASED SYSTEMS. THE OPERATIONS ARE DESCRIBED OF THE HIGHWAY RESEARCH INFORMATION SERVICE (HRIS) OPERATED BY THE HIGHWAY RESEARCH BOARD, NATIONAL RESEARCH COUNCIL UNDER THE NATIONAL ACADEMY OF SCIENCES-NATIONAL ACADEMY OF ENGINEERING. THE SCOPE OF THE INFORMATION STORED IN THE SYSTEM IS AS BROAD AS THE PROBLEMS OF PLANNING, LOCATING, CONSTRUCTING, OPERATING, AND MAINTAINING TRANSPORTATION SYSTEMS. OPERATIONS OF THE SYSTEM ARE DESCRIBED.

Guinee, JW Mobley, AB *Eng Geol & Soils Eng Symp Proc, Boise*

2A 229794

PROPOSALS FOR THE APPLICATION OF THE PUCE PROGRAM OF TERRAIN CLASSIFICATION AND EVALUATION TO SOME ENGINEERING PROBLEMS

FOLLOWING ATTEMPTS TO MODIFY EARLIER LAND CLASSIFICATIONS FOR ENGINEERING USE, THE PATTERN UNIT COMPONENT EVALUATION (PUCE) SYSTEM OF TERRAIN CLASSIFICATION HAS BEEN PROPOSED, BASED UPON EASILY RECOGNIZABLE AND DEFINABLE NATURAL FEATURES. THE SYSTEM RELATES ENGINEERING PROPERTIES TO THE TERRAIN AND ACTS FIRST AS A BASE FOR THE VALID EXTRAPOLATION OF TERRAIN PROPERTIES FROM ONE AREA TO ANOTHER, AND SECOND AS A FILE INTO WHICH ALL KNOWLEDGE OF ENGINEERING SIGNIFICANCE CAN BE COLLATED, STORED AND RETRIEVED FOR FUTURE USE. THE CLASSIFICATION SYSTEM HAS FOUR LEVELS OF GENERALIZATION, VIZ. PROVINCE, TERRAIN PATTERN, TERRAIN UNIT, TERRAIN COMPONENT, ALL OF WHICH ARE DEFINED AND, FROM THIS DEFINITION, EASILY RECOGNIZABLE. A BASIC PREMISE OF THE SYSTEM IS THAT ONCE THE PROPERTIES OF ONE EXAMPLE OF ANY MEMBER OF A CLASS HAVE BEEN ESTABLISHED, THEN THOSE PROPERTIES REMAIN SIMILAR OVER ALL OCCURRENCES OF THAT MEMBER. HENCE, WHILE THE TERRAIN REMAINS CONSISTENT, PREDICTION OF PROPERTIES CAN BE MADE. ENGINEERING APPLICATIONS OF THIS PRINCIPLE MAY BE MANY AND VARIED. PREDICTION IN TERMS OF THE APPROPRIATE LEVEL IN THE CLASSIFICATION COULD BE MADE OF: ROUTE LOCATION, GRADE LINE LOCATION, EARTHMOVING QUANTITIES, EARTHMOVING EQUIPMENT, BRIDGING AND CULVERTING FREQUENCIES, BEHAVIOR OF NATURAL MATERIALS AS SUBGRADE, LOCATION OF NATURAL MATERIALS FOR USE AS PAVEMENT CONSTRUCTION MATERIALS, AND BEHAVIOR OF NATURAL MATERIALS AS PAVEMENT CONSTRUCTION MATERIALS. THE MILITARY ENGINEER MAY FACE SIMILAR PROBLEMS IN CONSTRUCTION OF THE MANY FACILITIES REQUIRED BY AN ARMY. IN ADDITION HE MUST MAKE AN ASSESSMENT OF THE TRAFFICABILITY OF THE NATURAL SURFACE. THE PUCE PROGRAM OFFERS A BASIS FOR THE RECORDING AND EXTRAPOLATION OF EXPERIENCE OF GROUND MOBILITY ON LARGE AND SMALL AREAS OF TERRAIN. /AUTHOR/

Aitchison, GD Grant, K *Australian Road Research Board Proc*

2A 229795

ENGINEERING EXPECTATIONS FROM TERRAIN EVALUATION

ANY SYSTEM OF TERRAIN EVALUATION FOR ENGINEERING IS INTENDED TO BE BASIS FOR THE STORAGE AND RETRIEVAL AND COMMUNICATION OF INFORMATION. THE COMPLETE FEEDBACK CYCLE OF EVALUATION AND APPLICATION IN TERRAIN EVALUATION CAN BE CONSIDERED TO

WORK ONLY IN RELATION TO A SPECIFIC ASPECT OF ENGINEERING. CONSEQUENTLY, THE NEED FOR MANY PARTICULAR BRANCHES OF TERRAIN ENGINEERING IS APPARENT, EACH BRANCH BEING RELATED TO A SPECIFIC ENGINEERING EXPECTATION. THEREFORE, ENGINEERING EXPECTATIONS FROM TERRAIN EVALUATION MAY BE OF SUCH VARIETY AS TO DEFY ANY DETAILED ATTEMPT AT DESCRIPTION AND CLASSIFICATION. CATEGORIES ARE DELINEATED IN A TABLE WHICH MAY SERVE TO INDICATE AN AWARENESS OF THE BROAD NATURE OF THE ENGINEERING EXPECTATIONS FROM A TERRAIN EVALUATION. IT MAY BE SEEN THAT A FEASIBILITY STUDY FOR ROAD DEVELOPMENT IN AN UNDERDEVELOPED REGION WOULD INVOLVE THE ENGINEERING EXPECTATIONS OF THE RESULTS OF ALL EARTH SCIENCE STUDIES, TOGETHER WITH RECORDED ENGINEERING EXPERIENCE IN THE AREA.

Aitchison, GD *Australian Road Research Board Proc*

2A 229796

STORAGE AND RETRIEVAL OF INFORMATION IN A TERRAIN CLASSIFICATION SYSTEM

THE OBJECT OF THE PUCE (TERRAIN PATTERN-TERRAIN UNIT-- TERRAIN COMPONENT-EVALUATION) PROGRAM OF TERRAIN CLASSIFICATION AND EVALUATION IS TO PROVIDE A FRAMEWORK FOR THE STORAGE AND TRANSFER OF TERRAIN INFORMATION RELEVANT TO ENGINEERING PROJECTS, SUCH AS ROAD CONSTRUCTION. THIS PAPER DESCRIBES PROGRESS MADE IN THE DEVELOPMENT OF AN AUTOMATIC STORAGE AND RETRIEVAL SYSTEM FOR TERRAIN CLASSIFICATION AND EVALUATION DATA BASED ON THE PUCE PROGRAM AND DESIGNED FOR USE ON CDC 3600 AND 3200 COMPUTERS IN AUSTRALIA. INFORMATION PERTINENT TO THE TERRAIN CLASSIFICATION SYSTEM IS RECORDED ON SPECIALLY DESIGNED DATA SHEETS AND IS FED TO THE COMPUTER BY MEANS OF PUCHED CARDS FOR STORAGE ON MAGNETIC TAPE. THE PRESENT SYSTEM PERMITS RAPID COLLATION AND PRESENTATION OF CLASSIFICATION DATA. WHEN FULLY DEVELOPED IT WILL FACILITATE THE EXTRAPOLATION OF ENGINEERING INFORMATION FROM ONE LOCALITY TO OTHER AREAS OF SIMILAR TERRAIN AND THE TRANSFER OF DATA FROM ONE ENGINEERING GROUP TO ANOTHER. /AUTHOR/

Grant, K Lodwick, GD *Australian Road Research Board Proc*

2A 229808

THE SAND EQUIVALENT TEST FOR QUALITY CONTROL OF QUARRY PRODUCTS

THE USE OF STATISTICAL QUALITY CONTROL IN INDUSTRY HAS LONG BEEN RECOGNIZED AS AN IMPORTANT ADJUNCT TO EFFICIENT OPERATION, BUT IN THE EQUALLY COMPETITIVE FIELD OF ROAD CONSTRUCTION LITTLE IS MADE OF STATISTICAL TECHNIQUES AS AN AID TO SPECIFICATION WRITING AND THE CONTROL OF MATERIAL QUALITY. PAVEMENT MATERIALS ARE CUSTOMARILY SPECIFIED IN TERMS OF PLASTICITY INDEX AND MECHANICAL GRADING; HOWEVER THESE TESTS ARE NOT CONVENIENT FOR THE CONTROL OF PRODUCTION AND THE SAND EQUIVALENT TEST HAS FOUND EXTENSIVE USE IN THIS REGARD. TO EVALUATE THE CONTROL ACHIEVED BY THIS TEST, RESULTS FOR MATERIALS SUPPLIED BY SOME MELBOURNE QUARRIES OVER A PERIOD HAVE BEEN CORRELATED WITH PLASTICITY INDEX AND GRADING RESULTS. AFTER ALLOWING FOR THE EFFECT ON THE SAND EQUIVALENT TEST OF MOISTURE IN THE SAMPLE THE TEST WAS FOUND TO BE A SATISFACTORY INDICATOR OF QUALITY. THE EFFECT OF TEMPERATURE AND THE INFLUENCE OF THE VARIOUS ROCK TYPES GRADING, AND CLAY CONTAMINATION ON THE TEST WAS ALSO INVESTIGATED. THE PAPER CONCLUDES WITH THE DEVELOPMENT OF A TENTATIVE METHOD OF QUALITY CONTROL FOR QUARRY AND PLANT MIXED PRODUCTS USING THE SAND EQUIVALENT TEST. /AUTHOR/

Head, BL Raper, LR Kneipp, H DISCUSSEER Akehurst, CA DISCUSSEER Proffitt, AT DISCUSSEER Hanks, JN DISCUSSEER *Aus-*

tralian Road Research Board Proc

2A 229833

THE APPLICATION OF GEOPHYSICAL METHODS TO GRADING AND OTHER HIGHWAY CONSTRUCTION PROBLEMS

FOR DETERMINING THE PRESENCE AND LOCATION OF SOLID ROCK FOUNDATIONS, AND FOR CLASSIFYING SOILS AND OTHER UNDERLYING STRATA WITH RESPECTS TO THEIR RELATIVE DEGREES OF COMPACTION, THE SEISMIC METHOD IS MORE DEPENDABLE THAN THE ELECTRICAL RESISTIVITY METHOD AND HAS AN INHERENT ADVANTAGE OVER ALL OTHER METHODS NOW USED, IN THAT IT MEASURES DIRECTLY THE RIGIDITY OF THE EARTH'S CRUST. A BLASTING CAP OR SMALL CHARGE OF DYNAMITE EXPLODED AT OR UNDER THE SURFACE OF THE GROUND BECOMES THE CENTER OF A WAVE DISTURBANCE. SENSITIVE MICROPHONE DETECTORS PLACED AT DIFFERENT DISTANCES FROM THE SHOT PICK UP THE DISTURBANCE SUCCESSIVELY AND TRANSMIT THE ELECTRIC IMPULSES TO GALVANOMETERS WHICH RECORD THEM AS LIGHT TRACES ON A MOVING PHOTOGRAPHIC FILM. BY MEANS OF AN ACCURATE TIMING MECHANISM THE TIME OF TRANSIT OF THE WAVE DISTURBANCE FROM THE SHOT POINT TO EACH DETECTOR IS ALSO INDICATED ON THE FILM, THE SPEED OF TRANSIT BEING INDICATIVE OF THE ELASTIC CHARACTER OF THE MATERIAL TRAVERSED. DATA FROM A NUMBER OF SHOTS ARE PLOTTED ON A TIME-DISTANCE CURVE, AND THE RELATIVE RIGIDITIES OF THE UNDERLYING MATERIALS THEREBY CLASSIFIED. THE THICKNESS OF SURFACE LAYERS OF SOFT MATERIAL OVER DENSER LAYERS OF CLAY OR SHALE ARE INDICATED, AND LIKEWISE THE DEPTH TO MATERIAL OF STILL GREATER RIGIDITY, SUCH AS SOLID ROCK. /AUTHOR/

Shepard, ER Bernhard, RK DISCUSSEER Teller, LW DISCUSSEER Buchanan, JA DISCUSSEER *Highway Research Board Proceedings*

2A 229839

TOPSOIL, SAND-CLAY AND GRADED MIX ROADS IN SOUTHEASTERN UNITED STATES

TOPSOIL, SAND-CLAY, SAND-CLAY-GRAVEL, CHERT, PEBBLE SOIL, DISINTEGRATED GRANITE, FLOAT, AND LIMEROCK ARE USED IN HIGHWAY CONSTRUCTION FOR BASE AND SURFACE COURSES. GRADATION SHOULD BE FROM COURSE TO FINE IN ORDER THAT A DENSE MASS MAY BE OBTAINED WITH AS LOW POROSITY AS POSSIBLE. SPECIFICATIONS FOR GRADATION AND PHYSICAL CHARACTERISTICS ARE PRESENTED FOR BASE COURSE MATERIALS IN TABULAR FORM FOR NORTH CAROLINA, GEORGIA, AND ALABAMA. THE TABLES DEAL WITH MECHANICAL ANALYSIS AND PHYSICAL CHARACTERISTICS OF COARSE AND FINE AGGREGATES INCLUDING LIQUID LIMIT, PLASTICITY INDEX, SHRINKAGE LIMIT, MOISTURE EQUIVALENT, ETC.

Hicks, LD Abercrombie, WF Land, JL Willis, EA *Highway Research Board Proceedings*

2A 229841

GRADED MIX ROADS IN MISSOURI

THE CONSTRUCTION OF GRADED MIX ROADS DURING 1937-1938 WAS LIMITED TO PROVIDING BASES FOR THEIR BITUMINOUS WEARING COURSE TREATMENTS. THE MATERIALS USED, SUCH AS CRUSHED LIMESTONE, CHERT GRAVEL, AND CHERT MINE TAILINGS, ARE DETERMINED BY THE LOCALITY. SINCE 1937 THE DEPTH OF STABILIZED COMPACTED MATERIAL WAS INCREASED TO 6 IN. MIXED IN ONE COURSE AND COMPACTED IN THIN INCREMENTS BY SHEEPS-FOOT TAMPERS. OTHER CHANGES THAT DEVELOPED IN THE CONSTRUCTION METHOD AFTER NOTING INCREASED RAVELING AND PITTING, CONSISTED OF TWO COURSE CONSTRUCTION THAT SHORTENED MIXING TIME, PRODUCED A FINISHED MIX AND COMPACTED THE MATERIAL TO A DENSE AND STABLE CONDITION WHILE CLAY-AGGREGATE STABIL-

ZATION WAS BEING DEVELOPED, THE PRIMARY CONSIDERATION HAS BEEN TO OBTAIN A PLASTIC INDEX OF ABOUT 10. HOWEVER, REGARDLESS OF THE PLASTIC INDEX, LITTLE OR NO RAVELING OCCURS WHEN A THIN BITUMINOUS ARMOR COAT IS APPLIED AFTER THE BASE HAS BEEN PRIMED AND COMPACTED. SOMETIMES A WATER-BOUND MACADAM BASE WILL SUFFICE.

Schappler, RC *Highway Research Board Proceedings*

2A 229879

NOTES ON SIMPLE CONDUCTIVITY AND PH MEASUREMENTS AS INDICATORS OF THE PRESENCE OF DELETERIOUS SOLUBLE SALTS IN BASE-COURSES

THE IMPORTANCE OF DELETERIOUS SOLUBLE SALTS IS BECOMING INCREASINGLY RECOGNIZED AS A FACTOR IN CERTAIN ROAD FAILURES IN SOUTHERN AFRICA. EXISTING METHODS IN USE BY ROADS AUTHORITIES FOR THE DETECTION AND DETERMINATION OF SOLUBLE SALTS ARE RELATIVELY TEDIOUS. THE SIMPLE AND EXTREMELY RAPID CONDUCTIVITY AND PH METHODS USED IN PEDOLOGICAL WORK ARE DESCRIBED, AS WELL AS A FEW EXPERIMENTS IN CONNECTION WITH THEIR APPLICATION TO CALCRETES. IT IS SUGGESTED THAT THE SATURATED SOIL PASTS CONDUCTIVITY METHOD, CARRIED OUT ON A MATERIAL ALREADY PREPARED FOR AND LEFT OVER FROM A ROUTINE LIQUID LIMIT DETERMINATION, AND SUPPLEMENTED WHEN NECESSARY BY A SIMPLE QUALITATIVE TEST FOR SULFATE-IS PROBABLY ADEQUATE AS AN INDICATOR TEST FOR THE PRESENCE OF DELETERIOUS AMOUNTS AND TYPES OF SOLUBLE SALTS IN ROAD MATERIALS. THE SLIGHTLY LONGER BUT MORE ACCURATE SATURATION EXTRACT METHOD IS ALSO APPLICABLE. CONDUCTIVITY METHODS ARE READILY APPLICABLE TO ALL ROAD CONSTRUCTION MATERIALS INCLUDING NATURAL SOILS, CRUSHER-RUN AND WATERS. TENTATIVE CONSERVATIVE ONE-FOURTH INCH SOIL PASTE CONDUCTIVITY LIMITS FOR BASE-COURSE OF 3.5 AND 0.5 M MHOS/CM ARE SUGGESTED FOR SODIUM CHLORIDE AND SODIUM SULFATE AND MAGNESIUM SULFATE RESPECTIVELY. LIMITS FOR COMPACTION, CURING AND CONCRETE WATERS SHOULD BE ASSESSED AFTER CONSIDERATION OF THE SALINITY OF THE MATERIAL AND THE AMOUNT OF SALTS LIKELY TO BE ADDED BY THE WATER. /ARTICLE/

Nat Inst Road Research /S Africa/ Rs/23/68

ACKNOWLEDGMENT: Via /South Africa/

2A 229910

SOIL PARTICLE SIZE DISTRIBUTION BY A CENTRIFUGE METHOD IN COMPARISON WITH SEDIMENTATION PROCESSES

A CENTRIFUGAL SEDIMENTATION METHOD FOR THE ISOLATION OF PARTICLES OF SOIL IN THE MICRON AND SUB-MICRON RANGE IS DISCUSSED. IT WAS STANDARDIZED AGAINST NORMAL HYDROMETER TECHNIQUES AND HAS PROVED TO BE RAPID AND EFFICIENT. THE CONCENTRATION OF DISPERSING AGENT UNDER CONSTANT TEMPERATURE, WAS FOUND TO BE A VARIABLE WHICH COULD EXPLAIN SOME ABNORMALITIES IN PARTICLE SIZE DISTRIBUTION ANALYSIS. THE PROCEDURE WAS DEVISED FOR THE PURPOSE OF OBTAINING SOIL COLLOIDAL PARTICLES OF APPROXIMATE KNOWN DIAMETERS, IN ORDER THAT THEIR CHEMICAL AND PHYSICAL PROPERTIES COULD BE INVESTIGATED WITH OTHER SOIL PARAMETERS, IN THE ASSESSMENT OF GRAVEL AS A ROAD-MAKING MATERIAL. THE THEORY UNDERLYING THE METHOD HAS NOT BEEN CONSIDERED. /AUTHOR/

Denham, SC *Main Roads /Australia/* Aug. 1970

ACKNOWLEDGMENT: Australian Road Research Board

2A 229916

GEOLOGIC SETTING OF LANDSLIDES ALONG SOUTH SLOPE OF PINE MOUNTAIN, KENTUCKY

LANDSLIDES ALONG THE SOUTH SLOPE OF PINE MOUNTAIN IN SOUTHEASTERN KENTUCKY ARE INTEGRALLY RELATED TO BEDROCK GEOLOGY. MOST OF THE SLIDES ARE PLANAR BLOCK GLIDES OF SANDSTONE AND INTERBEDDED SHALE AND SILTSTONE THAT HAVE SLID DOWN DIP SLOPES ON FLOORS OF SHALE, COAL, OR UNDERCLAY. THE CENTRAL PORTION OF A 1/2-MILE WIDE SLIDE THAT HAD BEEN STABLE FOR MANY YEARS RECENTLY SLID WHEN THE TOE WAS CUT INTO DURING HIGHWAY CONSTRUCTION. THE OLD SLIDE PROBABLY ORIGINATED AS A PLANAR BLOCK GLIDE, BUT IT DEVELOPED ROTATIONAL ASPECTS AT THE TOE AND FLANKS. STRATA UNDERLYING THE SOUTH SLOPE OF PINE MOUNTAIN ARE OF PENNSYLVANIAN AGE AND INCLUDE MASSIVE SANDSTONE, INTERBEDDED SILTSTONE AND SHALE, AND THIN BEDS OF COAL AND UNDERCLAY. BEDS DIP GENERALLY SOUTHEASTWARD BUT FLATTEN ABRUPTLY AT THE FOOT OF THE MOUNTAIN AND ARE NEARLY HORIZONTAL SOUTH OF IT. THE CUMBERLAND RIVER FOLLOWS THIS FLEXURE ALONG MUCH OF PINE MOUNTAIN AND IN MANY PLACES CUTS LATERALLY AGAINST THE DIPPING BEDS. LANDSLIDES HAVE REPEATEDLY OCCURRED AND OTHERS MAY OCCUR WHERE DIPPING STRATA OF PINE MOUNTAIN ARE UNDERCUT BY RIVERS OR BY CONSTRUCTION WORK. OLD BUT PRESENTLY STABLE SLIDES MAY BE REACTIVATED WHEN CUT INTO BY HIGHWAY OR OTHER EXCAVATIONS. /AUTHOR/

Froelich, AJ *Highway Research Record, Hwy Res Board*

2A 229924

SAFETY FACTORS IN SOIL MECHANICS

THE INFLUENCES ON THE SAFETY MARGIN IN EARTHWORK AND EXPLORATION AND TESTS, ANALYSIS OF STABILITY UNDER THE APPLIED LOADS, AND CONSTRUCTION AND OPERATION OF THE STRUCTURE DURING ITS SERVICE LIFE. CUSTOMARY OVERALL AND SUGGESTED PARTIAL SAFETY FACTORS USED IN STABILITY ANALYSIS ARE MAINLY GOVERNED BY THE VARIABILITY AND UNCERTAINTY OF ASSESSMENT OF THE SOIL RESISTANCE, THE VARIABILITY OF THE APPLIED LOADS, APPROXIMATIONS IN THE STABILITY ANALYSES, AND THE SERIOUSNESS OF A FAILURE. /AUTHOR/

Meyerhof, GG *Canadian Geotechnical Journal*

2A 229937

CLIMATE, ENGINEERING PETROLOGY AND THE DURABILITY OF NATURAL ROAD BUILDING MATERIALS IN SOUTHERN AFRICA

A NATURAL ROAD BUILDING MATERIAL IS DURABLE ONLY IF THE CHANGE IN ITS PHYSICAL AND CHEMICAL PROPERTIES DURING CONSTRUCTION AND THE LIFE OF A ROAD REMAINS WITHIN LIMITS WHICH DO NOT INVALIDATE THE DESIGN. THE DURABILITY OF A NATURAL ROAD BUILDING MATERIAL DEPENDS ON THE ENVIRONMENTAL CONDITIONS OF ITS PLACE OF OCCURRENCE AND ON ITS PETROLOGICAL PROPERTIES. CLIMATE IS A PARTICULARLY IMPORTANT ENVIRONMENTAL FACTOR. THE N-VALUE, A NUMERICAL EXPRESSION DERIVED USING THE CLIMATIC FACTORS WHICH DETERMINE THE MODE OF WEATHERING, HAS BEEN DEVELOPED TO DEFINE THESE CLIMATIC ENVIRONMENTAL CONDITIONS. WHERE N IS MORE THAN 5 ALL ROCKS DISINTEGRATE, AND WHERE N IS LESS THAN 5 CERTAIN TYPES OF ROCK MAY DECOMPOSE AND CHANGE INTO CLAY. DECOMPOSITION AND DISINTEGRATION ARE THE TWO PRINCIPAL FORMS OF WEATHERING. THE FORMER, WHICH OCCURS ONLY IN ROCKS CONTAINING MINERALS WHICH CAN OXIDIZE OR HYDRATE UNDER ATMOSPHERIC CONDITIONS, AFFECTS THE DURABILITY AND THEREBY THE QUALITY OF A ROAD BUILDING MATERIAL MORE THAN DOES THE LATTER. ROCK MAY BE TESTED FOR DECOMPOSITION BY DETERMINING THE PERCENTAGE OF SECONDARY MINERALS FORMED, AND FOR

DISINTEGRATION BY CURSHING TESTS, ESPECIALLY THE 10% FINES AGGREGATE CRUSHING TEST ON DRY AND WET MATERIAL. SOUTH AFRICAN NATURAL ROAD BUILDING MATERIALS ARE DIVIDED INTO NINE GROUPS ACCORDING TO THE SIMILARITY OF THEIR ENGINEERING PROPERTIES. THE GREAT IMPORTANCE OF QUARTZ IN ASSESSING DURABILITY IS STRESSED AND MATERIALS ENGINEERS ARE ADVISED TO BECOME FAMILIAR WITH THIS MINERAL. /AUTHOR/

Weinert, HH
Nat Inst Road Research /S Africa/

**2A 229975
SOIL TESTS FOR DESIGN OF RUNWAY PAVEMENTS**

A REVIEW IS MADE OF THE SOIL TESTS EMPLOYED BY THE U. S. ENGINEER DEPARTMENT AND THE AVIATION ENGINEERS FOR THE DESIGN OF FLEXIBLE AND RIGID RUNWAY PAVEMENTS. FIELD BEARING TESTS AND THEIR APPLICATION TO BOTH FLEXIBLE AND RIGID PAVEMENT DESIGN AND THE USE OF THE CALIFORNIA BEARING RATIO TEST FOR FLEXIBLE PAVEMENT DESIGN WERE INVESTIGATED. THERE WILL SELDOM BE TIME TO CONDUCT ALL THE REQUIRED LABORATORY AND FIELD TESTS BEFORE DESIGN AND CONSTRUCTION OF RUNWAY PAVEMENTS. THEREFORE THIS EVALUATION HAS BEEN SET UP ON THE BASIS OF FIELD AND SIMPLE LABORATORY TESTS FOR QUICK CLASSIFICATION OF THE SOILS.

Middlebrooks, TA Bertram, GE Campen, WH DISCUSSE Smith, JR DISCUSSE Goldbeck, AT DISCUSSE Highway Research Board Proceedings

**2A 229978
AERIAL PHOTOGRAPHS AND THE DISTRIBUTION OF CONSTRUCTIONAL MATERIALS**

AERIAL PHOTOGRAPHS RECORD INDIVIDUAL AND DISTINCTIVE PATTERNS AND TEXTURES OF DIFFERENT TYPES OF SOIL AND ROCK. AERIAL PHOTOGRAPHS MAY BEST BE INTERPRETED BY CONSIDERING THEM AS SOIL MAPS OR GEOLOGIC MAPS. THESE ARE BRIEFLY DESCRIBED AND THEIR RELATION TO AERIAL PHOTOGRAPHS IS ILLUSTRATED. /AUTHOR/

Eardley, AJ Highway Research Board Proceedings

**2A 230137
RADAR: A PROMISING UNDERGROUND EYE FOR CONSTRUCTION**

A NEW SYSTEM, DUBBED "ESP," SENDS RADAR PULSES DOWN INTO THE EARTH AND RECORDS THE REFLECTIONS FROM INTERFACES OF DIFFERENT SOILS, ROCK, WATER, AND BURIED CONDUITS. IN OPERATION, PULSES ARE CONTINUOUSLY TRANSMITTED AND THEIR REFLECTIONS RECEIVED WITH A SMALL, FLAT, FOUR-WHEELED ANTENNA UNIT TOWED BY A LIGHT VAN. A CABLE CONNECTS THE UNIT WITH RECORDING INSTRUMENTS WITHIN THE VAN. THE TAPES RECORDING THE REFLECTIONS ARE THEN FED INTO A COMPUTER, AND A CONTINUOUS RADAR PICTURE IS PRINTED OUT. GEOLOGISTS INTERPRET THE PICTURES AND CONVERT THEM TO PROFILE DRAWINGS. RADAR EXPLORATION TECHNIQUES NOW BEING DEVELOPED COULD BE USED FOR ANALYZING THE CONDITION OF EXISTING PAVEMENTS AND SUPPORTINGS SUBGRADE MATERIAL, AND HELPING CONTRACTORS TO ESTIMATE THE YIELD OF POTENTIAL GRAVEL PITS. /AUTHOR/

Fournier, P
New England Construction Vol. 37 No. 4, July 1972, pp 52-3

**2A 230281
SUBSURFACE CORROSION STUDY**
RESULTS OF CORROSION TESTING OF SOIL SAMPLES RECOVERED FROM BORINGS MADE IN 1969 ALONG THE THEN BENNING ROUTE AND A PORTION OF THE PENTAGON ROUTE OF THE WASHINGTON METROPOLITAN AREA METRO SYSTEM ARE SUMMARIZED. THE SUBSURFACE INVESTIGATION IS

COVERED BY REPORT NO. 28 IN THE SERIES. REPORT NO. 32 CONTAINS A SERIES OF GEOLOGICAL SECTIONS ALONG THE SUBWAY, SUMMARY TABLES LISTING THE TEST PROPERTIES OF SOIL AND WATER SAMPLES RELEVANT TO CORROSION CHARACTERISTICS, AND A TEXT WITH SOME GENERAL CONCLUSIONS AS TO THE SIGNIFICANCE OF THE TEST DATA. /AUTHOR/

Mueser, Rutledge, Wentworth, & Johnston Sept. 1969, 185 pp

ACKNOWLEDGMENT: NTISNTIS PB 216 088, 3C61231133

**2A 230349
THE NEED FOR UNIFORMITY IN TESTING OF EXPANSIVE SOILS**

NUMEROUS AND WIDELY DIFFERENT METHODS ARE CURRENTLY AVAILABLE FOR TESTING AND CLASSIFYING POTENTIALLY EXPANSIVE SOILS AND ALTHOUGH THERE IS CONSIDERABLE OVERLAP AND SOME BASIC AGREEMENT BETWEEN THESE METHODS, THERE IS ALSO A SIMULTANEOUS LACK OF CONSISTENCY AND GREAT OPPORTUNITY FOR ERROR. IN MANY PRACTICAL PROBLEMS INVOLVING EXPANSIVE SOILS, AN ERRONEOUS MISCLASSIFICATION OF THE SOIL LEADS TO A LEVEL OF TREATMENT WHICH IS NEEDLESSLY COSTLY, EITHER DUE TO SUBSEQUENT DAMAGE AND REPAIRS, OR DUE TO UNWARRANTED TO SUBSEQUENT OVERDESIGN. THE EXISTING METHODS FOR RECOGNITION AND CLASSIFICATION OF EXPANSIVE SOILS CAN BE DIVIDED INTO THREE MAIN CATEGORIES AS FOLLOWS: (1) INDIRECT METHODS, OR THREE MAIN THOSE WHICH EMPLOY A MEASUREMENT OF A RELATED SOIL PROPERTY AS AN INDICATION OF SWELL POTENTIAL; (2) DIRECT MEASUREMENT OF ONE-DIRECTIONAL SWELL IN A LOADED SWELL TEST; AND (3) METHODS OF TESTS AND ANALYSES FOR QUANTITATIVE PREDICTION OF THE EXPECTED MAGNITUDE OF HEAVE IN ANY GIVEN FIELD CONDITION. IN ORDER TO EVOLVE (OR EVALUATE) A SUITABLE METHOD FOR TESTING AND CLASSIFICATION OF POTENTIALLY EXPANSIVE SOIL, THE FACTORS WHICH MAY INFLUENCE THE RESULTS OBTAINED MUST BE UNDERSTOOD AND TAKEN INTO CONSIDERATION. THE FOLLOWING FACTORS ARE KNOWN TO INFLUENCE THE RESULTS OBTAINED IN LOADED SWELL TESTS ON SOILS OF ANY GIVEN COMPOSITION: (1) INITIAL WATER CONTENT; (2) INITIAL DRY DENSITY; (3) SOIL STRUCTURE; (4) SURCHARGE LOAD; (5) SOLUTION CHARACTERISTICS; (6) TIME ALLOWED FOR SWELL; (7) CURING TIME FOR SAMPLE; (8) STRESS HISTORY; (9) SAMPLE SIZE AND SHAPE; AND (10) TEMPERATURE. IT IS THE AUTHOR'S OPINION THAT A RELIABLE AND REPRODUCIBLE TEST WHICH IS TO BE CONSIDERED AS A BASIS FOR THE CLASSIFICATION OF POTENTIALLY EXPANSIVE SOIL MUST STANDARDIZE AT LEAST THESE VARIABLES: INITIAL WATER CONTENT, INITIAL DENSITY, METHOD OF COMPACTION, SURCHARGE LOAD OR LOADS AND SEQUENCE OF APPLICATION, TIME ALLOWED FOR THE TEST, TIME REQUIRED FOR SAMPLE CURING AND SAMPLE SIZE AND SHAPE. STANDARDIZATION OF THESE FACTORS IN ONE TEST AND CLASSIFICATION PROCEDURE IS LONG OVERDUE AND WOULD BE OF SIGNIFICANT VALUE. TWO TEST METHODS ARE DISCUSSED; ONE IS THE TEST METHOD EVOLVED IN LOS ANGELES IN THE LATE 1960'S, AND THE OTHER IS THE TEST METHOD PROPOSED BY W. G. HOLTZ AND PUBLISHED IN ASTM STP 479, SPECIAL PROCEDURES FOR TESTING SOIL AND ROCK FOR ENGINEERING PURPOSES, FIFTH EDITION, 1970.

Krazynski, LM
Workshop Proceedings Vol. 1 May 1973, pp 98-136, Figs. 23 Ref

**2A 230350
CONTROLLED FIELD TESTS OF EXPANSIVE SOILS**
RESEARCH IS BEING CONDUCTED BY THE WATERWAYS EXPERIMENT STATION (WES) TO INVESTIGATE TECHNIQUES FOR RELIABLE AND RAPID LABORATORY AND FIELD MEASUREMENTS OF TOTAL SUCTION BY THERMOCOUPLE PSYCHROMETERS. A LABORATORY PSYCHROMETER, TWO FIELD PSYCHROMETERS (PROTOTYPE P AND TYPE F), AND A COM-

MERCIIALLY AVAILABLE PSYCHROMETER WERE CHOSEN FOR STUDY. THE FIELD THERMOCOUPLE PSYCHROMETERS WERE INSTALLED AT VARIOUS DEPTHS NEAR JACKSON, MISSISSIPPI, AND ON LACKLAND AIR FORCE BASE (LAFB) NEAR SAN ANTONIO, TEXAS. FROM THE TEST RESULTS OBTAINED THE FOLLOWING CONCLUSIONS WERE DRAWN: (1) IN THE LABORATORY, TOTAL SUCTION READINGS BY THERMOCOUPLE PSYCHROMETERS ARE IN GOOD AGREEMENT WITH MATRIX SUCTIONS MEASURED BY PRESSURE MEMBRANE APPARATUS AFTER CONSIDERING THE OSMOTIC SUCTION. PSYCHROMETRIC READINGS ARE MADE RAPIDLY AFTER EQUILIBRIUM IS ATTAINED. EQUILIBRIUM IS ATTAINED IN THE LABORATORY WITHIN 24 HOURS. (2) IN SITU SUCTION DATA SHOW GOOD AGREEMENT BETWEEN THE DIFFERENT TYPES OF FIELD PSYCHROMETERS. THE PSYCHROMETER READINGS AT LAFB SHOW A RECENT DRYING TREND WHICH IS GENERALLY CONSISTENT WITH PIEZOMETRIC AND FIELD WATER CONTENT DATA OBTAINED FROM NUCLEAR PROBE MEASUREMENTS. (3) THE LIFESPAN OF THE COMMERCIAL PSYCHROMETER WAS LIMITED AT THE JACKSON AND LACKLAND TEST AREAS, DUE TO CORROSION OF THE ONE-MIL-DIAMETER THERMOCOUPLE, WITH SOME FAILING WITHIN THREE AND NINE MONTHS AFTER INSTALLATION.

Johnson, LD Mcanear, CL
Workshop Proceedings Vol. 1 Apr. 1973, pp 137-59, 6 Fig, 6 Tab, 24 Ref

2A 230351
METHOD FOR DETERMINING THE POTENTIAL VERTICAL RISE, PVR (TEXAS TEST METHOD TEX-124-E)

A PROCEDURE IS PRESENTED WHICH PROVIDES A MEANS FOR THE DETERMINATION OF THE POTENTIAL VERTICAL RISE (PVR) IN A SOIL STRATA, SUCH AS MAY BE ENCOUNTERED IN THE PLACEMENT OF A ROADWAY, BRIDGE, OR BUILDING FOUNDATION. A SHORT EXAMPLE IS GIVEN WHICH ILLUSTRATES HOW THE TEST METHOD WORKS. BY USING THE DETERMINATION OF PVR IN CONJUNCTION WITH THE UNIT LOADS TO BE IMPOSED BY THE STRUCTURE, THE ENGINEER CAN MAKE CHOICES ON THE METHODS OF CONSTRUCTION TO BE EMPLOYED AND THE REMEDIAL PROCEDURES TO USE IN SECURING THE GREATEST VALUE FOR HIS CONSTRUCTION MONEY. SOME OF THE CHOICES, DEPENDENT UPON THE DEPTH, AMOUNT OF SWELLING CLAYS, AND OTHER CONDITIONS ARE AS FOLLOWS: (1) REMOVAL OF NEAR THE SURFACE CLAY LAYERS AND REPLACEMENT WITH GRANULAR MATERIAL. (2) PONDING WITH WATER FOR THIRTY OR MORE DAYS TO BRING DRIER CLAYS TOWARD OPTIMUM CONDITIONS; (3) STABILIZATION OR MODIFICATION OF CLAY LAYERS NEAR THE SURFACE USUALLY USING LIME; (4) UTILIZATION OF DENSITY AND MOISTURE CONTROL METHODS AND MOISTURE PRESERVATION SUCH AS ASPHALT MEMBRANES OR WIDE GRANULAR SECTIONS, WHICH IS OF GREAT MERIT AFTER PONDING; (5) EMPLOYING IN BUILDINGS THE USE OF AMPLE STEEL IN GRADE BEAMS, TOP AND BOTTOM, OR THE USE OF HEAVY STEEL IN FOUNDATION SHAFTS AND INSULATING THEM FROM THE CLAY; AND (6) SUCH OTHER MEASURES AS LEAVING AIR SPACE UNDER GRADE BEAMS, SUSPENSION OF FLOORS FROM FOUNDATION SHAFTS OR THE USE OF EXPANSION JOINTS TO SEPARATE THE FLOOR FROM FOUNDATION GRADE BEAMS.

Smith, AW
Workshop Proceedings Vol. 1 May 1973, pp 189-205, 3 Fig, 2 Tab, 4 Ref

2A 230470
ARABIAN SALT-BEARING SOIL (SABKHA) AS AN ENGINEERING MATERIAL

SABKHA IS ESSENTIALLY A CARBONATE SAND CONTAINING VARYING PROPORTIONS OF EVAPORITIC MINERALS AND IS FOUND IN THE SALT FLATS OF THE ARABIAN PENINSULA. THIS REPORT DISCUSSES THE HIGHWAY ENGINEERING PROPERTIES AND USES OF THE MATERIAL AND COMPARED ITS PERFORMANCE WITH THAT OF SIMILAR SALINE MATERIALS IN OTHER ARID AREAS OF THE WORLD. THE MANNER IN

WHICH THE EVAPORITIC MINERALS CONTRIBUTE TO THE PERFORMANCE OF THE MATERIAL IN ROAD CONSTRUCTION IS NOT FULLY UNDERSTOOD AND IN ORDER TO FIND OUT MORE ABOUT THEIR INFLUENCE ON THE PERFORMANCE OF SABKHA ROAD BASES, A FULLSCALE EXPERIMENT HAS BEEN CONSTRUCTED TO STUDY THE RELATIVE PERFORMANCE UNDER TRAFFIC OF THREE DIFFERENT SABKHAS USED AS ROAD BASES UNDER A THIN BITUMINOUS SURFACING. /AUTHOR/

Ellis, CI
Transport & Road Research Lab /UK/ R&d Rpt No Lr 523, 1973, 20 pp, 5 Fig, 3 Tab, 2 Phot, 28 Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

2A 230503
BRITISH PRACTICE IN THE DESIGN AND SPECIFICATION OF CEMENT-STABILIZED BASES AND SUBBASES FOR ROADS
CURRENT BRITISH PRACTICE IN THE DESIGN AND SPECIFICATION OF SOIL-CEMENT FOR USE IN THE BASE OR SUBBASE FOR ROADS IS DESCRIBED. THE COMPOSITION OF THE MATERIAL, THE STRUCTURAL DESIGN OF ROADS INCORPORATING SOIL-CEMENT, AND THE METHODS USED TO CONTROL THE QUALITY OF THE MATERIAL IN PRACTICE ARE PRESENTED. THE SUITABILITY OF A SOIL FOR STABILIZATION IS BASED ON REQUIREMENTS SIMILAR TO THOSE IN THE UNITED STATES, GOOD GRADING, LOW PLASTICITY OF THE FINES, AND FREEDOM FROM DELETERIOUS CHEMICAL CONSTITUENTS. THE PEDOLOGICAL CLASSIFICATION OF A SOIL PROFILE IS USED TO ESTIMATE THE DEPTH OF SOIL UNSUITABLE FOR STABILIZATION, BECAUSE OF ORGANIC CONTENT. MEASUREMENTS OF THE PH OF A SOIL-CEMENT PASTE 1 HOUR AFTER MIXING ARE USED AS A CHECK ON THE PRESENCE OF DELETERIOUS ORGANIC MATTER. SOIL-CEMENT HAS BEEN WIDELY USED SINCE 1945 FOR THE CONSTRUCTION OF HOUSING ESTATE ROADS AND LOW-TRAFFIC RURAL ROADS. CEMENT-STABILIZED MATERIALS HAVE ALSO BEEN USED FOR THE CONSTRUCTION OF MAIN ROADS, IN PARTICULAR AS THE SUBBASE OF CONCRETE AND BITUMINOUS-SURFACED ROADS. THE QUALITY CONTROL OF SOIL-CEMENT DURING CONSTRUCTION IS BASED LARGELY ON TESTS TO CHECK THE STRENGTH AND STATE OF COMPACTION OF THE LAID MATERIAL.

Maclean, DJ Lewis, WA *Highway Research Record, Hwy Res Board*

2A 230517
FIELD EVALUATION OF NUCLEAR GAGES USED IN COMPACTION CONTROL OF EMBANKMENTS

THIS STUDY WAS DESIGNED TO EVALUATE NUCLEAR MOISTURE DENSITY GAGES UNDER ACTUAL FIELD CONDITIONS. A PRELIMINARY EVALUATION OF ONE NUCLEAR-CHICAGO D/M SYSTEM SHOWED FAVORABLE RESULTS. HENCE A MORE EXTENSIVE STUDY WAS CONDUCTED WITH ELEVEN ADDITIONAL NUCLEAR GAGES. A COMPLETE D/M SYSTEM WAS ASSIGNED TO EACH OF PENNSYLVANIA'S ENGINEERING DISTRICTS AND USED ON VARIED CONSTRUCTION AND SOIL TYPES. THESE GAGES WERE USED IN THE FIELD FOR ONE FULL YEAR, AND THE RESULTS WERE COMPARED TO THE SANDCONE METHOD FOR DETERMINING SOIL DENSITY AND THE OVEN-DRYING AND SPEEDY MOISTURE METHODS OF DETERMINING MOISTURE CONTENT. TEST RESULTS WERE COMPILED AND TABULATED BY IBM 650 DATA PROCESSING MACHINE. TABULATIONS WERE REQUESTED TO ISOLATE VARIABLES AFFECTING CORRELATION OF NUCLEAR TO SAND-CONE RESULTS. THESE VARIABLES ARE SOIL TYPE, SOIL GRADATION, CONSTRUCTION TYPE /EMBANKMENT, SOIL CEMENT, SUBBASE, ETC./ AND DIFFERENT D/M SYSTEMS. STANDARD DEVIATIONS WERE COMPUTED FOR SERIES OF GROUPED TESTS TO DETERMINE THE REPEATABILITY OF BOTH METHODS FOR MEASURING MOISTURE AND DENSITIES OF CONSTRUCTION MATERIALS. /AUTHOR/

Worona, V Gunderman, WG *Highway Research Record, Hwy Res Board*

2A 230534

LIME AND PHOSPHORIC ACID STABILIZATION IN MISSOURI

THIS REPORT PRESENTS INFORMATION ACCUMULATED SINCE 1958 ON A 17.37-MI CHEMICAL STABILIZATION PROJECT IN WORTH AND GENTRY COUNTIES IN NORTHWEST MISSOURI. THE RESULTS OF FIELD INVESTIGATIONS AND LABORATORY RESEARCH TESTS, PRELIMINARY TO CONSTRUCTION IN 1961-62, ARE REVIEWED. EXPLANATION OF THE DESIGN PROCEDURE, BASED ON MISSOURI'S FLEXIBLE PAVEMENT THICKNESS CHART, IS INCLUDED. ALSO REPORTED ARE RESULTS OF TESTS DURING CONSTRUCTION, AND THOSE OF SUBSEQUENT INVESTIGATIONS BY BENKELMAN BEAM, RUT GAGE, ROUGHOMETER AND CORE DRILL. THE FIRST SECTION OF THE REPORT IS LIMITED TO DETAILS OF THE LIME STABILIZATION ON ALL THREE PROJECTS, F-297/7/ AND F-297/9/ IN WORTH COUNTY AND F-524/2/ IN GENTRY COUNTY. THE SECOND SECTION REVIEWS THE DESIGN, CONSTRUCTION AND PERFORMANCE OF THE 16 TEST SECTIONS COMPOSING 2 MI OF PROJECT F-524/2/, GENTRY COUNTY, IN WHICH VARIOUS COMBINATIONS OF 4- AND 8-IN. THICKNESSES OF ROLLED STONE BASE WERE CONSTRUCTED ON UNTREATED GLACIAL CLAY SUBGRADE, ON A 5-IN. SUBBASE OF THAT SOIL MIXED WITH LIME OR WITH PHOSPHORIC ACID, OR ON A 5-IN. ROLLED STONE SUBBASE. /AUTHOR/

Thomas, CE Jones, WG Davis, WC *Highway Research Record, Hwy Res Board*

2A 230535

EVALUATION OF EXPERIMENTAL STABILIZED SOIL BASE CONSTRUCTION, WEBSTER COUNTY, IOWA

THIS PAPER PRESENTS A PORTION OF THE RESULTS OF AN EXPERIMENTAL STABILIZED SOIL ROAD BASE PROGRAM INITIATED BY THE IOWA STATE HIGHWAY COMMISSION AND THE WEBSTER COUNTY ENGINEERS OFFICE. THE 8.058-MI LONG SITE CHOSEN IS TYPICAL TECHNIQUES, GRADATION SPECIFICATIONS PRECEDING INTRODUCTION OF THE STABILIZING AGENT/S/; DISCUSSION OF USE OF LIME AS A PRE-TREATING AGENT FOR REDUCTION OF PLASTICITY AND INCREASE OF FRIABILITY, COMPARISON OF LABORATORY AND FIELD STANDARD PROCTOR MOISTURE-DENSITY RELATIONSHIPS, IN-PLACE FIELD DENSITY DETERMINATIONS USING OIL DENSITY AND STANDARD PROCTOR PENETROMETER METHODS, AND VARIATION OF UNCONFINED COMPRESSIVE STRENGTH OF 7-DAY MOIST-CURE SPECIMENS WITH VARIATIONS IN MOISTURE AND DENSITY. /AUTHOR/

Hoover, JM *Highway Research Record, Hwy Res Board*

2A 230539

A SOIL ASPHALT STABILIZATION REPORT

THE LACK OR GRADUAL DEPLETION OF AGGREGATE SOURCES WITHIN ECONOMICAL DISTANCE OF MANY HIGHWAY CONSTRUCTION PROJECTS HAS RESULTED IN AN INCREASING INTEREST IN THE STABILIZATION OF FINE GRAINED SOILS. SANDY SOILS ARE FAIRLY COMMON IN THIS PROVINCE AND DEPOSITS CAN GENERALLY BE FOUND IN CLOSE PROXIMITY TO OUR HIGHWAY PROJECTS. THIS HAS MADE POSSIBLE THEIR ECONOMIC USE AS A BASE COURSE MATERIAL AND SANDS HAVE BEEN UTILIZED IN MANY INSTANCES SINCE 1959, USING PORTLAND CEMENT AS A STABILIZING ADDITIVE. THE PAST FEW YEARS HAVE SEEN INCREASED ACTIVITY INTO THE DEVELOPMENT OF METHODS OF ASPHALT STABILIZATION OF FINE GRAINED MATERIALS. OTHER PROVINCES, NOTABLY MANITOBA, AND SEVERAL U.S. STATES HAVE HAD SUCCESS USING THESE MATERIALS IN SUB-BASE CONSTRUCTION. IN THIS CONNECTION A SECTION OF BASE COURSE, EMPLOYING AN ASPHALT-STABILIZED SAND SUB-BASE, WAS PLACED BY THE DEPARTMENT OF HIGHWAYS DURING THE PAST SEASON /1963/. THE PURPOSE OF PLACING THIS ASPHALT BASE WERE

TWO-FOLD, BEING 1/ TO EVALUATE ASPHALT STABILIZATION OF SOME OF OUR TYPICAL SAND TYPES UNDER ALBERTA CLIMATIC AND ENVIRONMENTAL CONDITIONS, AND 2/ TO DEVELOP A SUCCESSFUL ALTERNATE TO SOIL-CEMENT FOR THE OBVIOUS ECONOMIC REASONS. /NAPA/

Dacyszyn, JM Kathol, B *Canadian Tech Asphalt Assoc Proc*

NAPA 4207, 3C62017073

2A 230545

SUMMARY OF TREATMENTS FOR HIGHWAY EMBANKMENTS ON SOFT FOUNDATIONS

EVALUATION AND SOLUTION OF FOUNDATION PROBLEMS INVOLVING HIGHWAY EMBANKMENTS IN NEW YORK STATE ARE BEING SUMMARIZED. CRITICAL SOILS ARE LOCATED AND SUFFICIENT DATA OBTAINED TO DETERMINE THE SOIL PROPERTIES. BY ESTABLISHING CLOSE COORDINATION BETWEEN THE LOCATION ENGINEERS AND SOILS ENGINEERS, IT IS OFTEN POSSIBLE TO AVOID CRITICAL SOILS PROBLEMS HAVING EXPENSIVE SOLUTIONS BY MINOR SHIFTS IN ALIGNMENT. THE MOST ECONOMICAL AND SATISFACTORY SOLUTION TO AN EMBANKMENT FOUNDATION PROBLEM IS DETERMINED NOT ONLY BY THE SOIL PROPERTIES, BUT ALSO BY CONSIDERATION OF CONSTRUCTION TIME, RIGHT-OF-WAY, LOCATION OF PROJECT, COST AND AVAILABILITY OF CONSTRUCTION MATERIALS, AND HIGHWAY GEOMETRICS.

Moore, LH *Highway Research Record, Hwy Res Board*

2A 230546

OBSERVATIONAL APPROACH AND INSTRUMENTATION FOR CONSTRUCTION ON COMPRESSIBLE SOILS

THE OBSERVATIONAL APPROACH FOR CONSTRUCTION ON COMPRESSIBLE SOIL IS DESCRIBED, WHICH CONSISTS OF USING OBSERVATIONS AND MEASUREMENTS TO EVALUATE THE PERFORMANCE OF STRUCTURES, BOTH EXISTING AND UNDER CONSTRUCTION, FOR THE PURPOSE OF DECIDING ON CORRECTIVE MEASURES OR IMPROVING DESIGN AND CONSTRUCTION OF FUTURE STRUCTURES. HORIZONTAL AND VERTICAL MOVEMENTS, DEFLECTION MEASUREMENT, SETTLEMENTS AND HEAVES, WATER TABLE, PORE WATER PRESSURE, AND ENGINEERING PROPERTIES ARE MEASURED. THE INSTRUMENTATION INCLUDES SURVEYING METHODS, SETTLEMENT PLATES, WATER LEVEL GAGE, THE WILSON SLOPE INDICATOR, PIEZOMETERS, STRAIN GAGES, AND EARTH PRESSURE CELLS.

Lacroix, Y *Highway Research Record, Hwy Res Board*

2A 230553

ASPHALTIC STABILIZATION OF SELECTED SAND AND GRAVEL BASE COURSES

A PROGRAM WAS CONDUCTED IN GRATIOT COUNTY, MICHIGAN TO EVALUATE SUBSTANDARD BASE COURSE MATERIALS WHEN STABILIZED WITH ASPHALT CEMENTS. THIS FIELD STUDY WAS CORRELATED TO LABORATORY STUDIES ON ASPHALT PERCENTS, TEMPERATURE OF MIXING, TEMPERATURE OF TESTING, MARSHALL STABILITY AND UNCONFINED COMPRESSION. TABULATED AND GRAPHICAL DATA IS PRESENTED TO SHOW MARSHALL STABILITY TEST RESULTS AND UNCONFINED COMPRESSION TEST RESULTS. ASPHALTIC CONTENT, STABILITY AND STRENGTH WERE RELATED TO TOTAL VOID VOLUME IN PREPARED AND TESTED SAMPLES. MAXIMUM STRENGTHS AND STABILITIES OCCURED AT DENSITIES SLIGHTLY LOWER THAN OPTIMUM DENSITY FOR A GIVEN MIXTURE. THE STRENGTH AND STABILITY OF BASE COURSE MATERIAL STABILIZED WITH ASPHALTIC FILMS VARIES DIRECTLY WITH THE ASPHALT CONTENT, INVERSELY WITH TEMPERATURE, AND DIRECTLY WITH DENSITY UP TO A CRITICAL DENSITY VALUE BEYOND WHICH DENSITY AFFECTS ARE MUST LESS. UNCONFINED COMPRESSION TESTS INDICATE VALUES OF 80 TO 90 POUNDS PER SQUARE INCH AT TEMPERATURES OF 77 DEGREES F WOULD BE ADEQUATE FOR

BASE COURSE CONSTRUCTION MATERIALS STABILIZED WITH ASPHALT CEMENT.

Riley, JC Blomquist, GC *Highway Research Circular Hwy Res Board*

2A 230554

AUTOMATIC EMBANKMENT ANALYSIS' EQUILIBRIUM AND INSTABILITY CONDITIONS

FORMALIZATION OF THE CONCEPT HAS BEEN MADE THAT MANY STRESS STATES OCCUR IN A BODY OF SAND, EACH STATE DEPENDING UPON THE MANNER IN WHICH FINAL CONFIGURATION OF THE BODY WAS OBTAINED. THE RESTRICTED CLASS OF SOLUBLE BOUNDARY VALUE PROBLEMS WERE EXTENDED BY THE USE OF THE FINITE ELEMENT METHOD FOR PLANE ELASTICITY AND THE SOLUTION OF THE RESULTING ALGEBRAIC EQUATIONS BY DIGITAL COMPUTER. THE DIFFERENCE BETWEEN BUILT-UP AND CUT-DOWN EMBANKMENTS WAS ILLUSTRATED WITH REFERENCE TO POSSIBLE SLIP-LINES. AN AUTOMATIC PLOT OF THESE LINES TOGETHER WITH PRINTOUT STATEMENTS OF A MEASURE OF SAFETY FOR EACH LINE ALLOWED THE POTENTIAL FAILURE SURFACES IN AN EMBANKMENT TO BE ACCURATELY DESCRIBED. THE IMPORTANCE OF THE INITIAL LOCAL STATE OF STRESS IN THE EARTH'S SURFACE PRIOR TO CONSTRUCTION OF AN EMBANKMENT WAS GRAPHICALLY ILLUSTRATED.

Brown, CB King, IP *Geotechnique /UK/*

ACKNOWLEDGMENT: Highway Res Abstracts Hwy Res Board

2A 230556

A METHOD OF DETERMINING SWELL POTENTIAL OF AN EXPANSIVE CLAY

THE SWELL PREDICTION METHOD PROPOSED BY THE AUTHORS UTILIZES THE RESULTS OF CONSOLIDOMETER TESTS ON UNDISTURBED SAMPLES OF THE SWELLING CLAY. A UNIQUE SPLIT TUBE SAMPLER WITH REMOVABLE INNER RINGS WAS DEvised AND BUILT TO OBTAIN THE SAMPLES. SEPARATE CONSOLIDOMETER SAMPLES ARE TESTED FOR EACH OF THREE LOADING CONDITIONS TO SIMULATE /1/ SWELL DUE TO UNLOADING ONLY, /2/ SWELL DUE TO SATURATION ONLY, AND /3/ SWELL DUE TO BOTH UNLOADING AND SATURATION. SINGLE LOADING AND UNLOADING CYCLES ARE USED TO EXPEDITE TEST RESULTS. THE CONSOLIDOMETER DATA, IN CONJUNCTION WITH THE ACTUAL LAYER THICKNESS OF THE SWELLING CLAY, ARE THEN USED TO PREDICT THE AMOUNT OF SWELLING TO BE EXPECTED AT GRADE. THE RESEARCHERS HAVE NOT YET HAD THE OPPORTUNITY TO USE THEIR METHOD TO PREDICT SWELLING IN ACTUAL HIGHWAY CONSTRUCTION, BUT A POST FACTO PREDICTION ON AN AREA OF OBVIOUS PAVEMENT DISTRESS CHECKED THE ACTUAL SWELL TO WITHIN APPROXIMATELY FIVE HUNDREDTHS OF A FOOT. /BPR/

Budge, WD Sampson, E Schuster, RL
Colorado University Hpr-1/2/

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4650002 65)

2A 230557

STABILIZATION OF SILTY SOILS IN ALASKA, PART 1

THIS BRIEF REPORT STATES THE OBJECTIVE OF THE STUDY /TO DETERMINE AN ECONOMICAL METHOD OF STABILIZING A-4 SILTY MATERIAL FOR USE IN HIGHWAY CONSTRUCTION IN ALASKA/ PRESENTS A REVIEW OF THE LITERATURE /WITH REFERENCES/ DISCUSSES AND COMPARES VARIOUS POSSIBLE WAYS OF PREVENTING DAMAGING FROST HEAVE /STABILIZATION/ PROPOSES THREE TREATMENTS FOR LABORATORY INVESTIGATION AND SUBSEQUENT POSSIBLE FIELD STUDY. THE THREE TREATMENTS ARE: /1/ ADDITION OF SMALL AMOUNTS OF CEMENT /1 TO 3 PERCENT/, WITH AND WITHOUT SODIUM HYDROXIDE AND A DISPERSING AGENT FOR INHIBITTING THE EFFECTS OF ORGANIC MATTER AND ENHANCING THE ACTION OF THE CEMENT, /2/ USE OF PHOSPHATE DISPERSANTS TO OBTAIN LESS PERMEABLE SOIL, THUS

INHIBITING WATER MOVEMENT AND ATTENDANT HEAVE AND /3/ USE OF ASPHALTIC AND PLASTIC MOISTURE BARRIERS AND ENVELOPES. DESIGN INFORMATION IS GIVEN BASED ON A STANDARD DESIGN OVER THE CBR—3 SILT AS FOLLOWS' A WEARING COURSE, SIX INCHES OF D-1 BASE, 6 IN. OF TYPE II MATERIAL /CBR 80/ AND 16 IN. OF TYPE I MATERIAL /CBR 30/. THE PROPOSED DESIGN WOULD HAVE 22 IN. OF TREATED SILT /CBR 25/ IN PLACE OF THE TYPE I AND II LAYERS. PRESUMABLY EACH OF THE 3 TREATMENTS WOULD BE TESTED SEPARATELY IN THIS 22 IN. ZONE. COST INFORMATION IS GIVEN FOR VARIOUS ASPECTS OF THE TREATMENTS. /BPR/

Peyton, HR Lund, JW
Alaska Department Highways

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4650002 65)1C62020379, 1C62020661, 1C62020038, PB 173 024 \$3.00

2A 230560

SOIL-CEMENT CONSTRUCTION USING LOESS SOIL

GRANULAR MATERIALS SUITABLE FOR HIGHWAY BASE COURSES ARE SCARCE IN WESTERN IOWA. THIS PAPER REPORTS ON THE DESIGN, CONSTRUCTION PROCEDURES AND PROBLEMS, AND RESULTS OF LABORATORY AND FIELD TESTING INVOLVED IN THE CONSTRUCTION OF TWO EXPERIMENTAL SECTIONS OF TWO ROADS IN WESTERN IOWA, IN WHICH LOESS SOIL-CEMENT WAS USED AS THE BASE. CLAY CONTENT AND MOISTURE CONTENT STRONGLY AFFECTED THE DEGREE OF PULVERIZATION ATTAINABLE, HIGH VALUES OF EITHER BEING TROUBLESOME. HEAVY SPIKE DRAGS CAUSED COMPACTION PLANES ON BOTH SECTIONS. A SINGLE BITUMINOUS SEAL COAT DID NOT ADEQUATELY PROTECT THE BASE ON ONE ROAD, TWO COATS APPEARED SATISFACTORY ON THE OTHER. IN GENERAL, FREEZE-THAW LOSSES FROM CORES TAKEN FROM THE COMPLETED ROADS WERE GREATER THAN THOSE FROM CORRESPONDING LABORATORY SPECIMENS. UNCONFINED COMPRESSIVE STRENGTH OF CORES AT 8 DAYS CURING AVERAGED 400 PSI LESS THAN 7-DAY LABORATORY SPECIMENS.

Roberts, SE Schoeneman, EP
Iowa State Highway Commission Jan65, Jan. 1965

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4310001 65)

2A 230583

QUALITY CONTROL ANALYSIS, PART 2, SOIL AND AGGREGATE BASE COURSE

AN ATTEMPT HAS BEEN MADE TO DETERMINE THE EXTENT OF VARIABILITY OF SOIL AND AGGREGATE BASE COURSE CHARACTERISTICS USING DATA COLLECTED FROM COMPLETED PROJECT FILES. ON THE BASIS OF THIS VARIABILITY, NUMERICAL LIMITS HAVE BEEN ESTABLISHED USING STATISTICAL QUALITY CONTROL TECHNIQUE. THE HISTORICAL DATA TEND TO FOLLOW NORMAL DISTRIBUTION. UNSTABILIZED AGGREGATE BASE COURSE HAS LESS VARIABILITY THAN STABILIZED BASE COURSES AND THE SIGMAS ARE CONSIDERABLY DIFFERENT FOR DIFFERENT CONTRACTORS.

Louisiana Department Highways

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4721183 66)1C33020631, 1C62020484, PB-173 925 \$ 3.00

2A 230597

STABILIZATION OF SILTY SOILS IN ALASKA-PHASE II

PREVENTION OF FROST HEAVE AND OF STRENGTH LOSS ON THAWING OF SILT OR LOESS SOILS OF THE A-4 TYPE USED FOR HIGHWAY CONSTRUCTION IN ALASKA WERE STUDIED. EFFECTS OF PORTLAND CEMENT, TETRA SODIUM PYROPHOSPHATE /TSPP/, CALCIUM CHLORIDE, SODIUM HYDROXIDE, TRI SODIUM PHOSPHATE AND PLASTIC MEMBRANES ON HEAVE RATE, HEAVE RATIO, FROST PENETRATION, PERMEABILITY, AND AFTER THAW CALIFORNIA BEARING RATIO WERE CONSIDERED. TSPP WAS THE ONLY CHEMICAL WHICH

EFFECTIVELY REDUCED PERMEABILITY. TSPP AT 0.5% RATE AND SODIUM HYDROXIDE AT 0.3% RATE WERE MOST EFFECTIVE TREATMENTS FOR FROST HEAVE CONTROL. TSPP TREATMENT COSTS ABOUT \$2 PER CU YD AND SODIUM HYDROXIDE ABOUT \$1.70 PER CU YD. PROVIDING A CLOSED SYSTEM BY USE OF A PLASTIC MEMBRANE ALSO PROVED SUCCESSFUL.

Peyton, Kennedy, Lund,
Alaska University

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4651022 66)PB 174 727, 1C62020038, 1C62020379, 1C62020661

2A 230636

STABILIZATION OF CHINLE CLAY BY ELECTRO-OSMOTIC TREATMENT- PHASE II

RESULTS ARE PRESENTED OF LABORATORY STUDIES ON THE ELECTRO-OSMOTIC TREATMENT OF CHINLE CLAY, AS WELL AS THE INSTALLATION AND OPERATION OF A FULL-SCALE FIELD TEST. LABORATORY MODEL STUDIES INDICATED THAT OPTIMUM TREATMENT OF THE CHINLE CLAY IS OBTAINED UNDER THE FOLLOWING CONDITIONS: STEEL ELECTRODES, SATURATED POTASSIUM CHLORIDE SOLUTION, A VOLTAGE GRADIENT OF 0.5 VOLTS PER INCH TO THE EXTENT THAT ONE GALLON PER CUBIC FOOT OF KCl SOLUTION IS INTRODUCED INTO THE CLAY. LEACHING TESTS INDICATED THAT THE STABILIZATION EFFECTS ARE PERMANENT. RESULTS OF COMPACTION, COMPRESSIVE STRENGTH AND CONSOLIDATED UNDRAINED TRIAXIAL TESTS INDICATE THAT ELECTRO-OSMOTIC TREATMENT IN THE LABORATORY, EITHER REMOLDED OR IN THE UNDISTURBED STATE, IMPROVES THE CHINLE CLAY AS A CONSTRUCTION MATERIAL. THE 150-FT. 2-LANE TEST SECTION IS LOCATED ON INTERSTATE 40. THE ANODES SERVING AS INJECTION WELLS WERE 5-INCH SLOTTED STEEL PIPE, PLACED AT 15-FT. INTERVALS ALONG THE EDGES OF THE PAVEMENT. CATHODES WERE NO. 6 REINFORCING BARS, DRIVEN IN THE CENTERLINE OF THE PAVEMENT AT 10-FT. INTERVALS. THE REPORT PRESENTS DATA INDICATING THE AMOUNT OF SOLUTION USED AND THE AMOUNT OF ELECTRICAL ENERGY REQUIRED. THE MAJOR SHORTCOMING OF THE FIELD TECHNIQUE WAS THAT A LARGE PROPORTION OF THE SOLUTION WAS WASTED INTO THE SHOULDERS OF THE ROAD.

O, BANNON Niese, Kuhn, Lee,
Arizona State University Hpr-1/5/, July 1967

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4651032 67)PB 176 176, 1C62021033

2A 230647

SUITABILITY OF SYNTHETIC AGGREGATES MADE FROM CLAY-TYPE SOILS FOR USE IN FLEXIBLE BASE

AN INVESTIGATION WAS CONDUCTED TO DETERMINE THE LIMITING RANGE OF NATURAL SOILS WHICH CAN BE FIRED TO PRODUCE AGGREGATES SUITABLE FOR USE IN FLEXIBLE BASE MATERIALS. THE FINDINGS OF THE LIMITED STUDY ARE LISTED: (1) THE CLAY MATERIALS, MONTMORILLONITE, ILLITE, AND KAOLINITE WILL NOT REHYDRATE UNDER ATMOSPHERIC CONDITIONS ONCE THEY ARE COMPLETELY DEHYDRATED. THEY BECOME CHEMICALLY STABILIZED FOR USE AS HIGHWAY CONSTRUCTION MATERIALS. COMPLETE DEHYDRATION CAN BE ACCOMPLISHED BY HEATING THE CLAY TO 1400 DEGREES F FOR A PERIOD OF 15 MINUTES. (2) INCOMPLETE DEHYDRATION OF AGGREGATES MADE BY DEHYDRATING CLAY-TYPE SOILS CAN BE DETECTED BY A RELATIVELY SIMPLE LABORATORY TEST. (3) MOST CLAY-TYPE SOILS HAVING A RELATIVELY HIGH STRENGTH WHEN AIR-DRIED CAN BE FIRED TO PRODUCE HARD, DURABLE AGGREGATE SUITABLE FOR USE IN FLEXIBLE BASE AND ASPHALTIC CONCRETE. IT IS INDICATED THAT SYNTHETIC AGGREGATES PRODUCED FROM SOILS THAT ARE SUITABLE FOR FLEXIBLE BASE AND ASPHALTIC CONCRETE WILL USUALLY BE SUITABLE FOR USE AS PORTLAND CEMENT

CONCRETE AGGREGATES. HOWEVER, THERE ARE MANY CHEMICAL COMPOUNDS PRESENT IN SYNTHETIC AGGREGATES PRODUCED FROM NATURALLY OCCURRING SOILS. SOME, THOUGH NOT DETRIMENTAL IN FLEXIBLE BASE AND ASPHALTIC CONCRETE APPLICATION, MAY ADVERSELY AFFECT THE HYDRATION OF PORTLAND CEMENT CONCRETE. /BPR/

Moore, WM Van, PELT R Scrivner, FH Kunze, GW
Texas Transportation Institute, Texas State Department of Highways & Public Transp, Bureau of Public Roads /US/

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4811416 68)PB 178 357, 1C62021168

2A 230659

LIME TREATED SOILS FOR PAVEMENT CONSTRUCTION

PROPERTIES AND CHARACTERISTICS OF LIME-SOIL MIXTURES ARE DISCUSSED AND THE SUITABILITY DEMONSTRATED OF SUCH MIXTURES FOR USE IN PAVEMENT STRUCTURES. CRITERIA ARE PRESENTED FOR EVALUATING SOIL-LIME MIXTURES FOR USE IN MODIFIED SUBGRADES, SUBBASES AND BASE COURSES. THESE CRITERIA WERE DEVELOPED FROM BOTH LABORATORY AND FIELD EXPERIMENTS, AS WELL AS THEORETICAL STRESS COMPUTATIONS. FOR EXAMPLE, IF A SOIL-LIME SUBBASE HAVING AN 8-INCH COVER IS TO BE CONSTRUCTED (BASE PLUS BITUMINOUS SURFACING = 8 INCHES), LABORATORY SPECIMENS OF THE SOIL-LIME MIXTURE, CURED IN A MANNER EQUIVALENT TO THAT EXPECTED IN THE FIELD AND THEN IMMERSED IN WATER FOR 8 DAYS, SHOULD RETAIN AN UNCONFINED COMPRESSIVE STRENGTH OF AT LEAST 70 PSI. CURED SPECIMENS OF THE MIXTURE SUBJECTED TO 3, 7 OR 10 FREEZE-THAW CYCLES SHOULD RETAIN STRENGTHS OF 70, 110 OR 140 PSI, RESPECTIVELY. AFTER BEING IN SERVICE FOR ONE WINTER, THE ACTUAL SUBBASE SHOULD RETAIN A STRENGTH OF AT LEAST 40 PSI. /BPR/

Thompson, MR
Illinois University, Urbana, Illinois Division of Highways, Bureau of Public Roads /US/

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4651152 68)1C62020234, 1C62020676, 1C62020763, 1C62021324, 1C62021259, 1P62080792, 1C63020299

2A 230673

BENEFICIATION OF LOW GRADE SOILS-PART I

RESULTS ARE PRESENTED OF A TESTING PROGRAM OF 9 CLAY SOILS THAT HAVE BEEN DEFINED AS PROBLEM SOILS BECAUSE THEY EXHIBIT HIGH VOLUME CHANGES, HAVE LOW BEARING VALUES WHEN WET AND ARE HIGHLY ELASTIC, WHICH MAKES THEM DIFFICULT TO COMPACT. THE SOILS WERE STABILIZED WITH HIGH-CALCIUM, HYDRAULIC HYDRATED LIME. THE EFFECTS OF LIME ON THE ATTERBERG LIMITS, CBR AND UNCONFINED COMPRESSIVE STRENGTH ARE PRESENTED. THE MAJOR CONCLUSION IS THAT LOW GRADE SOILS OF PUERTO RICO CAN BE IMPROVED BY LIME TREATMENT TO THE EXTENT THAT THEY ARE ACCEPTABLE HIGHWAY CONSTRUCTION MATERIALS. /BPR/

Puerto Rico Department Public Works, Bureau of Public Roads /US/
Hpr-pr-1(6), Dec. 1967

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4651372 68)

2A 230706

DETERMINATION OF DESIGN COEFFICIENTS FOR LIME-SOIL MIXTURES FOR USE IN THE ILLINOIS FLEXIBLE PAVEMENT STRUCTURAL DESIGN PROCEDURE

THE FINDINGS OF THE RESEARCH PROJECT IHR-76, "LIME STABILIZATION OF SOILS FOR HIGHWAY PURPOSES," CONDUCTED BY THE DEPARTMENT OF CIVIL ENGINEERING, UNIVERSITY OF ILLINOIS, IN COOPERATION WITH THE ILLINOIS DIVISION OF HIGHWAYS AND THE BUREAU OF PUBLIC ROADS, HAVE INDICATED THAT LIME-SOIL MIXTURES CAN

BE USED EFFECTIVELY AND ECONOMICALLY AS QUALITY HIGHWAY CONSTRUCTION MATERIALS. THE WORK WAS UNDERTAKEN TO PERMIT APPLICATION OF THE FINDINGS OF IHR-76 IN PAVEMENT DESIGN BY DEVELOPING TENTATIVE STRENGTH COEFFICIENTS AND MATERIAL REQUIREMENTS AND LIMITATIONS FOR INCLUSION OF THE USE OF LIME-STABILIZED-SOIL MIXTURES AS BASE AND SUBBASE IN THE ILLINOIS FLEXIBLE PAVEMENT STRUCTURAL DESIGN PROCEDURE. /BPR/

Illinois Division of Highways, Bureau of Public Roads /US/

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4621-232 70)REPORT PENDING, 1C62021967

2A 230714

FINAL SUMMARY REPORT MATERIALS DEVELOPMENT AND UTILIZATION

STUDY OBJECTIVES WERE TO DEVELOP TECHNIQUES AND PROCEDURES FOR ACHIEVING MAXIMUM UTILIZATION OF LOCAL AND ON-SITE MATERIALS IN PAVEMENT CONSTRUCTION WITH PARTICULAR REFERENCE TO ILLINOIS SOILS AND MATERIALS. STABILIZATION TECHNIQUES CONSIDERED WERE CEMENT, LIME, BITUMINOUS, LIME-FLY ASH, AND COMBINATION (LIME-CEMENT, LIME-BITUMEN). RESEARCH FINDINGS FROM THE STUDY HAVE BEEN PREVIOUSLY DISSEMINATED IN VARIOUS REPORTS. THE REPORTS ARE REFERENCED AND ABSTRACTED IN THE FINAL SUMMARY REPORT. COMMENTS CONCERNING RESEARCH IMPLEMENTATION, RESEARCH BENEFITS, AND FOLLOW-UP RESEARCH ARE PRESENTED. /BPR/

Thompson, MR
Illinois University, Urbana, Illinois Division of Highways, Bureau of Public Roads /US/ No IHR-94

ACKNOWLEDGMENT: Bureau of Public Roads /US/REPORT PENDING, 1C62022131

2A 230781

IMPROVED TENSILE STRENGTH FOR CEMENT-TREATED BASES AND SUBBASES

THIS REPORT SUMMARIZES THE FINDINGS OF AN EVALUATION AND INTERPRETATION OF THE RESULTS FROM PREVIOUS STUDIES CONCERNING THE TENSILE AND SHRINKAGE CHARACTERISTICS OF CEMENT-TREATED MATERIALS. THE EFFECTS ON TENSILE STRENGTH PRODUCED BY EIGHT FACTORS PREVIOUSLY SHOWN TO BE IMPORTANT ARE ANALYZED IN DETAIL, AND THE EFFECTS ARE EVALUATED IN TERMS OF THEIR SIGNIFICANCE AND RELATIONSHIP TO SHRINKAGE CRACKING OF CEMENT-TREATED MATERIALS. BASED ON THESE EVALUATIONS, A MODIFICATION IS PROPOSED FOR THE TEXAS HIGHWAY DEPARTMENT MIX DESIGN PROCEDURE, WHICH SHOULD IMPROVE TENSILE STRENGTH AND MINIMIZE SHRINKAGE CRACKING. IN ADDITION, RECOMMENDATIONS REGARDING THE CONSTRUCTION OF CEMENT-TREATED BASES AND SUBBASES FOR IMPROVED TENSILE STRENGTH AND REDUCED SHRINKAGE CRACKING ARE MADE. /FHWA/

Caulley, RF Kennedy, TW
Texas Univ, Center for Highway Research Interim 1998, 50 pp

ACKNOWLEDGMENT: Texas Highway Department, Federal Highway Administration FHWA S0119, NTIS PB 222 779, 1C62023289

2A 230791

STRENGTH GAIN PHENOMENON IN EARTHEN EMBANKMENT CONSTRUCTION

CONSTRUCTION OF EMBANKMENTS ON SOILS OF VERY LOW SHEAR STRENGTH OR BEARING CAPACITY DEMANDS AN ADEQUATE KNOWLEDGE OF THE RATE OF STRENGTH-GAIN AS THE CONSOLIDATION OR SETTLEMENT OF SUBSOIL PROGRESSES DUE TO EMBANKMENT LOADS. LABORATORY INVESTIGATIONS WERE CARRIED OUT TO KNOW THIS STRENGTH-GAIN PHENOMENON OF THREE PROBLEMATIC

TYPES OF SOILS AT DIFFERENT PERCENTAGE OF CONSOLIDATION UNDER DIFFERENT LOAD-INCREMENTS. /RRL/A/

Sutaria, TC *Indian Roads Congress Road Res Bull*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 230807

BASES AND FOUNDATIONS

CONTENTS: EVALUATION OF THE STRENGTH OF BASES DETERMINATION OF FOUNDATION DISPLACEMENT SURFACE FOUNDATIONS EXECUTION OF SURFACE FOUNDATION CONSTRUCTION WORKS ON LAND COVERED WITH WATER SOIL STABILIZATION PILE FOUNDATIONS AND ISOLATED PILES CONSTRUCTION OF PILE FOUNDATIONS AND ISOLATED FOUNDATIONS LARGE VOLUME FOUNDATIONS FOUNDATIONS UNDER SPECIAL CONDITIONS CHOICE OF THE TYPE OF FOUNDATION AND BASE /LCPC/A/RRL/

Kosterin, EV
Vyssaja Skola /Ussr/

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 230820

PRACTICAL APPLICATION OF ELECTRO-OSMOSIS

WHERE OTHER METHODS HAVE FAILED ELECTRO-OSMOSIS HAS PROVED SUCCESSFUL IN STIFFENING WET CLAYS. IT IS ALSO EFFECTIVE IN LOWERING THE WATER-TABLE TO ALLOW FOUNDATIONS TO BE CONSTRUCTED, TO RECLAIM BOGGED AND SALTED AREAS, AND TO DRAW CHEMICAL STABILIZER INTO THE SOIL TO STABILIZE THE SUBSOIL. THE PRINCIPLE OF ELECTRO-OSMOSIS IS DESCRIBED, AS ARE EXAMPLES OF ITS APPLICATION IN VARIOUS COUNTRIES. /RRL/

Gladwell, JK *New Zealand Engineering*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 230824

ROLE OF THE CALCULATED RISK IN EARTH WORK AND FOUNDATION ENGINEERING

THE MEANING OF THE TERM CALCULATED RISK IS FIRST EXPLORED AND THE TERMS UNKNOWN RISK AND HUMAN RISK ARE INTRODUCED. SEVERAL CASE HISTORIES ARE THEN REVIEWED FOR THE PURPOSE OF DEMONSTRATING THE IMPORTANCE OF RISKS IN EARTHWORK AND FOUNDATION ENGINEERING. THE FINAL SECTION DEALS WITH THE QUESTION OF HOW TO COPE WITH RISKS, WITH EMPHASIS ON THE USE AND ABUSE OF BOARDS OF CONSULTANTS FOR PROJECTS INVOLVING GREAT HAZARDS TO LIFE AND PROPERTY. /RRL/A/

Casagrande, A *Am Soc Civil Engr J Soil Mech Div*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 230834

SOIL SOLIDIFICATION AND SOIL STABILIZATION IN ROAD CONSTRUCTION, PARTS 1 AND 2

THE AUTHOR DISCUSSES SOIL SOLIDIFICATION AND STABILIZATION USING MECHANICAL METHODS, CEMENT, BITUMINOUS BINDERS, LIME, AND SOME CHEMICALS, AND THE ADVANTAGES AND DISADVANTAGES OF EACH METHOD. MECHANICAL STABILIZATION IMPROVES THE PARTICLE DISTRIBUTION AND INTERNAL FRICTION, STABILIZATION WITH CEMENT INCREASES THE BEARING CAPACITY OF SOIL, BITUMINOUS BINDERS CAN IMPROVE THE SUB-SOIL, BUT CANNOT BE USED WITH PLASTIC SOILS. LIME CHANGES THE SOIL STRUCTURE AND IMPROVES THE SOIL, PARTICULARLY WHEN APPLIED TO COHESIVE SOILS, AND IS, THEREFORE, PARTICULARLY RECOMMENDED FOR USE WITH THESE. BASICALLY THE METHOD SELECTED SHOULD DEPEND UPON THE SOIL BEING STABILIZED. /RRL/

Klinger, B *Strassenbau Technik, Cologne /Ger/*
ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 230838

COMPACTION OF FINE SANDS

SOME DATA ON THE COMPACTION OF CLEAN FINE SAND PUMPED FROM BOTANY BAY AND USED AS FILLING ON EXTENSIONS OF SYDNEY AIRPORT, AND ALSO OF A FINE DUNE SAND USED IN THE CONSTRUCTION OF ADELAIDE AIRPORT ARE PRESENTED. THE COMPACTION RESULTS INDICATE THAT FINE CLEAN SANDS CAN BE READILY COMPACTED WITH PNEUMATIC-TYRED ROLLERS, AND ALSO THAT THE COMPACTION WHICH CAN BE ACHIEVED INCREASES WITH INCREASE IN TYRE PRESSURE, THOUGH THE INCREASE WAS NOT GREAT FOR TYRE PRESSURES IN EXCESS OF ABOUT 40 LB/SQ. IN. /RRL/

Cochrane, RH *Australian Civil Eng & Construction*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 230853

THE NATURE AND PROPERTIES OF THE SUBGRADE SOIL AT MELBOURNE AIRPORT

DURING CIVIL ENGINEERING CONSTRUCTION ON AND NEAR MELBOURNE AIRPORT, THE SOIL WAS FOUND TO BE VERY UNSTABLE AFTER RAIN, AND CONSTRUCTION TRAFFIC TENDED TO BECOME BOGGED. THE UNUSUAL SENSITIVITY TO RAINFALL WAS FOUND TO BE DUE TO THE HIGH CONCENTRATION OF SODIUM CHLORIDE IN THE SOIL TOGETHER WITH APPROXIMATELY 40 PER CENT OF THE CLAY MINERAL MONTMORILLONITE. WHEN THE SALT CONCENTRATION IN THE SOIL WATER WAS REDUCED BY RAIN THE MONTMORILLONITE TENDED TO DISPERSE RESULTING IN A RAPID DECREASE IN STRENGTH. THE ADDITION OF LIME TO THE SOIL PREVENTS DISPERSION AND 4 PER CENT WOULD BE EXPECTED TO PRODUCE A STRONG AND STABLE MATERIAL. /RRL/A/

Russam, K Dumbleton, MJ *Australian Road Research Board Proc*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 230862

LIME STABILIZATION, CALIFORNIA'S EXPERIENCE WITH LIME TREATMENT IN ROAD CONSTRUCTION

THE CHEMICAL REACTIONS OF HYDRATED LIME AND ITS APPLICATION TO VARIOUS AGGREGATES ARE DISCUSSED. THE TECHNIQUE OF DRILL-LIME STABILIZATION IS OUTLINED AND AN EXAMPLE CITED OF ITS SUCCESSFUL EMPLOYMENT. TREATMENT WITH LIME REQUIRES THE CORRECT AMOUNT OF LIME AND WATER, UNIFORM MIXING, PROPER COMPACTION AND ADEQUATE CURING. IT IS MOST EFFECTIVE WITH CLAYEY SOILS AND GRAVEL CLAY MIXTURES WITH WHICH IT MAY CAUSE AN INCREASE IN FRIABILITY, SAND EQUIVALENT AND R VALUE /RESISTANCE TO DEFORMATION/ AND A DECREASE IN PLASTICITY INDEX AND AMOUNT OF VOLUME CHANGE. REFERENCE IS MADE TO RESEARCH PROJECTS CARRIED OUT IN THIS FIELD BY THE MATERIALS AND RESEARCH DEPARTMENT OF THE DIVISION OF HIGHWAYS. /RRL/

Zube, E Gates, C *California Highways & Public Works*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 230865

LIME IS A PROBLEM SOLVER WITH WISCONSIN GLACIAL SUBGRADES

SOIL STABILIZATION METHODS ON A NUMBER OF ROAD PROJECTS IN WISCONSIN SINCE 1961 ARE DESCRIBED. CEMENT AS WELL AS LIME HAS BEEN USED, BUT THE ARTICLE DEALS MAINLY WITH THE APPLICATION OF LIME. /RRL/

Roads and Streets

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 230893

THE PROPERTIES OF CHALK IN RELATION TO ROAD FOUNDATIONS AND PAVEMENTS

STUDIES HAVE BEEN MADE OF A NUMBER OF PROPERTIES OF CHALK WITH PARTICULAR REFERENCE TO ROAD CONSTRUCTION. THE MOISTURE RETENTION PROPERTIES, PERMEABILITIES, AND FROST SUSCEPTIBILITIES OF A WIDE RANGE OF CHALKS HAVE BEEN EXAMINED. THE RELATION BETWEEN THE HEAVE AND THE SATURATION MOISTURE CONTENT IS GIVEN FOR RECOMPACTED SAMPLES RANGING FROM SOFT CHALK TO OOLITIC LIMESTONE. THE EFFECT ON THE FROST SUSCEPTIBILITY OF RECOMPACTED SOFT CHALK OF GRADING, STABILIZATION WITH CEMENT AND ADDING BENTONITE HAS ALSO BEEN EXAMINED. ALTHOUGH THE ADDITION OF CEMENT REDUCED THE FROST HEAVE, COMPARISON OF THE RESULTS WITH BENTONITE SUGGESTED THAT THE PRIMARY EFFECT OF THE CEMENT WAS TO REDUCE THE PERMEABILITY OF THE CHALK. THE LABORATORY COMPACTION, COMPRESSIBILITY AND STRENGTH PROPERTIES OF A TYPICAL SOFT CHALK HAVE BEEN STUDIED. INFORMATION IS ALSO GIVEN ON THE COMPACTION OF CHALK FILL. PROBLEMS LIKELY TO ARISE DURING EMBANKMENT CONSTRUCTION ARE DISCUSSED. A DETAILED STUDY WAS MADE OF THE STABILIZATION WITH CEMENT OF A RANGE OF GRADINGS OF PULVERIZED CHALK. THE EFFECT OF CEMENT CONTENT AND STATE OF COMPACTION ON THE COMPRESSIVE STRENGTH IS EXAMINED. /RRL/A/

Lewis, WA Croney, D *Inst Civil Engineers Proc London /UK/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 230896

PROTECTION OF FOUNDATION SOIL BY BITUMEN AND GLASS FIBRE WOOL

A NEW METHOD OF SEALING BY COVERING THE FOUNDATION SOIL WITH A COATING OF GLASS FIBRE REINFORCED BITUMEN IS DESCRIBED. EARLY TESTS ON SITE IN 1963 SHOWED THAT SIMPLE TREATMENT WITH A BINDER IS INADEQUATE BECAUSE OF ITS MECHANICAL SENSITIVITY. FOLLOWING ON PRELIMINARY LABORATORY EXPERIMENTS, THEREFORE, A METHOD WAS EVOLVED, IN WHICH THE BITUMEN COATING IS STRENGTHENED WITH GLASS FIBRE WOOL AND THUS RENDERED MORE ABLE TO WITHSTAND MECHANICAL LOADING. THE TESTS SHOWED THAT A FOUNDATION SOIL TREATED IN THIS WAY REMAINED INTACT EVEN AFTER RAIN WHEREAS IN THE CASE OF AN UNPROTECTED FOUNDATION SOIL THE GRAVEL IN THE OVERLYING ANTI-FROST LAYER HAD INTERMIXED WITH PLASTIC SOIL. IN THE SECTION OF THE FULDA-WURZBURG MOTORWAY UNDER CONSTRUCTION, BECAUSE OF THE BAD SUMMER FOR CONSTRUCTION WORK OF 1965, THE METHOD WAS USED ON A LARGE SCALE. IN THE COURSE OF CONSTRUCTION, BECAUSE OF THE INITIALLY SOFT CONDITION OF THE BITUMEN COATING, THE EMULSION WAS REPLACED BY HOT BITUMEN. IN SUMMARY, IT IS ESTABLISHED THAT A BITUMEN/GLASS FIBRE WOOL COVERING IS A USEFUL AND ECONOMIC REMEDY FOR FOUNDATION SOIL WHICH IS SENSITIVE TO THE WEATHER. /RRL/

Stahff, U *Bitumen /Germany/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 230901

EXPERIENCE IN THE CONSTRUCTION OF ROAD EMBANKMENT ON SOFT SOILS

THIS WELL-KNOWN AMERICAN EXPERT REPORTS ON THE PROBLEMS OF ROAD CONSTRUCTION IN THE U.S.A. ON SOILS OF LOW LOAD CARRYING CAPACITY, INCLUDING EXCAVATION AND DISPLACEMENT OF WEAK SOILS AND THE VALUE OF SAND DRAINS. U.S.A. EXPERIENCE IS SUMMARIZED BY THE AUTHOR AS FOLLOWS: -/1/ IF SOFT, HUMUS LAYERS ARE UNDERNEATH ROAD FILLS, MORE OR LESS UNEVEN SETTLING IS THE RESULT, PRODUCING MORE OR LESS WAVY

ROAD SURFACES AND VERY OFTEN OVER-EXPENSIVE REPAIRS, /2/ THE PEAT-BLASTING METHOD WITH THE HELP OF JETTING OF PREPARED CHARGES SHOULD BE DEVELOPED IN LARGE-SCALE TESTS, AND /3/ THE DRIVING OF SAND DRAINS THROUGH ORGANIC SOILS OF WEAK STRUCTURE IS NOT ONLY A WASTE OF MONEY BUT OFTEN CAUSES DIFFICULTIES WHICH COULD BE AVOIDED WITHOUT SAND DRAINS. SHOULD, HOWEVER, SAND DRAINS BE ADVISEABLE IN A PARTICULAR CASE, THEY MUST BE SO LAID THAT THE SOFT SOIL STRATUM IS DISTURBED AS LITTLE AS POSSIBLE. /FG/RRL/

Casagrande, L *Strasse Und Autobahn /Germany/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 230902

ROAD STABILIZATION WITHOUT BINDERS

SERVICE ROADS ARE STILL EXTENSIVELY BEING BUILT BY SOIL STABILIZATION WITHOUT BINDERS. THE FOLLOWING METHODS OF STABILIZING WITHOUT BINDERS ARE DISCUSSED: /1/ SCREENED (CLASSIFIED) STONE (CHIPPINGS), /2/ UNSCREENED STONE, AND /3/ MECHANICAL COMPACTING. IN THIS CONTEXT, SOME WELL-BUILT ROADS OF THE STATE AND PRIVATE FORESTRY UNDERTAKINGS ARE INSTANCED WHERE STABILIZATION WITHOUT BINDERS HAS BEEN USED ALMOST EXCLUSIVELY. IN THESE CASES, LOCALLY AVAILABLE MATERIALS ARE PREDOMINANTLY USED. /RRL/

Klempert, B *Wasser Und Boden /Germany/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 230903

PEAT BLASTING IN THE CONSTRUCTION OF THE HOLLAND LINE

A REPORT IS GIVEN ON THE PREPARATORY WORKS AND EXECUTION OF PEAT BOG CROSSING DURING THE CONSTRUCTION OF THE HOLLAND LINE BETWEEN WESEL AND EMMERICH. SOIL RESEARCH TESTS SHOWED THE UNFAVORABLE SUBSOIL CONDITIONS WITH PEAT BEDS UP TO 8 METERS THICK. PEAT BLASTING WAS CARRIED OUT ON TWO SECTIONS. THE COSTS OF DISPLACEMENT PEAT BLASTING, COMPACTION PEAT BLASTING AND VERTICAL DRAINAGE ARE COMPARED. THE SOIL INVESTIGATIONS ARE DESCRIBED AND CONCLUSIONS GIVEN FOR THE CHOICE OF THE OPTIMUM SUBSOIL IMPROVEMENT TECHNIQUES /PRE-LOADING, SAND-DRAINING, TUBBING OR PEAT BLASTING/. A DETAILED ACCOUNT WILL BE ISSUED OF THE SOIL MECHANICAL RELATIONSHIPS AND THE EVALUATION OF THE SETTLEMENT MEASUREMENTS /PRESSURE-SETTLEMENT CURVES, TIME SETTLEMENT CURVES/.

Kipp, R *Strasse Und Autobahn /Germany/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 230907

TECHNOLOGICAL QUESTIONS ON STABILIZATION IN ECONOMIC FARM ROAD CONSTRUCTION

THE TOOLS REQUIRED FOR THE MIXED-IN-PLACE METHOD FOR SOIL CONSOLIDATION ARE COMPARED. INFLUENCES SUCH AS SIZE OF SECTIONS, DISTANCE THE BUILDING MATERIALS HAVE TO BE TRANSPORTED, ATMOSPHERIC CONDITIONS AND MANAGEABILITY ARE CONSIDERED. THE COMPARISON FAVORS THE EMPLOYMENT OF SINGLE MIXERS, WHICH ALLOW CONTINUOUS PRODUCTION AND INVOLVE LITTLE COST. AT A DAILY PRODUCTION OF 2,000 SQUARE METERS, THE SAVING, AS COMPARED TO MULTIPLE MIXERS, IS APPROXIMATELY 10 PER CENT. MOREOVER, THEY ARE MORE ADAPTABLE TO WEATHER CONDITIONS AND ARE ESPECIALLY ADVANTAGEOUS WHEN HYDRAULIC BINDERS ARE USED. /RRL/FG/

Freudenberg, G Fauth, C *Strasse, Berlin /Germany/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 230912

AN EXAMPLE OF EMBANKMENT CONSTRUCTION ON SOFT GROUND- CORUTENAY BAY CAUSEWAY

THE COURTENAY BAY CAUSEWAY PROVIDES A TWO LANE HIGHWAY LINK BETWEEN EAST SAINT JOHN AND THE CITY OF SAINT JOHN NEWBRUNSWICK. IT IS ABOUT ONE-HALF MILE LONG, 30 FEET IN MAXIMUM HEIGHT, AND CUTS OFF THE NORTH END OF COURTNEY BAY FROM THE SEA. SIGNIFICANT SITE CONDITIONS ARE FOUNDATION SOIL CONSISTING OF UP TO 90 FEET OF ORGANIC SILT AND SILTY CLAY, AND A NORMAL TIDAL RANGE OF ABOUT 28 FEET. THE CAUSEWAY WAY, AS BUILT, UTILIZED ABOUT 114,000 CU. YDS OF QUARTZITE ROCK FILL ON A SAND AND GRAVEL BLANKET LAYER OF 78,000 CU. YDS. THE PAPER PRESENTS A CASE HISTORY OF DESIGN AND CONSTRUCTION WITH OBSERVATIONS OF SETTLEMENT AND PERFORMANCE. /CGRA/

Estes, WE Matich, MA *Transactions Engineering Inst /Can/*

2A 230919

THE CONSOLIDATION OF PEAT A LITERATURE REVIEW

A CHARACTERISTIC FEATURE OF PEATS IS THEIR EXTREMELY COMPRESSIBLE NATURE, CONSEQUENTLY, CONSTRUCTION OF ROADS AND OTHER STRUCTURES ON PEATS NORMALLY CAUSES EXTENSIVE SETTLEMENT. APPLICATION OF THE CLASSICAL CONSOLIDATION THEORY IN THE ANALYSIS OF SETTLEMENT OF PEATS HAS PRODUCED CONSIDERABLE DISCUSSION, AS HAS THE QUESTION OF THE RELATIVE CONTRIBUTIONS OF PRIMARY AND SECONDARY CONSOLIDATION TO THE OVER-ALL SETTLEMENT. A LARGE BODY OF LITERATURE HAS ACCUMULATED ON THE PROBLEM OF CONSOLIDATION OF PEAT, BOTH IN THE LABORATORY AND IN THE FIELD. THE GREAT MAJORITY OF THIS LITERATURE HAS BEEN PRODUCED SINCE 1958 WITH AN EXTENSIVE INCREASE IN CONSTRUCTION ON PEATLANDS. THIS REPORT BRIEFLY REVIEWS THE LITERATURE. /CGRA/

Macfarlane, IC *Nrc Div Bldg Res Tech Papers*

2A 230922

LIME STABILIZATION ON BOUCHERVILLE BYPASS

FOR THE FIRST TIME QUEBEC WILL USE HYDRATED LIME TO STABILIZE CLAY SOILS. SOIL CEMENT WAS USED AS A STABILIZATION FACTOR AND ITS USE IS INCREASED. /CGRA/

Heavy Construction News /Canada/

2A 230925

SURCHARGE DISPLACES 20 FT BOG

THE PROBLEM WAS TO BUILD A HIGHWAY OVER AN OLD LAKEBED OF UNSTABLE MARL. TO CONSTRUCT A STABLE FOUNDATION, THE MUCK WAS DISPLACED BY A ROLLING SURCHARGE OF SAND. THE WORK HAD TO BE CARRIED OUT DURING THE WINTER AND COMPLETED BEFORE THE SPRING THAW TO PREVENT THE MACHINERY FROM GETTING BOGGED DOWN. /CGRA/

Salmins, G *Engineering and Contract Record /Can/*

2A 230931

PROCEEDINGS OF THE SIXTH INTERNATIONAL CONFERENCE ON SOIL MECHANICS AND FOUNDATION ENGINEERING VOLUME II

CONTENTS' DIVISION 3' SHALLOW FOUNDATIONS AND PAVEMENTS. THE THEORY AND PRACTICE FOR FOUNDATIONS OF BUILDINGS AND OTHER WORKS, INCLUDING BEARING CAPACITY, PRESSURE DISTRIBUTION, SETTLEMENT, UNDERPINNING, AND LABORATORY AND FIELD STUDIES OF FOUNDATIONS INCLUDING THOSE FOR ROADS, RUNWAYS, AND RAIL TRACKS. DIVISION 4' DEEP FOUNDATIONS. THE THEORY AND PRACTICE FOR DEEP FOUNDATIONS, INCLUDING BEARING CAPACITY, SETTLEMENT, AND TESTING. DIVISION 5: EARTH AND ROCK PRESSURES. EARTH AND ROCK PRESSURES ON RETAINING WALLS, STRUTTED EXCAVATIONS, CRATERED EXCAVATIONS, BULKHEADS, BURIED CON-

DENTS, SHAFT AND TUNNEL LININGS; PRESSURE IN SILOS AND BINS. THEORETICAL, MODEL AND FIELD INVESTIGATIONS OF EARTH PRESSURE AND ITS DISTRIBUTION, AND RELATED CONSTRUCTION PROBLEMS. DIVISION 6' EARTH AND ROCK DAMS, SLOPES AND OPEN EXCAVATIONS. THE PERFORMANCE OF EARTH AND ROCK DAMS DURING CONSTRUCTION AND IN USE, EARTH AND ROCK DAMS AND LEVEES AND ASSOCIATED FOUNDATION AND SEEPAGE PROBLEMS, NATURAL SLOPES, CUTTINGS, AND OPEN EXCAVATIONS NOT STRUTTED OR RETAINED, THEORETICAL, MODEL, AND FIELD INVESTIGATIONS OF SLOPE STABILITY, COMPACTION, PORE WATER PRESSURES, AND CONSTRUCTION MATERIALS IN SOIL AND ROCK DAMS AND SLOPES. /AUTHOR/

Intl Conf Soil Mech & Fdn Eng Proc

ACKNOWLEDGMENT: Canadian Good Roads Association

2A 230944

THE PERFORMANCE OF A TIMBER CRIB FOUNDED ON SOFT VERY SENSITIVE LACUSTRINE CLAY

A TIMBER CRIB INTAKE STRUCTURE WAS CONSTRUCTED OFFSHORE IN A LAKE FOUNDED ON A VERY SOFT TO SOFT CLAY OF HIGH MOISTURE CONTENT AND SENSITIVITY. THE CLAY IS A LATE GLACIAL FRESH-WATER SEDIMENT WHICH HAS BEEN CONSOLIDATED BY PRESSURES PROBABLY NOT EXCEEDING OVERBURDEN PRESSURE. SAMPLING AND TESTING OF THE CALY INDICATED A TWO-PART CONSOLIDATION CURVE WITH THE BREAK OCCURRING AT A POINT ABOUT 400 LB/SQ. FT. IN EXCESS OF THE INSITU OVERBURDEN PRESSURE. BEYOND THE BREAK IN THE OEDOMETER CURVE THE COMPRESSION INDEX WAS UP TO 30 TIMES GREATER THAN IN THE INITIAL PORTION BEING A MAXIMUM OF 3.0 TO 3.5. THE CRIB WAS FOUNDED ON A SAND AND GRAVEL MATTRESS KEYED INTO THE LAKE BOTTOM, THE RESULTING NET STRESS INCREASE ON THE CLAY BEING SLIGHTLY WITHIN THE INFERRED RANGE OF APPARENT PRECONSOLIDATION ESTABLISHED BY LABORATORY TESTS. PERFORMANCE READINGS ON THE CRIB FOR A PERIOD OF ABOUT A YEAR AFTER CONSTRUCTION HAVE SUBSTANTIATED THE FIELD EXISTENCE OF AN APPARENT PRECONSOLIDATION OF ABOUT THE ORDER OF MAGNITUDE PREDICTED BY LABORATORY TESTS. /CGRA/

Brezinski, LS *Canadian Geotechnical Journal*

ACKNOWLEDGMENT: Canadian Good Roads Association

2A 230972

ARROW PROJECT COFFERDAM

THE ARROW PROJECT IS LOCATED ON THE COLUMBIA RIVER IN SOUTH BRITISH COLUMBIA. THE EARTH-FILL COFFERDAM REQUIRED FOR THE CONSTRUCTION OF THE CONCRETE STRUCTURES, WAS COMPLETED EARLY IN 1966 AND REMOVED LATE IN 1967. THE COFFERDAM CONSISTED OF A SAND AND GRAVEL FILL WITH A CENTRAL IMPERVIOUS CORE. THE CORE WAS IN TWO PARTS: THE LOWER CORE CONSISTED OF A CONCRETE CUTOFF WALL FORMED BY THE SLURRY TRENCH PROCESS; THE UPPER CORE WAS A COMPACTED IMPERVIOUS TILL. THE COFFERDAM WITHSTOOD A MAXIMUM HYDRAULIC HEAD OF 115 FEET. DESIGN, CONSTRUCTION, PERFORMANCE AND REMOVAL OF THE COFFERDAM ARE DESCRIBED. PRODUCTION RATES FOR THE CONCRETE CUTOFF WALL ARE GIVEN TOGETHER WITH AN ESTIMATE OF COSTS. /CGRA/

Gadsby, JW Bares, FA *Canadian Geotechnical Journal*

ACKNOWLEDGMENT: Canadian Good Roads Association

2A 231002

ASPHALT MEMBRANES IN EXPRESSWAY CONSTRUCTION ENVELOPE-TYPE ASPHALT MEMBRANES PROVIDED EXCELLENT STABILIZATION OF PLASTIC EARTH FILLS FOR BRIDGE ABUTMENTS IN URBAN EXPRESSWAY CONSTRUCTION IN HOUSTON. TEST FILLS WERE OBSERVED OVER A 14-YEAR

PERIOD WITH EXCELLENT FINDINGS. THE OBSERVATIONS INCLUDE DETAILED CONSTRUCTION RECORDS OF MOISTURE-DENSITY CONDITIONS, FOLLOWED BY ANNUAL CONTINUOUS CORE-DRILLING OF FILLS AND TESTING OF CORES FOR MOISTURE CONTENT, DENSITY, AND TRIAXIAL COMPRESSIVE STRENGTH. TEST HOLES PENETRATED THE ENTIRE DEPTH OF FILL AS WELL AS THE COMPACTED SUBGRADE BELOW FILLS. FOR COMPARISON, NEARBY SOILS OF THE SAME NATURE AS THE FILLS BUT NOT PROTECTED WITH THE ASPHALT MEMBRANES HAVE BEEN SAMPLED AND SIMILARLY TESTED AT INTERVALS AS FOUND CONVENIENT. OTHER OBSERVATIONS INCLUDED THE PHYSICAL APPEARANCE OF SUCH FILLS, LATERAL MOVEMENTS IN FILLS /OR MORE PROPERLY, THE LACK OF SUCH MOVEMENTS/, STABILITY OF THE MEMBRANES UNDER EXTREME DRYING CONDITIONS, AND THE APPEARANCE OF THE MEMBRANES WHEN EXPOSED DURING SUBSEQUENT STAGE CONSTRUCTION. ONE OF THE MOST STARTLING CONCLUSIONS FROM THESE PERFORMANCE OBSERVATIONS IS THAT THE MEMBRANE FILLS ARE IN MANY CASES MORE STABLE THAN CONCRETE PAVEMENTS PLACED ON THE FILLS. THE USE OF ASPHALT MEMBRANES IN EARTH FILLS IN EXPRESSWAY CONSTRUCTION IN HOUSTON REPRESENTS A MAJOR USE OF THIS TYPE OF DESIGN, HAVING BEEN USED ON 54 STRUCTURES REQUIRING 104 ABUTMENT FILLS OF VOLUME OF OVER 400,000 CUBIC YARDS AND TREATED WITH APPROXIMATELY 1,600,000 GALS OF GRADE OA-55 OIL ASPHALT. SURFACE AND BURIED TYPES OF ASPHALT MEMBRANES WERE ALSO USED WITH GOOD SUCCESS, AND THESE ARE DISCUSSED BRIEFLY WITH COMMENTS ON GENERAL PERFORMANCE AND DESIGN CRITERIA. COVERAGE OF 1 GAL PER SQ YD OF GRADE OA-55 OIL ASPHALT WAS FOUND TO BE SUFFICIENT TO MAINTAIN A CONTINUOUS MEMBRANE EVEN UNDER MOST ADVERSE CONDITIONS AND TO MAINTAIN ESSENTIALLY CONSTANT MOISTURE CONTENT, DENSITY, AND COMPRESSIVE STRENGTH IN THE FILLS THEY ENVELOP. /AUTHOR/

Harris, FA *Highway Research Record, Hwy Res Board*

2A 231044

CEMENT-TREATED BASES

CEMENT TREATED BASE /BTC/ CONSTRUCTION IN WASHINGTON STATE USES MOSTLY MANUFACTURED OR PROCESSED AGGREGATE. PLANT-MIX CONTROL OF AGGREGATE GRADATIONS IS OBTAINED USING SPECIFICATIONS FOR GRADING REQUIREMENTS FOR ROAD MIX AGGREGATES. FIELD INVESTIGATIONS ESTABLISHED THAT COMPRESSIVE STRENGTH OF THE CTB WAS HEAVILY DEPENDENT UPON ITS DENSITY. ALTHOUGH BATCH PLANTS ARE PERMITTED, MIXING IS GENERALLY ACCOMPLISHED IN CONTINUOUS TYPE PUG MULLS HAVING A CAPACITY IN THE ORDER OF 400 TONS PER HOUR. SPECIFICATIONS REQUIRE THAT THE CEMENT FLOW BE UNIFORM AND ACCURATE AND, AT ANY MOMENT, NOT LESS THAN 90 PERCENT OF THE DESIGN OR PLANNED AMOUNT. THIS SPECIFICATION REQUIREMENT IS MOST DIFFICULT TO OBTAIN. EXPERIENCE SHOWED THAT A CEMENT-TREATED BASE SECTION COULD NOT BE EXPECTED TO LAST WHEN IT HAD TO SERVE ON A FLOODED SUBBASE WHERE WATER WAS TRAPPED IN THE ROADWAY SECTION. THIS LED TO THE DISCOVERY OF THE NEED FOR EXTREMELY HIGH PERMEABILITY IN SHOULDER MATERIAL TO ALLOW LATERAL DRAINAGE OF WATER WHICH WOULD ACCUMULATE BENEATH PAVEMENTS. BENKELMAN BEAM DEFLECTION STUDIES WERE CONDUCTED THAT CTB WHICH WOULD DEFLECT IN EXCESS OF 0.012 IN. UNDER A 15,000 POUND AXLE LOAD WOULD BE SUBJECT TO EARLY DISTRESS. EXPERIENCE HAS SHOWN THAT CEMENT CONTENTS BELOW 4 PERCENT SHOULD NOT BE RECOMMENDED

Leclerc, RV *Western Construction*

2A 231046

EARTHWORKS AND PAVEMENTS FOR THE NEW INTERNATIONAL AIRPORT FOR KUALA LUMPUR
THE CHOICE OF THE CONSTRUCTION TYPE USED FOR THE NEW INTERNATIONAL AIRPORT FOR KUALA LUMPUR IS ELUCIDATED. DESCRIBED ARE THREE IMPORTANT ASPECTS OF THE CONSTRUCTION, NAMELY THE EARTHWORKS AND COMPACTION, CONSTRUCTION OF THE STABILIZED SOIL WORKING BASES AND EVALUATION OF THE STRENGTH OF THE COMPLETED PAVEMENTS.

Skepper, HG Rook, H Ting, WH *Inst Civil Engineers Proc London /UK/*

2A 231048

THE VENEMO ASPHALT-FACED ROCK-FILL DAM
THE PAPER DESCRIBES THE DESIGN AND CONSTRUCTION OF THE VENEMO DAM, A DAM WITH AN IMPERVIOUS FRONTAL FACING OF ASPHALTIC CONCRETE AND A FILL CONSISTING OF TUNNEL SPOIL. COMPACTION FIELD TESTS ON TUNNEL SPOIL WERE CARRIED OUT AND THE COMPRESSION OF THE ROCK FILL WAS MEASURED BY MEANS OF CROSS ARMS INSTALLED IN THE FILL. A DESCRIPTION OF THE CONSTRUCTION OF THE DAM AND OF THE ASPHALTING IS GIVEN TOGETHER WITH THE RESULTS OF QUALITY CONTROL. THE PERFORMANCE OF THE DAM AFTER ONE YEAR IN SERVICE IS CHECKED BY MEASUREMENTS OF THE SEEPAGE THROUGH THE DAM AS WELL AS OF THE COMPRESSION OF THE FILL. /AUTHOR/

Kjernsli, B Torblaa, I *Norwegian Geotechnical Institute Publ*

2A 231051

MICHIGANS EXPERIENCE WITH NUCLEAR GAGES FOR MEASURING SOIL COMPACTION
MICHIGANS RESEARCH IN NUCLEAR METHODS FOR HIGHWAY FOUNDATION COMPACTION CONTROL IS DESCRIBED FROM ITS INCEPTION IN 1952 THROUGH A MAJOR FIELD EXPERIMENT IN 1955-66 DURING FREEWAY CONSTRUCTION. THE EQUIPMENT USED IS DISCUSSED AS WELL AS GAGE CALIBRATION PROCEDURES, TRAINING OF INSPECTION PERSONNEL, FIELD TESTING PROCEDURES, AND SAFETY PRECAUTIONS. THE NUCLEAR METHOD HAS PROVED SUITABLE FOR FIELD USE, IN WHICH IT SAVES TIME AND REDUCES OPERATOR FATIGUE. SPECIAL STUDIES, IN ADDITION TO DEVELOPMENT OF THE MICHIGAN COMBINATION DENSITY-MOISTURE GAGE, ARE OUTLINED, INCLUDING EVALUATION OF OTHER EQUIPMENT AND USE OF STATISTICAL CONTROL METHODS. /AUTHOR/

Mainfort, RC
Michigan Dept State Highways

2A 231060

A THREE DIMENSIONAL PRESSURE CELL
THE DESIGN AND CONSTRUCTION OF A PRESSURE CELL WHICH WILL ENABLE THE DIRECT STRESSES IN THREE PERPENDICULAR DIRECTIONS TO BE MEASURED AT ANY POINT WITHIN THE SOIL MASS IS DESCRIBED. IF THE STRESSES IN THREE PERPENDICULAR DIRECTIONS ARE MEASURED, THEN THE RESULTS CAN BE USED TO PROVE THE ACCURACY OF THE BOUSSINESQ EXPRESSIONS. POISSONS RATIO FOR THE SOIL MASS CAN ALSO BE DETERMINED. THE RESULTS OBTAINED FROM WITHIN THE SOIL MASS CAN ALSO GIVE IMMEDIATE VALUES FOR THE COEFFICIENT OF EARTH PRESSURE WHEN THE SOIL IS IN THE AT REST STATE. THE CELL DESCRIBED IS ROBUST AND EXTREMELY SENSITIVE. THE COST OF THE CELL IS RELATIVELY SMALL AND CELLS CAN BE READILY MANUFACTURED IN THE LABORATORY. PROVIDED THAT THE CELLS ARE USED IN CIRCUMSTANCES WHERE THE DENSITIES ARE RELATIVELY HIGH AND PRESSURES RESTRICTED TO WITHIN THE ELASTIC RANGE THE CELLS GIVE GOOD, CONSISTENT RESULTS. /AUTHOR/

Mackey, RD *Civil Eng & Public Works Review /UK/*
ACKNOWLEDGMENT: Highway Res Abstracts Hwy Res Board

2A 231063

FACTORS INFLUENCING THE FIELD STABILITY OF SOIL-AGGREGATE MIXTURES
ADEQUATE STABILITY IS A MAJOR REQUIREMENT FOR SOIL-AGGREGATE MIXTURES TO BE SATISFACTORILY USED IN PAVEMENTS. PROPER MIXTURE DESIGN REQUIRES A KNOWLEDGE OF THE FACTORS THAT INFLUENCE STABILITY. FIELD STABILITIES OF GRAVEL AND CRUSHED OIL AGGREGATE MIXTURES WERE EVALUATED AT 147 VARIOUS TEST SITES. STATISTICAL TECHNIQUES WERE USED TO DETERMINE THOSE MIXTURE PROPERTIES WHICH INFLUENCE FIELD STABILITY AS MEASURED BY THE BURGGRAF SHEAR TEST. FIELD MOISTURE CONTENT AND FIELD DENSITY WERE THE MOST IMPORTANT FACTORS. FIELD DENSITY WAS SUBSTANTIALLY AFFECTED BY THE AMOUNT OF MATERIAL PASSING THE NO. 22 SIEVE AND PARTICLE INDEX. /AUTHOR/

Thompson, MR *Materials Research and Standards*

ACKNOWLEDGMENT: Highway Res Abstracts Hwy Res Board

2A 231066

A LABORATORY INVESTIGATION OF THE PHYSICAL AND CHEMICAL PROPERTIES OF SPENT OIL SHALE
TO DETERMINE THE SUITABILITY OF SPENT OIL SHALE FOR USE IN ROAD CONSTRUCTION, AN INVESTIGATION WAS MADE INTO THE VARIABILITY AND PHYSICAL AND CHEMICAL PROPERTIES OF THIS SHALE. LARGE SAMPLES WERE TAKEN ON A COLOUR AND TEXTURE BASIS FROM THE CENTRE OF A TYPICAL LARGE DEPOSIT NEAR THE PROPOSED ROUTE OF THE NEW TRUNK ROAD, AND SUBJECTED TO STANDARD TESTS. THE SHALES TESTED WERE SUITABLE FOR ROAD FILLS AND SUB-BASES BELOW THE ZONE OF FREEZING. ALTHOUGH CONSIDERABLE VARIATIONS WERE MEASURED IN THE PHYSICAL PROPERTIES, PARTICULARLY IN THE GRADING OF THE SHALES, THESE WOULD NOT AFFECT THEIR USE IN ROAD CONSTRUCTION. CONSIDERABLE VARIATIONS WERE MEASURED IN THE SPECIFIC GRAVITY OF THE SHALES. THESE COULD CAUSE DIFFICULTIES WHEN USING THE MAXIMUM AIR VOIDS CONCEPT IN COMPACTION. THE OPTIMUM MOISTURE CONTENTS FOR B.S. COMPACTION TESTS /STANDARD AND HEAVY/ WERE CONSIDERABLY ABOVE THE NATURAL MOISTURE CONTENT OF THREE OF THE FIVE SHALES TESTED. THE CALIFORNIA BEARING RATIO VALUE OF SAMPLES AT BOTH B.S. STANDARD AND B.S. HEAVY COMPACTION REMAINED SATISFACTORILY HIGH OVER A WIDE RANGE OF MOISTURE CONTENTS. THE ADDITION OF CEMENT WAS REQUIRED TO REDUCE TO ACCEPTABLE LIMITS THE VOLUME CHANGE UNDER FREEZING CONDITIONS.

Lake, JR Fraser, CK Burns, J *Roads & Road Construction, London /UK/*

ACKNOWLEDGMENT: Highway Res Abstracts Hwy Res Board

2A 231067

SOIL SWELLING TEST
STUDIES ON LATERITES FROM THE PORTUGUESE OVERSEAS PROVINCES WERE CARRIED OUT IN ORDER TO INVESTIGATE HOW FAR THE RECOMMENDED LIMITS CAN BE SAFELY EXCEEDED IN ORDER TO APPLY MATERIALS WHICH OTHERWISE SHOULD NOT BE ACCEPTED FOR ROAD CONSTRUCTION IN FACE OF THE STANDARDS. DUE TO THE REDUCED CHEMICAL ACTIVITY AND CONSEQUENTLY LOW EXPANSIBILITY WHICH ARE TYPICAL OF THE FINE FRACTIONS OF LATERITIC SOILS, IT WAS SOUGHT TO ASSOCIATE THE CONSISTENCY LIMITS TO A NEW SWELLING PARAMETER RELATED WITH THOSE PROPERTIES, WHICH WOULD MAKE IT POSSIBLE TO ASCERTAIN THE NATURE OF THE MATERIAL. A QUICK TEST BASED ON A METHOD FOLLOWED AT ESTACAO AGRONOMICA NACIONAL /NATIONAL AGRONOMIC STATION/ WAS CONDUCTED. STUDIES WERE SUBSEQUENTLY CARRIED OUT IN ORDER TO IMPROVE THIS METHOD WITHOUT IMPAIRING ITS CHARACTERISTICS OF QUICKNESS AND SIMPLICITY. THE STUDY INCLUDED A CRITICAL ANALYSIS OF THE FIRST

TENTATIVE STANDARD, THE DEVELOPMENT OF A NEW APPARATUS FOR THE SWELLING TEST, THE STANDARDIZATION OF COMPACTION METHOD AND STUDIES ON THE INFLUENCE OF THE INITIAL MOISTURE CONTENT OF THE SOIL, A METHOD FOR MEASURING THE EXPANSION BY MEANS OF DIAL GAGES AND THE STANDARDIZATION OF THE FORCE EXERTED BY THEM ON THE SAMPLE, AND THE DISPERSION OF THE RESULTS SUPPLIED BY THE METHOD IN ITS NEW FORM. A RELATION BETWEEN THE SWELLING VALUES DETERMINED BY THE FIRST AND THE SECOND TENTATIVE STANDARDS WAS ALSO ESTABLISHED.

De, CASTRO E
Nat Lab Civil Eng, Lisbon /Port/

ACKNOWLEDGMENT: Highway Res Abstracts Hwy Res Board

2A 231070

HIGHWAY RIDES ON RIVERBED GRAVEL

THE HENDRICKSON BROS. ARE BUILDING ROUTE 81 THROUGH MARATHON, NEW YORK. AMONG THE DIFFICULTIES ENCOUNTERED DURING CONSTRUCTION WAS THE RELATIVELY UNSTABLE NATURE OF THE NATURAL MATERIALS ON THE SITE. SPRING RAINS EARLIER IN THE YEAR REQUIRED ADDITIONAL WORK TO BE DONE IN AREAS FILLED LAST FALL. THE GRAVEL PITS NEAR THE SITE YIELDED A GRAVEL WITH TOO MUCH PLASTICITY, WHICH NECESSITATED DRAG-LINE WORKING THE RIVER BOTTOM. ONLY FROM THIS SOURCE COULD A SUPPLY OF GOOD GRAVEL BE OBTAINED. PROBLEMS WITH UNSTABLE SOIL OCCURRED PARTICULARLY AT THOSE POINTS WHERE A CUT AND FILL MEET. THE WATER ABSORPTIVE SOIL REQUIRED WORK TO BRING IT TO USEABLE CONDITION. AN EXTENSIVE NETWORK OF UNDERGROUND DRAINS HAD TO BE INSTALLED ALONG THE LAST HALF MILE AT THE NORTHERN END OF THE JOB BECAUSE THE LAND THERE WAS QUITE SWAMPY.

Constructioneer

2A 231075

CONSTRUCTION IN MUSKEG: A SUMMARY AND COMPILATION OF CURRENT PRACTICE

THE BASIC APPROACHES TO CONSTRUCTION IN MUSKEG AREAS ARE TO /1/ AVOID MUSKEG, /2/ REMOVE THE PEAT, OR /3/ DESIGN FOR AND UTILIZE THE MUSKEG. THE COMPLETE REMOVAL OF PEAT AND ITS REPLACEMENT BY GOOD FILL TO PROVIDE A SOLID FOUNDATION IS USUALLY EMPLOYED FOR ROADS CROSSING SHALLOW DEPOSITS OR MAIN HIGHWAYS CARRYING HEAVY TRAFFIC. CURRENT PRACTICE IN CANADA AND IN THE NORTHERN U. S. APPEARS TO FAVOR MECHANICAL EXCAVATION, ALTHOUGH DEEP PEAT DEPOSITS ARE TROUBLESOME. IN THIS CASE, GRAVITY DISPLACEMENT METHODS, WITH OR WITHOUT PARTIAL EXCAVATION, ARE OFTEN USED. EXPLOSIVES ARE USED LESS NOW THAN PRIOR TO WORLD WAR II, DUE TO THE UNPREDICTABLE RESULTS. THE USE OF HYDRAULIC STABILIZATION OR JETTING IS ALMOST CONFINED TO THE STATE OF MINNESOTA, ALTHOUGH THE METHOD HAS CONSIDERABLE POTENTIAL WHERE LARGE AMOUNTS OF GRANULAR FILL AND WATER ARE AVAILABLE. STABILITY, SETTLEMENT, AND FROST ACTION MUST BE CONSIDERED WHEN BUILDING ON PEAT. WITH FLOTATION METHODS THE BEARING CAPACITY IS UTILIZED AND CONTINUED SETTLEMENTS ARE ACCEPTED. THE SAND-DRAIN TECHNIQUE HAS BEEN APPLIED TO STABILIZE SOFT DEPOSITS BUT IT IS NOW QUESTIONABLE. PILE FOUNDATIONS ARE THE LEAST AFFECTED BY PEAT PROPERTIES. DRAINAGE OF A MUSKEG AREA IS USUALLY EXTREMELY DIFFICULT AND OFTEN IMPOSSIBLE. EXTRACTS OF SELECTED REFERENCES ON MUSKEG AND PEAT HAVE BEEN GROUPED IN THE APPENDIXES. /AUTHOR/

Pihlainen, JA *Crrrel Technical Reports, Army Dept /US/*

ACKNOWLEDGMENT: Highway Res Abstracts Hwy Res Board

2A 231078

CRITERIA FOR COMPACTED FILLS

THIS STUDY IS CONCERNED WITH THE PROBLEMS ENCOUNTERED WITH MAN-MADE FILLS UPON WHICH SINGLE-OR MULTI-FAMILY RESIDENTIAL STRUCTURES WILL BE ERECTED, AND THE EFFECTS OR SUCH FILLS ON STRUCTURE FOUNDATIONS, PAVEMENTS AND WALKS, UTILITIES, AND INDIVIDUAL SEWAGE DISPOSAL SYSTEMS. DIVERSE PROBLEMS ARE ASSOCIATED WITH MAN-MADE FILLS, PARTICULARLY WITH FILLS SUPPORTING LIGHT, SHALLOW FOUNDATION RESIDENTIAL STRUCTURES. IN THIS REPORT ARE PRESENTED MEANS OF RECONIZING PROBLEMS AT A SITE, PROCEDURES FOR IMPROVING THE SITE, AND MINIMUM CRITERIA BY WHICH THE SITE CAN BE EVALUATED FOR ACCEPTANCE. SUPPLEMENTARY INFORMATION IS PROVIDED IN SUPPORT OF THE RECOMMENDATIONS, I.E., SITE INVESTIGATION, ENGINEERING CONSIDERATIONS, FILL CONSTRUCTION, AND EXISTING FILLS. CONSIDERED UNDER SITE INVESTIGATION ARE PRELIMINARY SITE INVESTIGATION, SOIL INVESTIGATION, AND LABORATORY TESTING, UNDER ENGINEERING CONSIDERATIONS, SETTLEMENT SHRINKAGE AND EXPANSION, SLOPE STABILITY, BEARING CAPACITY, DRAINAGE AND EROSION CONTROL, AND SANITARY ENGINEERING ASPECTS, UNDER FILL CONSTRUCTION, SITE PREPARATION, DRAINAGE, FILL MATERIAL, FILL PLACEMENT, AND INSPECTION AND CONTROL, AND UNDER EXISTING FILLS. SITE INVESTIGATION AND ENGINEERING CONSIDERATIONS. /AUTHOR/

National Academy Sciences

ACKNOWLEDGMENT: Highway Res Abstracts Hwy Res Board

2A 231087

SOIL COMPACTION IN HIGHWAY CONSTRUCTION

SOIL COMPACTION HAS BEEN EXTENSIVELY STUDIED IN LABORATORIES, BUT WHEN ACTUALLY APPLIED IN THE FIELD, IT RESULTS IN A MAZE OF CONTRADICTION SPECIFICATIONS, DIFFERING EQUIPMENT AND GENERAL DISAGREEMENT ON EVERY STEP OF THE PROCESS. FIELD INVESTIGATIONS WERE CONDUCTED TO DETERMINE WHAT THE DESIRABLE PROPERTIES OF COMPACTED SOILS MIGHT BE, TO LEARN WHAT SPECIFICATIONS WILL PRODUCE THESE PROPERTIES, TO FIND OUT HOW TO MEASURE THE ACHIEVEMENT OF THE RESULTS, AND TO FIND THE MOST EFFECTIVE METHODS OF COMPACTION. THE TESTING IS DESCRIBED AND SOME OF THE RESULTS ARE REPORTED. PRELIMINARY RESULTS SUGGEST THAT THERE IS MORE VARIATION THAN IS ALLOWED AND THAT THE SPECIFICATIONS SHOULD BE REVISED TO ALLOW FOR IT.

Selig, ET *Frontier, Ill Inst Technol Res Inst*

ACKNOWLEDGMENT: Highway Res Abstracts Hwy Res Board

2A 231094

SOIL VIBRATION STUDY

IT HAS BEEN OBSERVED BY HIGHWAY ENGINEERS THAT CRACKS AND BUMPS FORM IN PAVEMENT ADJACENT TO HIGHWAY BRIDGES AND BOX CULVERTS. WHEN A CRACK FORMS, THE DAMAGE IS AGGRAVATED BY HIGHWAY TRAFFIC AND WEATHER TO A POINT WHERE THE PAVEMENT MUST BE REPAIRED. THE SCOPE OF THIS RESEARCH PROGRAM WAS TO DEVISE A METHOD OF EVALUATING PROBABLE BEHAVIOR OF SOILS ADJACENT TO BRIDGE ABUTMENTS. IN THIS INVESTIGATION DIFFERENT SOIL BLENDS HAVE BEEN SUBJECTED TO BOTH IMPACT AND VIBRATION TESTS. RESULTS FROM THESE TESTS SHOW SIMILAR TRENDS IN THE BEHAVIOR OF SOILS UNDER DYNAMIC LOADING. IT IS, THEREFORE, ASSUMED THAT THE RESULTS OF THESE TESTS CAN BE EXTENDED TO APPLY TO THE DESIGN AND CONSTRUCTION OF HIGHWAY SUBGRADES AND FILLS ADJACENT TO ABUTMENTS. THE MAGNITUDE OF THE VIBRATION AND IMPACT INDICES, DETERMINED FROM THESE TESTS, INDICATES THE SUSCEPTIBILITY OF THE SOILS TO VOLUME CHANGE UNDER DYNAMIC LOADS. /AUTHOR/

Nielson, FD
New Mexico State University

ACKNOWLEDGMENT: Highway Res Abstracts Hwy Res Board

2A 231113

CEMENT-TREATED BASES

THE USE OF CEMENT-TREATED MATERIALS FOR SUBBASES FOR CONCRETE PAVEMENTS IS DISCUSSED. A CROSS SECTION OF A TYPICAL INTERSTATE DESIGN BEING USED IN NEW MEXICO IS GIVEN. THE AASHTO TEST ROAD VERIFIED THE ADEQUACY OF THIN SUBBASES UNDER CONCRETE PAVEMENTS. UNFORTUNATELY, CEMENT TREATED SUBBASES WERE NOT INCLUDED IN THE TEST ROAD. THE LABORATORY TESTS SUBSTANTIATED BY FIELD TESTS THAT SHOW THE MANY ADVANTAGES OF CEMENT TREATMENT ARE DESCRIBED. IN ADDITION TO THE PHYSICAL CHARACTERISTICS NOTED, SHOULD BE ADDED ECONOMY, EASE OF CONSTRUCTION AND THE FINAL ANALYSIS OF ANY PAVEMENT-PERFORMANCE.

Smith, BC
New Mexico University

2A 231121

THE CONSTRUCTION OF EMBANKMENTS ON COMPRESSIBLE SOILS

AFTER EXPLAINING THE PROBLEM OF THE CONSTRUCTION OF EMBANKMENTS ON POOR QUALITY SOILS, THE AUTHORS GIVE AN ACCOUNT OF WORK UNDERTAKEN ON THIS SUBJECT IN THE PONTS ET CHAUSSEES LABORATORIES. THESE STUDIES, CARRIED OUT WITH A VIEW TO BOTH SHORT TERM AND MEDIUM TERM EFFICACY, WERE CONDUCTED IN SEVERAL STAGES. STARTING FROM MODEST OBSERVATIONS ON THE BEHAVIOUR OF SOME EMBANKMENTS ON SOFT SOILS /PEAT IN PARTICULAR/ SOME IDEAS WERE FORMED WHICH GUIDED SUBSEQUENT INVESTIGATIONS. THE CONCLUSION WAS GRADUALLY REACHED THAT ONLY SYSTEMATIC EXPERIMENTS ON EXPERIMENTAL EMBANKMENTS COULD PROVIDE REAL SOLUTIONS TO THE PROBLEMS POSED. SUCH EMBANKMENTS WERE BUILT ON THREE DIFFERENT SITES. AT THE SAME TIME, A STUDY GROUP WAS FORMED TO WIDEN THE SCOPE OF THE RESEARCH AND TO MAKE FULL USE OF THE RESULTS OBTAINED FROM THE EXPERIMENTAL EMBANKMENTS. THIS STUDY GROUP /CALLED GERSC/ HAS BEEN OPERATING SINCE JUNE 1965 AND CONSISTS OF SEVEN ENGINEERS FROM THE LABORATOIRE DES PONTS ET CHAUSSEES. THE SUBJECTS COVERED RELATE TO SOIL RECONNAISSANCE, LABORATORY STUDIES, METHODS OF CALCULATION /SETTLEMENT AND STABILITY/, MEASURING APPARATUS, METHODS OF CONSTRUCTION, ETC. THE FOLLOWING METHODS OF STUDY ARE ENVISAGED: /1/ A COMPLETE BIBLIOGRAPHY ON THE SUBJECT, AND /2/ THE EXPLOITATION OF MEASUREMENTS MADE ON THE THREE EXPERIMENTAL EMBANKMENTS AND ON OTHER EMBANKMENTS BUILT ON SOFT SOIL. THIS EXPLOITATION MAY LEAD TO CERTAIN LINES OF RESEARCH NECESSARY FOR THE INTERPRETATION OF THESE MEASUREMENTS.

Karst, H Bourges, F *Bull Liaison Labs Routiers /France/*

2A 231132

CONSIDERATION OF BAMBOO-REINFORCED SOIL-CEMENT AS MATERIAL FOR CONSTRUCTION WITH SPECIAL REFERENCE TO ITS USE FOR PAVEMENTS. 3 PARTS.

A THEORY WAS SUGGESTED FOR DESIGN OF BAMBOO-REINFORCED SOIL-CEMENT BEAMS BASED ON ULTIMATE LOAD THEORY AND BOND FAILURE. THIS WAS IN GOOD ACCORD WITH THE TEST RESULTS. WITH SUITABLE MODIFICATIONS, THIS THEORY COULD BE EXTENDED TO BEAMS OF DIFFERENT SUPPORT CONDITIONS AND SLAB. IT WAS FURTHER SHOWN THAT ELASTIC THEORY WAS NOT SUITABLE FOR THE DESIGN. TESTS RESULTS SHOWED THAT THE SAFE DESIGN LOAD MIGHT BE INCREASED BY ABOUT 4 TIMES FOR A BAMBOO-REINFORCED SOIL-CEMENT STRUCTURE OVER

THAT OBTAINED BY ELASTIC ANALYSIS. BAMBOO-REINFORCED SOIL-CEMENT BASE UNDER THIN CONCRETE PAVEMENT SURFACING WAS LIKELY TO EFFECT A SAYING IN THE ORDER OF 30 PERCENT OVER NORMAL PLAIN CEMENT CONCRETE PAVEMENT. LABORATORY TESTS ON A FULL SIZE SLAB DESIGNED FOR 9,000 LB WHEEL LOAD INDICATED THAT ULTIMATE LOAD-CARRYING CAPACITIES IN THIS TYPE OF CONSTRUCTION FOR BOTH CORNER AND EDGE LOADINGS WERE CONSIDERABLY HIGHER /65 PER CENT HIGHER IN THE CASE OF CORNER FAILURE AND 335 PER CENT HIGHER IN THE CASE OF EDGE FAILURE/ THAN THE DESIGN LOAD. THIS RESERVE STRENGTH WOULD ADEQUATELY CATER FOR ANY TEMPERATURE AND SUBGRADE RESTRAINT STRESSES OCCURRING IN THE PAVEMENT. /AUTHOR/

Mehra, SR Ghosh, RK Chadda, LR *Civil Eng & Public Works Review /UK/, Civil Eng & Public Works Review /UK/, Civil Eng & Public Works Review /UK/*

2A 231172

STATISTICAL CONTROL OF DRY DENSITY

THE PAPER PRESENTS A SIMPLIFIED STATISTICAL APPROACH FOR THE CONTROL OF DRY DENSITY IN ROAD CONSTRUCTION. IN THE PROPOSED SAMPLING SCHEME A METHOD IS OUTLINED WHEREBY ENGINEERING DECISIONS CAN BE TAKEN ON THE NUMBER OF SAMPLES TO BE TESTED TO SATISFY VARIOUS ENGINEERING REQUIREMENTS SUCH AS THE ERROR IN TEST RESULTS AND THE DESIRED LIMITS OF ACCURACY FOR A SPECIFIED PROBABILITY. DECISIONS BASED ON THE SAMPLING SCHEME ARE USED, ALSO, TO DEFINE THE REQUIREMENTS FOR THE DESIGN, SPECIFICATION AND CONTROL OF DRY DENSITY IN A ROAD LAYER. BY COMPARING THE AVERAGE DENSITY OBTAINED FROM THE SPECIFIED NUMBER OF OBSERVATIONS WITH THE SPECIFICATION DENSITY, A RELIABLE DECISION CAN BE TAKEN IMMEDIATELY ON THE ACCEPTANCE OR REJECTION OF THE COMPLETED LAYER. /AUTHOR/

Kuhn, SH Burton, RW *Csirr Research Reports /South Africa/*

2A 231173

SOLUBLE SALTS IN ROAD FOUNDATIONS

THE FORMATION OF BLISTERS IN THE SURFACING OF ROADS HAS RECEIVED INCREASING ATTENTION. THE OCCURRENCE OF THESE BLISTERS CAN BE DUE TO DIFFERENT INDEPENDENT CONDITIONS, BUT, SO FAR, ONLY THE DEVELOPMENT OF THOSE CAUSED BY SOLUBLE SALTS IS FAIRLY WELL UNDERSTOOD. THE SALTS DERIVED FROM THE NATURAL SOIL AND ROCK IN THE DRY AREAS OF THE COUNTRY AND FROM MINE WASTE IN THE HUMID AREAS (JOHANNESBURG), WERE INVESTIGATED. TWO CASE HISTORIES ARE DESCRIBED IN DETAIL. THE ROAD-BUILDING MATERIALS AS WELL AS THE SALT PRECIPITATES FROM THE BLISTERS WERE SAMPLED AND INVESTIGATED BY CHEMICAL ANALYSES, X-RAY DIFFRACTION AND PH DETERMINATIONS. IT WAS FOUND THAT SODIUM AND MAGNESIUM SULPHATES WERE AT THE ROOT OF THE TROUBLE IN THESE SOUTH AFRICAN CASES ALTHOUGH CHLORIDES ARE KNOWN TO HAVE CAUSED SIMILAR DIFFICULTIES IN AUSTRALIA. THERE ARE NO EFFECTIVE REMEDIAL MEASURES WHICH CAN BE RECOMMENDED AT PRESENT AND IT IS SUGGESTED THAT THE PH OF SUSPECT MATERIAL BE CHECKED AS THE FIRST STEP IN TESTING. IF THE PH IS LESS THAN 6, MORE DETAILED DETERMINATION OF THE SOLUBLE SALTS ARE REQUIRED. WHERE THE USE OF SALINE FOUNDATION MATERIAL CANNOT BE PREVENTED, OR WHERE THE NATURAL SOIL IS A PERMANENT SOURCE OF SALTS BECAUSE OF ITS SALINITY, THE ROAD SHOULD BE DESIGNED SO THAT THE SALTS REMAIN PERMANENTLY HYDRATED. /AUTHOR/

Weinert, HH Clauss, KA *Csirr Research Reports /South Africa/*

2A 231180

BITUMINOUS STABILIZATION OF SANDY SOILS

THE NATIVE MATERIALS IN THE DESERT REGIONS OF INDIA DO NOT LEND THEMSELVES TO ROAD BUILDING. IN ORDER

TO AVOID THE EXPENSE OF IMPORTING SUITABLE MATERIALS, THE CENTRAL ROAD RESEARCH INSTITUTE HAS UNDERTAKEN CONTINUING EXPERIMENTS OVER THE PAST NINE YEARS TO FIND WAYS OF STABILIZING THE SANDS FOUND IN THE DESERTS. THE FOLLOWING BROAD CONCLUSIONS CAN BE DRAWN: BITUMINIZED SAND, EITHER WITH OR WITHOUT KANKAR (A SOFT TYPE OF AGGREGATE IN A NODULAR FORM, CONTAINING A HIGH PERCENTAGE OF SILICA AND CALCIUM OXIDE), IS A SUITABLE BUILDING MATERIAL: BECAUSE OF THE ARID CLIMATE WET STABILITY IS NOT A PROBLEM, SAND-ASPHALT, IS SUITABLE THICKNESS, CAN BE USED AS A CUSHION TO PREVENT THE CRUSHING OF KANKAR BASES. FURTHER EXPERIMENTATION SHOULD BE CARRIED OUT IN ORDER TO ESTABLISH FIRMER SPECIFICATIONS FOR THE USE OF BITUMINIZED SANDS. /AUTHOR/

Mehra, SR Swaminathan, CG Mazumdar, BC *Indian Roads Congress Journal*

2A 231211

DESIGN AND CONSTRUCTION OF EMBANKMENTS ON EXPANSIVE CLAY FOUNDATIONS

BASIC PRINCIPLES GOVERNING THE DESIGN OF EMBANKMENTS ON EXPANSIVE-CLAY FOUNDATIONS ARE DISCUSSED, AND METHODS OF STABILITY ANALYSIS ARE OUTLINED INVOLVING TWO STEPS, NAMELY: (1) COMPUTATION OF SWELLING PRESSURES AND VOLUME CHANGE DUE TO SWELLING UNDER GIVEN CONFINING PRESSURES, ASSUMING NO LATERAL YIELD, (2) RECOURSE TO EFFECTIVE STRESS PARAMETERS, OR TO AN UNDRAINED STRENGTH-WATER CONTENT RELATIONSHIP CORRESPONDING TO THE VOID RATIO AT THE END OF THE SWELLING PROCESS. THE POSSIBILITY OF PROGRESSIVE FAILURE IN HIGHLY PLASTIC SOILS IS DISCUSSED WITH SPECIAL REFERENCE TO EXPANSIVE CLAYS. THE STABILITY OF EXISTING EMBANKMENTS IS REAPPRAISED IN THE LIGHT OF THE ABOVE PRINCIPLES, WITH SPECIFIC EXAMPLES. /AUTHOR/

Datye, KR Saldanha, EC Ranganatham, BV *Israel Soc Soil Mechanics & Fdn Eng*

2A 231238

PLANNING OF PROJECTS-EARTHWORKS-DENMARK

THE PROPOSED MOTORWAYS IN DENMARK CALL FOR COMPREHENSIVE SOIL SURVEYS FOR THE PAVEMENT DESIGN. IN PLANNING THESE SURVEYS, SYSTEMATIC USE IS BEING MADE OF EXISTING GEOLOGICAL AND GEOLOGICAL-GEOTECHNICAL EXPERIENCE. GEOLOGICAL MAPPING OF THE SUBSOIL WHICH HAS BEEN UNDERTAKEN IS DESCRIBED. ON THE STRENGTH OF THESE MAPS AND OF PERSONAL EXPERIENCE GEOLOGICAL REPORTS AND MAPS ARE WORKED OUT FOR THE AREAS AFFECTED BY PROPOSED MOTORWAY INSTALLATIONS. THE USE OF SUCH REPORTS AND MAPS HAS RESULTED IN A HIGHER DEGREE OF ACCURACY IN ESTIMATING THE QUANTITIES OF SWAMPY GROUND WHICH MUST BE EXCAVATED AND HAS PERMITTED DETAILED PLANNING OF THE REMAINING SOIL SURVEYS, WITH CONSEQUENT SAVINGS IN THE EXTENT OF SOIL SURVEY OPERATIONS. THE MARKED RISE IN THE STANDARD OF LIVING IN DENMARK HAS RESULTED IN AN ENORMOUS INCREASE IN THE RATE OF MOTORWAY CONSTRUCTION THROUGHOUT THE COUNTRY. THIS HAS GIVEN RISE TO PROBLEMS OF ADMINISTRATION AND CO-ORDINATION BETWEEN THE DIFFERENT AUTHORITIES. IN ORDER TO SOLVE THIS PROBLEM, THE PERT NETWORK PLANNING SYSTEM HAS BEEN INTRODUCED FOR THE PREPARATION OF THE PROJECT AND HAS ALSO BEEN TRIED OUT FOR THE EXECUTION OF SPECIFIC JOBS. THE RESULTS OF NETWORK PLANNING FOR A CERTAIN SECTION OF THE MOTORWAY ACROSS FUNEN (84 KM) ARE DISCUSSED. IN THE CASE OF A BRIDGE CONSTRUCTION JOB AND A ROAD SURFACING JOB, THE CONTRACTORS WERE REQUIRED TO MAKE USE OF NETWORK PLANNING, AND THE APPLICATION OF THE SYSTEM CAN BE RECOMMENDED ALSO FOR THIS PURPOSE. NETWORK PLANNING, TAKING THE PLACE OF CON-

VENTIONAL PLANNING METHODS, CAN BE RECOMMENDED FOR THE PLANNING METHODS AND EXECUTION OF MAJOR ROAD WORKS AND FACILITATE THE ADAPTION OF THE WORKS TO A GIVEN RATE OF CAPITAL EXPENDITURE.

Mertz, EL Christiansen, G *Perm Intl Assoc Road Congresses Proc*

2A 231239

PLANNING OF PROJECTS-EARTHWORKS-FRANCE

EXPERIENCE OF SOME 100 MILLION CUBIC METERS OF HIGHWAY AND HIGHWAY EARTHWORKS IN FRANCE INDICATE TWO FUNDAMENTAL FACTORS: (1) RELATIVE TO THE ESTABLISHMENT OF PROJECTS, CONTROL WILL BE HENCEFORTH EXERCISED BY AN ELECTRONIC COMPUTER ASSOCIATED WITH AUTOMATIC DESIGN, AND (2) THE PLANNING AND EXECUTION OF EARTHWORKS ARE CONTROLLED NOW BY A REGULATION OF THE STANDARD BOOK OF SPECIFICATIONS. STANDARDIZATION OF THE PROJECTS AND IMPROVEMENT OF THE QUALITY OF CONTRACTS ARE DISCUSSED. SOIL AND CUT CLASSIFICATIONS IN THE CATEGORIES RELATED TO USE OR NECESSARY EQUIPMENT ARE DESCRIBED. PROBLEMS ON THE COMPACTION OF FILLS, THE STABILITY OF SLOPES, TOLERANCES AND CONTROL ON THE WORKS ARE DISCUSSED. AN EXAMPLE IS GIVEN OF MOTORWAY EARTHWORKS IN DIFFICULT TERRAIN IN DEEP CUT. SELECTED FILL IS CONSIDERED AS A DESIRABLE ELEMENT IN THE UPPER PART OF EARTHWORKS SO AS TO FACILITATE THE CONSTRUCTION OF THE HIGHWAYS.

Thiebault, A *Perm Intl Assoc Road Congresses Proc*

2A 231246

MEXICAN EXPERIENCE IN GEOMETRIC DESIGN OF EARTHWORKS WITH ELECTRONIC PHOTOGRAMMETRIC PROCEDURE

THE INTRODUCTION OF THIS WORK BRIEFLY DESCRIBES HOW THE DESIGN OF ROADS BEGAN IN MEXICO, AND HOW THE DESIGNING METHODS HAVE DEVELOPED UNTIL AERIAL PHOTOGRAPHY AND PHOTOGRAMMETRIC PLANNING WERE ADOPTED AFTER HAVING BEEN PROVEN VERY HELPFUL AND ESSENTIAL IN EXPEDITING OUR RATE OF DESIGNING. THEY ARE NOT ADEQUATE TO CONFORM TO THE COUNTRY'S NEEDS CONSIDERING ITS UNINTERRUPTED ECONOMICAL GROWTH. KNOWLEDGE WAS OBTAINED IN 1962 OF THE PAPER ENTITLED 'A NEW APPROACH OF DESIGNING AND LOCATION OF HIGHWAYS USING THE ELECTRONIC PHOTOGRAMMETRIC PROCEDURE' SUBMITTED BY THE SWEDISH DELEGATION TO THE ROAD CONGRESSES HELD IN LONDON AND MADRID. THIS PAPER GREATLY INTERESTED THE OFFICIALS OF THE FEDERAL GOVERNMENT OF MEXICO, WHO DEVOTED THEMSELVES TO A STUDY OF IT, AIMING AT THE POSSIBILITY OF ITS INTRODUCTION IN THIS COUNTRY. THE SECOND CHAPTER DESCRIBES THE WAY IN WHICH THE WORKS WERE INITIATED AND PERFORMED, AND HOW THE FINAL DESIGNS ARE TRANSFERRED TO THE CONSTRUCTION DIRECTION RESPONSIBLE FOR THE CORRESPONDING WORK. THE THIRD CHAPTER TELLS ABOUT THE EXPERIENCE GAINED AND MENTIONS THE LOW EFFICIENCY OF THE GROUND CONTROL TEAMS AND THE POOR USE MADE OF THE PHOTOGRAMMETRIC EQUIPMENT, WHICH INSTEAD OF BEING USED FOR DESIGNING AS IT SHOULD HAVE BEEN, WAS BEING USED FOR MAKING PHOTOGRAMMETRIC MAPS. IN THIS SAME CHAPTER, IT IS SHOWN HOW THIS DEFECT WAS CORRECTED, AND THE WAY THE PHOTOGRAMMETRIC EQUIPMENT WAS USED EFFECTIVELY, CONTINUING TO PRODUCE THE MAPS WHICH ENABLED THE SIDE SURVEY TEAMS WORKING ACCORDING TO CONVENTIONAL PROCEDURE, TO ACHIEVE GREAT RESULTS. THE FOURTH CHAPTER EXPLAINS THE PLANS ENVISAGED FOR THE REORGANIZATION OF THE WORK OF THE DESIGNING SYSTEM BY ESTABLISHING TWO OFFICES, ONE TO DEAL WITH PRELIMINARY DESIGN, AND THE OTHER WITH FINAL DESIGN, INSTEAD OF HAVING ONE TO DEAL WITH ELECTRONIC PHOTOGRAMMETRIC DESIGN, AND THE OTHER WITH CONVENTIONAL DESIGN METHODS. THE WAY THE

AERIAL SERVICE DEPARTMENT OF THE MINISTRY OF PUBLIC WORKS HAS BEEN ORGANIZED IS ALSO SHOWN IN THIS CHAPTER. THIS DEPARTMENT, BESIDES BEING CONCERNED WITH THE SPECIFIC SERVICES IN RELATION TO AERIAL PHOTOGRAPHY OF ROUTES, ARRANGES FLIGHTS FOR OFFICIALS IN CHARGE OF SURVEYS AND WORKS UNDER CONSTRUCTION. FINALLY, THE RESULTS ACHIEVED IN THE CONSTRUCTION OF ROADS TO DESIGNS DEVELOPED BY THE ELECTRONIC PHOTOGRAMMETRIC PROCEDURE, WHICH SO FAR HAVE PROVEN VERY SATISFACTORY, ARE ALSO DESCRIBED. /AUTHOR/ SATISFACTORY ARE ALSO DESCRIBED. /AUTHOR/

Garcia, GC Aguilar, SS *Perm Intl Assoc Road Congresses Proc*

2A 231250

PLANNING OF PROJECTS-EARTHWORKS-RHODESIA

THE STABILITY OF EMBANKMENTS AND EARTH SLOPES IN RHODESIA IS PRIMARILY A MATTER OF PROPER DESIGN WITH DUE REGARD TO THE EXTERNAL FACTORS WHICH CAN INFLUENCE THE STRENGTH PARAMETERS OF SUCH STRUCTURES. RHODESIAN SOILS HAVE INHERENT STRENGTH AND ARE GENERALLY STABLE. A FIELD EXPERIMENT WAS CONDUCTED IN THE STABILIZATION OF GRANITIC SAND VELD WITH CEMENT AND BITUMEN EMULSION. THE EXPERIMENTAL BRIDGE APPROACH WAS CONSTRUCTED WITH LOW STABILIZER CONTENTS USING 2, 3 AND 4 PERCENT CEMENT AND 2 PERCENT BITUMEN ADDED AS 4 PERCENT EMULSION. THIS ROAD WAS CONSTRUCTED IN JANUARY, 1959 AND HAS SHOWN NO SIGNS OF DISTRESS OR CHANGE IN RIDING QUALITY. A FIELD EXPERIMENT WAS CONDUCTED TO DETERMINE THE COST OF, AND CONSTRUCTIONAL PROBLEMS INVOLVED, IN THE VARIOUS METHODS OF TREATING AN ACTIVE CLAY FORMATION. EXPERIMENTAL SECTIONS OF ROAD WERE CONSTRUCTED ON BLACK COTTON SOIL OF THE MONTMORILLONITE GROUPS FORMED BY THE CHEMICAL WEATHERING OF DOLERITE. THREE ALTERNATIVE DESIGN SECTIONS WERE BUILT, (TWO WITH LIME STABILIZATION AND ONE WITH A RIVER SAND LUBRICATING LAYER). VARIOUS CONSTRUCTION TECHNIQUES WERE TRIED AND THE COST OF EACH ASSESSED. SOME RECOMMENDATIONS WERE MADE AND A SYSTEM OF BENCHMARKS WAS ESTABLISHED TO OBSERVE THE PERFORMANCE OF THE VARIOUS SCHEMES IN THE FUTURE. INVESTIGATION INTO THE CAUSES OF THE DEFORMATION OF KARIBA AERODROME RUNWAY INDICATED THAT THE DEFORMATION IS THE RESULT OF MOISTURE CHANGES IN AN EXPANSIVE SUB-SOIL.

Holden, A Burgers, A *Perm Intl Assoc Road Congresses Proc No II-17, 1967*

2A 231264

SYMPOSIUM ON PUZZOLANAS, THEIR SURVEY, MANUFACTURE AND UTILIZATION, NEW DELHI, DECEMBER 1964, PROCEEDINGS

A THREE-DAY SYMPOSIUM WAS HELD WITH A VIEW OF PUBLICIZING THE WORK OF THE CENTRAL ROAD RESEARCH INSTITUTE ON PUZZOLANAS AND ENCOURAGING DISCUSSION OF WORK DONE BY OTHER COUNTRIES. THIRTY-SEVEN PAPERS WERE PRESENTED DURING THE SYMPOSIUM INCLUDING 11 FROM OTHER COUNTRIES, VIZ., GERMANY, AUSTRIA, RUMANIA, JAPAN, U.K., FRANCE AND ITALY, DETAILING THEIR EXPERIENCES. THE DISCUSSIONS WERE ORGANIZED UNDER FOUR SESSIONS AS FOLLOWS: (1) PUZZOLANA SURVEY AND FUNDAMENTAL RESEARCH, (2) MANUFACTURE OF PUZZOLANAS AND PUZZOLANIC PRODUCTS AND THEIR GENERAL PROPERTIES, AND (3) UTILIZATION OF PUZZOLANAS AND PUZZOLANIC PRODUCTS WITH SPECIAL REFERENCE TO BUILDINGS AND ROADS. /AUTHOR/

Central Road Research Inst of India 332 pp, 1967

2A 231272

NUCLEAR TESTING CORRELATED AND APPLIED TO COMPACTION CONTROL IN COLORADO

A DESCRIPTION IS GIVEN OF THE INVESTIGATION MADE BY THE COLORADO DEPARTMENT OF HIGHWAYS INTO THE FEASIBILITY AND PRACTICALITY OF USING COMMERCIALY AVAILABLE NUCLEAR DEVICES TO PERFORM MOISTURE AND DENSITY TESTS IN THE FIELD ON HIGHWAY CONSTRUCTION MATERIALS. THE CORRELATION FOUND BETWEEN NUCLEAR AND CONVENTIONAL METHODS IS PRESENTED ALONG WITH AN EXPLANATION OF THE EQUIPMENT AND ITS BASIC FUNCTIONS. ELECTRONIC RELIABILITY IS DISCUSSED AND DATA CONCERNING THE AMOUNT OF PERSONNEL IRRADIATION WHILE WORKING IN CLOSE CONTACT WITH EQUIPMENT CONTAINING ISOTOPES OF CESIUM AND RADIUM-BERYLLIUM ARE GIVEN. THE USE OF A NUCLEAR DEVICE TO CONTROL THE COMPACTION OF EMBANKMENT MATERIAL ON A LARGE PROJECT IN WESTERN COLORADO IS DESCRIBED AND ACCEPTANCE OF THIS NEW CONCEPT OF TESTING BY FIELD PERSONNEL IS RELATED. PRELIMINARY INFORMATION CONCERNING AN ATTEMPT TO CORRELATE THREE DIFFERENT NUCLEAR DEVICES WITH THE CONVENTIONAL METHOD OF DETERMINING THE DENSITY OF ASPHALTIC CONCRETE SURFACE COURSES IS ALSO PRESENTED. /AUTHOR/

Brown, WR *Highway Research Board Bulletin*

2A 231279

BRIDGE FOUNDATIONS IN PERMAFROST AREAS: GOLDSTREAM CREEK, FAIRBANKS, ALASKA

UNDER A JOINT RESEARCH PROJECT BETWEEN THE ALASKA DEPARTMENT OF HIGHWAYS AND THE U.S. ARMY COLD REGIONS RESEARCH AND ENGINEERING LABORATORY, CO-OPERATIVE FIELD OBSERVATIONS AND TESTS WERE CONDUCTED DURING AND FOLLOWING CONSTRUCTION OF THE GOLDSTREAM CREEK BRIDGE, FAIRBANKS, ALASKA. THIS REPORT PRESENTS SITE INVESTIGATIONS AND BRIDGE FOUNDATION DESIGN OF THE ALASKA DEPARTMENT OF HIGHWAYS, BRIDGE PILE INSTALLATION DATA, AND GROUND TEMPERATURE CONDITIONS FOR THE SIX-MONTH PERIOD FOLLOWING CONSTRUCTION. TWO TEST PILES AND THREE ANCHOR PILES WERE INSTALLED IN PROXIMITY TO THE SITE AND LOAD SETTLEMENT TEST WERE PERFORMED. OBSERVATIONS OF BRIDGE PERFORMANCE WILL BE CONTINUED FOR A THREE-YEAR PERIOD AFTER CONSTRUCTION. /AUTHOR/

Crory, FE *Crrrel Technical Reports, Army Dept /US/*

2A 231286

THE BEHAVIOR OF FOUNDATIONS DURING CONSTRUCTION THIS PAPER IS BASED ON AN EXTENSIVE STUDY OF FOUNDATIONS ON M.I.T. CAMPUS. MEASUREMENTS OF PORE PRESSURE AND MOVEMENT OF FOUNDATIONS ON THE CAMPUS ARE PRESENTED, SOME OF THE FUNDAMENTALS OF FOUNDATION BEHAVIOR DURING EXCAVATION ARE IDENTIFIED, AND PREDICTED AND MEASURED PERFORMANCES COMPARED. MOST OF THE HEAVE WAS CAUSED BY STRAINS IN THE OVERCONSOLIDATED SOIL IMMEDIATELY BELOW THE SURFACE OF THE EXCAVATION. MOST OF THE HEAVE WAS TIME-DEPENDENT, I.E., CONSOLIDATION HEAVE. COMPRESSIVE HORIZONTAL STRAINS OCCURRED IN THE FOUNDATION SOIL DURING BOTH THE INITIAL HEAVE AND THE CONSOLIDATION HEAVE. THEORETICAL PREDICTIONS OF PERFORMANCE RESULTED IN: (1) AN UNDERPREDICTION OF INITIAL HEAD DROP, (2) AN UNDERPREDICTION OF CONSOLIDATION RATE, (3) A CLOSE PREDICTION OF TOTAL HEAD AT THE END OF THE EXCAVATION PERIOD, AND (4) AN OVERPREDICTION IN BOTH INITIAL HEAVE AND CONSOLIDATION HEAVE. /ASCE/

Lambe, TW *Am Soc Civil Engr J Soil Mech Div*

2A 231287

GROUND FREEZING IN CONSTRUCTION

ARTIFICIAL GROUND FREEZING IS A VALUABLE AID, AND AT TIMES MAY BE THE ONLY MEANS POSSIBLE, FOR EXCAVATION. THE SOIL BECOMES STABILIZED TO GIVE SHEAR STRENGTH FOR A RETAINING STRUCTURE AND A WATER STOP. DESIGN INCLUDES STRENGTH AND DEFORMATION OF A VISCOELASTIC MATERIAL IN A STRUCTURE, AND OF HEAT FLOW IN A MATERIAL IN WHICH WATER CHANGES TO ICE CAUSING RADICAL CHANGES IN THERMAL PARAMETERS. EXAMPLES SHOW HOW THE RHEOLOGICAL PARAMETERS OF STRAIN, TEMPERATURE, STRESS AND TIME FOR TYPICAL SOILS ARE RELATED. TECHNIQUES AND DESIGN DATA ARE GIVEN FOR THE STRUCTURAL DESIGN OF A CYLINDRICAL COFFERDAM. THERMAL PARAMETERS AND TECHNIQUES, WITH ASSUMPTIONS AND CONSEQUENT EQUATIONS FOR DESIGN, ARE PROVIDED WITH EXAMPLES OF TWO TYPICAL SOILS, STRAIGHT AND CURVED WALLS, FOR COMPUTING TIME OF FREEZING, TEMPERATURES, ENERGY AND REFRIGERATION-LOAD FROM WHICH COST ESTIMATES MAY BE MADE FOR A PARTICULAR JOB. CONSTRUCTION PRACTICES ARE DISCUSSED, WITH SPECIAL ATTENTION TO THE HAZARDS OF THE GROUND FREEZING TECHNIQUE. /ASCE/

Sanger, FJ *Am Soc Civil Engr J Soil Mech Div*

2A 231306

CONSTRUCTION PROBLEMS EXPERIENCED WITH LOESS SOILS

THE PHYSICAL PROPERTIES AND STRUCTURAL MAKEUP OF LOESS SOILS ARE BRIEFLY DESCRIBED, PRINCIPALLY WITH REFERENCE TO THE MANNER IN WHICH THEY CONTRIBUTE TO THE BEHAVIOR OF LOESS IN VARIOUS TYPES OF CONSTRUCTION WORK. THE INTERNAL STRUCTURE, STRATIFICATION AND SLOPE FACE PROBLEMS ARE DISCUSSED. CONSTRUCTION PROBLEMS OF LOESS IN THE CENTRAL NEBRASKA PROJECT ARE DESCRIBED. THIS PROJECT REPRESENTED A FAIRLY LARGE-SCALE PROJECT AND DEMONSTRATED THAT LOESS SOIL COULD SAFELY BE USED IN CONSTRUCTION WORK AS AN EMBANKMENT MATERIAL OR IN SITU AS A FOUNDATION MATERIAL FOR EARTH DAM STRUCTURES OR HYDRAULIC STRUCTURES. THE POLICY OF COMPACTING THE SOIL IN ALL DAMS WET OF OPTIMUM IS BELIEVED TO BE THE PRINCIPAL REASON THAT ALL STRUCTURES SAFELY WITHSTOOD THE RATHER SEVERE DIFFERENTIAL SETTLEMENTS THAT OCCURRED. THE SATISFACTORY BEHAVIOR OF THE STEEP BACK SLOPES USED ALONG THE POWER CANAL TO DATE (APPROXIMATELY 30 YEARS) IS AMPLE EVIDENCE THAT STEEP SLOPES SHOULD BE USED IN LOESS SOILS.

Turnbull, WJ *Highway Research Record, Hwy Res Board*

2A 231314

LIME STABILIZATION IN PUNJAB

EXPERIENCE GAINED FROM THE LABORATORY AND FIELD WORK ON SOIL STABILIZATION WITH LIME FOR THE CONSTRUCTION OF DURABLE ROADS PARTICULARLY IN WATER LOGGED AREAS IS REPORTED. AS INDICATED AT THE END OF ANNEXURE II OF THIS REPORT, MORE THAN 2 MILLION SQUARE METERS = 500 KMS. OR 300 MILES OF 12 INCHES WIDE ROAD LENGTH HAS BEEN CONSTRUCTED DURING THE LAST 7 YEARS (SINCE 1960). THIS TECHNIQUE HAS BEEN USED THROUGHOUT THE STATE OF PUNJAB COMPRISING AN AREA OF ABOUT 475,000 SQUARE MILES (123,000 KM.) (NOW DIVIDED INTO STATES OF NEW PUNJAB, HARYANA AND A PART OF HIMACHAL PRADESH AND CHANDIGARH UNION TERRITORY) WITH VARYING SOIL CONDITIONS AND SUB-BASE THICKNESSES, AS WOULD BE SEEN FROM THE NAMES OF ROADS AND DIVISIONS GIVEN IN ANNEXURE III. ALMOST ALL TYPES OF SOILS AVAILABLE IN THE STATE RESPONDED FAVOURABLY TO THE LIME TREATMENT AND THE ROADS BUILT HAVE BEHAVED VERY SATISFACTORILY UNDER NORMAL AND HEAVY TRAFFIC SINCE THEIR CONSTRUCTION, IN

SPITE OF SEVERAL FLOODS AND HEAVY RAINS. COMMERCIAL QUALITY OF WHITE LIME WITH A PURITY OF 80% TO 90%, GENERALLY AVAILABLE IN THE STATE, WAS USED FOR THIS PURPOSE. /AUTHOR/

Uppal, IS

B&r Research Laboratory

2A 231322

ASPHALT MEMBRANES AND EXPANSIVE SOILS

EXPANSIVE SOIL PROBLEMS IN HIGHWAY CONSTRUCTION IN COLORADO ARE DESCRIBED. COLORADO HAS LARGE AREAS WHERE EXPANSIVE SOILS PREDOMINATE INCLUDING: (1) SECTIONS WHERE MANCOS SHALE AND PIERRE SHALE ARE PREVALENT, (2) A LARGE BAND OF CLAYS NAMED THE LARAMIE FORMATION, (3) A DENVER FORMATION, AND (4) CREEK VALLEYS CONTAINING COMPARATIVELY RECENT DEPOSITS OF PLASTIC, FINE-GRAIN MATERIALS. DISTRESS FROM SWELLING SOILS IS EVIDENT IN MANY COSTLY WAYS AND IS PARTICULARLY OBVIOUS IN PORTLAND CEMENT CONCRETE PAVING. RESEARCH FOR THE INTERSTATE 70 CONSTRUCTION PROJECT INDICATED THAT ASPHALT MEMBRANE IS ONE OF THE BETTER SOLUTIONS TO EXPANSION PROBLEMS IN MANCOS SHALE CUTS. INVESTIGATION HAS SHOWN THAT 2 1/2 YEARS AFTER PLACEMENT THE ASPHALT MEMBRANE ON THE PROJECT IS IN EXCELLENT CONDITION. IT IS STILL PLIABLE, UNIFORM IN CHARACTER, AND SHOWS NO SIGNS OF MOVEMENT OR CRACKING. TENTATIVE CONCLUSIONS INDICATE THAT SOME MECHANISM IS AT WORK WHICH CAUSES FREE WATER TO BE ACCUMULATED OR GENERATED IN THE GRANULAR MATERIALS UNDER ASPHALT PAVEMENTS, EVEN IN DESERT AREAS WHERE THERE IS NO WATER TABLE. AIR PERMEABLE GRANULAR SUBBASE AND BASES ARE APPARENTLY RESPONSIBLE FOR HYDROGENESIS. THIS SUGGESTS THAT DENSE-GRADED ASPHALT BASES MAY ACT AS VAPOR BARRIERS WHEN PLACED DIRECTLY ON THE SUBGRADE. IT HAS BEEN FOUND THAT WATER WAS NOT ACCUMULATED UNDER ASPHALT PAVEMENTS WHERE ASPHALT STABILIZED BASE WAS PLACED DIRECTLY ON THE SUBGRADE. SPECIFICATIONS FOR CATALYTICALLY-BLOWN ASPHALT ARE PRESENTED. THE PURPOSE OF THE MEMBRANE IS TO PREVENT INTRUSION OF MOISTURE INTO THE SUBGRADE AND TO KEEP THE EXPANSIVE CLAYS IN EQUILIBRIUM.

Merten, FK Brakey, BA *Asphalt Institute Information Series*

2A 231326

SUBGRADE MOISTURE CONDITIONS UNDER AN EXPERIMENTAL PAVEMENT

THIS PAPER DEALS WITH ONE PHASE OF A PROGRAM TO OBTAIN MOISTURE HISTORIES OF SUBGRADES AND SPECIFICALLY COVERS THE FIRST STEP OF THIS PHASE WHICH INVESTIGATES THE SUBGRADE CONDITION UNDER AN EXPERIMENTAL PAVEMENT OF PORTLAND-CEMENT CONCRETE. THIS STEP HAS TWO PURPOSES: (1) TO ATTEMPT TO EVALUATE THE EFFECTS OF DESIGN VARIABLES ON SUBGRADE MOISTURE HISTORIES AND (2) SUBSEQUENTLY TO AID IN THE EVALUATION OF THE DESIGN VARIATIONS AS THEY AFFECT THE PAVEMENT PERFORMANCE. THIS FIRST REPORT ENCOMPASSES ONLY THAT PART OF THE COMPLETE INVESTIGATION WHICH DEALS WITH THE RESULTS OBTAINED FROM THE MEASUREMENT OF SUBGRADE MOISTURE CONTENT BY MEANS OF ELECTRICAL RESISTANCE MOISTURE CELLS. THE EXPERIMENTAL PAVEMENT INCLUDES VARIABLES OF (1) COARSE AGGREGATE (LIMESTONE OR CHERT GRAVEL), (2) BASE TREATMENT (ROLLED STONE, DENSE DESIGN, OR SAND GRAVEL, OPEN DESIGN, OR NO BASE), AND (3) SUBGRADE TREATMENT (OILED EARTH TREATMENT OR PLAIN EARTH, NO TREATMENT). THESE VARIABLES WERE COMBINED INTO 12 COMPARABLE SECTIONS. THESE SECTIONS VARY FROM 0.2 MILE TO 0.6 MILE IN LENGTH WITH THE TOTAL EXPERIMENTAL PROJECT APPROXIMATELY 5 MILES LONG. THE MOISTURE CELLS, INSTALLATIONS, INSTRUMENTATIONS, AND

CALIBRATION PRECEDURES ARE DESCRIBED. CONSTRUCTION NOTES AND VALIDATING FIELD MOISTURE CHECKS ARE INCLUDED IN THE APPENDIXES ALONG WITH TOPOGRAPHY NOTES AND THE LOG OF THE SUBGRADE SOIL HORIZONS. DATA OBTAINED FROM 96 MOISTURE CELLS HAVE BEEN AVERAGED IN VARIOUS COMBINATIONS TO COMPARE THE EFFECT OF DIFFERENCES IN CELL LOCATION WITH RESPECT TO PAVEMENT COVER, SINCE THE COVER CHANGES THE DEGREE OF EXPOSURE TO THE POSSIBLE MEANS MOISTURE ENTRANCE FROM ABOVE. THESE DATA HAVE ALSO BEEN ARRANGED TO SHOW DIFFERENCES CAUSED BY THE VARIATIONS IN CONSTRUCTION FEATURES AND TO SHOW THE VARIATIONS IN MOISTURE CONTENT AMONG THE 12 COMPARABLE SECTIONS. THE EFFECTS OF THE OILED-EARTH SUBGRADE TREATMENT ARE OF ESPECIAL INTEREST, ALONG WITH THE COMMENTARY CONCERNING POSSIBLE UNDESIRABLE RESULTS OF POOR CONSTRUCTION OF THE OILED-EARTH TREATMENT. THE INFLUENCE OF DROUGHT ON SUBGRADE-MOISTURE CONDITIONS IS APPARENT, AND POSSIBLE REASONS FOR THE VARIATIONS IN THE EFFECTS OF THIS INFLUENCE ARE DISCUSSED. THIS REPORT IS IN THE NATURE OF A PROGRESS REPORT AND THEREFORE DOES NOT ATTEMPT TO PRESENT FINAL CONCLUSIONS. /AUTHOR/

Guinee, JW Thomas, CE *Highway Research Board Bulletin*

2A 231371

FOUNDATIONS OF BRIDGES AND OTHER STRUCTURES

THESE REFERENCES ON FOUNDATIONS OF BRIDGES AND OTHER STRUCTURES INCLUDE SELECTIONS ON APPLICATION OF ELASTICITY AND PLASTICITY THEORIES TO FOUNDATION PROBLEMS, SOIL MECHANICS AND FOUNDATION ENGINEERING, CEMENT GROUTING OF FOUNDATIONS, STRAIN GAGE OPERATIONS UNDER WATER, EARTH PRESSURE MEASUREMENTS, BEARING CAPACITY OF FOUNDATIONS, FOUNDATION VIBRATIONS, APPROXIMATIONS FOR BEAMS ON ELASTIC FOUNDATIONS, STRESSES UNDER A FOUNDATION, FOUNDATION MOVEMENTS, PILE FOUNDATIONS AND PILE STRUCTURES, EFFICIENCIES OF PILE GROUPS, BEARING CAPACITY OF PILES, PILE LOAD TESTS, PREDETERMINING PILE LENGTHS, PRESSURE DISTRIBUTION ALONG FRICTION PILES, SKIN FRICTION OF FOUNDATION PILE, PILE DRIVING BY ELECTROOSMOSIS AND BY VIBRATION STRESSES IN PILES DURING DRIVING, DRIVING CHARACTERISTICS OF PILES IN SOIL, EXPERIENCES WITH PRESTRESSED CONCRETE PILES, STEEL H-B PILES, SHEET STEEL PILES, TIMBER PILES, SOIL MODULUS FOR LATERALLY LOADED PILES, STABILITY OF FOUNDATION PILE AGAINST BUCKLING UNDER AXIAL LOAD, PILE HEAVE AND REDRIVING, FREEZING FACILITATES SHAFT SINKING, DEFLECTION AND STRENGTH OF ANCHORED BULKHEADS, SEALING A COFFERDAM, CAISSON FOUNDATIONS BELLED CAISSONS ANCHOR WALLS, BRIDGE PIERS BUILT IN CELLULAR COFFERDAMS, ENGINEERING SEISMOLOGY, LATERAL FORCES OF EARTHQUAKE AND WIND, SCOUR AT BRIDGES, SUBSOIL CORROSION OF STEEL, SOIL CONDITIONS AND SAMPLING, TESTS OF CYLINDRICAL SHELLS, SUBWAY CONSTRUCTION, SOIL COMPACTION BY VIBROFLOTATION AND BY EXPLOSIVES, BUILDING CODE REQUIREMENTS FOR EXCAVATIONS AND FOUNDATIONS, CONSTRUCTION OF CUT-OFF WALLS, UNDERWATER CONCRETING, AND SETTLEMENT OF STRUCTURES.

Highway Research Information Service

2A 231372

THE STRUCTURE OF CLAY AND ITS IMPORTANCE IN FOUNDATION ENGINEERING

THE TERMS STRESS, DEFORMATION AND RUPTURE AS APPLIED TO SOILS ARE DISCUSSED. THE SAME PRINCIPLES WHICH GOVERN THE DESIGN OF SUPERSTRUCTURES APPLY TO THE GROUND ON WHICH SUCH A STRUCTURE IS BUILT. THE STRENGTHS AND STRESS-STRAIN RELATIONSHIP OF CONSTRUCTION MATERIALS, AS WELL AS STRESS DISTRIBUTION IN INDIVIDUAL MEMBERS OF A PARTICULAR STRUC-

TURE MUST BE KNOWN; IT IS ALSO NECESSARY TO KNOW THE SAME FACTORS FOR THE SOIL UNDERNEATH TO DETERMINE THE SAFETY AGAINST RUPTURE AND SETTLEMENT OF THE STRUCTURE DUE TO COMPRESSION AND DEFORMATION OF THE SOIL. TEST METHODS ARE REVIEWED FOR DETERMINING COMPRESSIBILITY OF CLAY AND ITS MEASUREMENT. THE DIFFERENCE IN COMPRESSIBILITY BETWEEN UNDISTURBED AND REMOLDED CLAYS VARY CONSIDERABLY. CLAY BOND AND ELASTICITY ARE DESCRIBED FROM UNCONFINED AND CONFINED COMPRESSION TESTS. REMOLDING EFFECT IS DISCUSSED OF PILE- DRIVING ON THE STRUCTURE OF CLAY. RESEARCH IS REVIEWED, BUT LEADS TO THE CONCLUSION THAT A DEFINITE BEARING VALUE OF CLAY DOES NOT EXIST. EXCAVATION IS SHOWN TO BE THE ONLY RELIABLE METHOD FOR REDUCING SETTLEMENTS. OBSERVATION OF SETTLEMENT AND BUILDING CONSTRUCTIONS INDICATES THAT THE WHOLE PROBLEM OF BUILDING FOUNDATIONS ON CLAY BOILS DOWN TO 2 SIMPLE PRINCIPLES: (1) DO NOT DISTURB THE NATURAL STRUCTURE OF THE CLAY, AND (2) DECIDE ON A CERTAIN RATE SETTLEMENT WHICH SHOULD NOT BE EXCEEDED AND DETERMINE THAT PRESSURE WHICH WILL CAUSE THIS RATE OF SETTLEMENT. THE DIFFERENCE BETWEEN THE BUILDING LOAD AND THE ABOVE PRESSURE IS THE WEIGHT OF THE SOIL WHICH MUST BE REMOVED BEFORE ERECTING THE BUILDING.

Casagrande, A *Boston Society Civil Engineers Journal*

2A 231377

NEW YORK'S PIER 57 FOUNDED ON TWO 27,000-TON REINFORCED CONCRETE BOXES

UNIQUE PIER CONSTRUCTION IS BEING CONDUCTED IN NEW YORK. THE PIER PROPER WILL STAND ON TWO HUGE REINFORCED CONCRETE BOXES WHOSE LOAD WILL BE CARRIED LARGELY BY BUOYANCY. A THIRD BOX WILL SUPPORT THE BULKHEAD. SAND PILES DRIVEN INTO THE RIVER BOTTOM SERVE TO CONSOLIDATE THE SUBSOIL. PRESTRESSED CONCRETE STRINGERS WILL CARRY THE HEAVY LOADS IMPOSED ON THE MAIN PIER FLOOR BY SHIP CARGOES. BECAUSE OF LIMITED SPACE AT THE PIER SITE, THE BOXES ARE BEING BUILT 38 MILES UP THE HUDSON, AND WILL BE FLOATED DOWN TO THEIR FINAL DESTINATION. THE SHIPPING TERMINAL WILL PROVIDE A PIER WITH A TWO-STORY SHED 120 FT. WIDE HAVING 15-FT APRONS ON EACH SIDE. THE MAIN DECK CONSISTS OF PRECAST PRESTRESSED CONCRETE STRINGERS, SPANING ABOUT 20 FT., WITH A POURED CONCRETE TOPPING AND WEARING SURFACE. THE SECOND DECK AND ROOF ARE OF REINFORCED CONCRETE. THE COMPLETED PIER WILL REST ON VERTICAL SAND PILES AND SAND MAT. TO PRESERVE STABILITY OF SOIL AT SITE, OLD WOODEN PILES WERE LEFT IN PLACE, BUT WERE CUT OFF AT BELOW BOTTOM ELEVATION OF THE PIER. REINFORCED CONCRETE SLAB 4 IN. THICK SERVES AS BOTTOM FORM FOR TWO PIER BOXES. THE SLAB IS TREATED WITH RESINOUS CURING COMPOUND TO IMPROVE CURING AND PREVENT ADHESION TO CONCRETE BOXES. BUTT- WELDED REINFORCING BARS ARE USED AS CONCRETE REINFORCING.

Buckley, JM Verpillot, EA *Civil Engineering Asce*

2A 231391

USE OF SODIUM CHLORIDE IN ROAD STABILIZATION

THE EFFECTS OF SODIUM CHLORIDE ON SOIL MIXTURES FOR ROAD SURFACES ARRIVES FROM PROPERTIES IT IMPARTS TO PROPERLY PROPORTIONED SOIL MIXTURES THROUGH WATER RETENTION, CRYSTALLIZATION, INCREASE IN SURFACE TENSION AND PHYSICAL- CHEMICAL CHANGES IN THE CLAY COMPONENT. THE SODIUM CHLORIDE IN A STABILIZED MIXTURE ACTS TO CONSERVE ITS WATER CONTENT. CRYSTALLIZATION OF SODIUM CHLORIDE WITHIN THE PORES OF THE COMPACTED MASS AS EVAPORATION SLOWLY PROCEEDS CONTRIBUTES TO ITS STRENGTH AND STABILITY. THE FILLING OF THE VOID MINIMIZES THE CONTRACTION THUS REDUCING SHRINKAGE CRACKING. SODIUM CHLORIDE HAS

THE PROPERTY OF CHANGING THE ELECTRIC FIELDS AROUND THE COLLOIDAL CLAY PARTICLES TO PRODUCE FLOCCULATION SO THAT THE TREATED CLAY BECOMES MORE COHESIVE AND THE SOIL MIXTURES BECOME MORE DENSE UNDER TRAFFIC AND LESS PERMEABLE. IT IS BELIEVED THAT THE HIGH DENSITIES OF ROAD SURFACES TREATED WITH SODIUM CHLORIDE ARE NOT DUE ENTIRELY TO THE MOISTURE RETAINING PROPERTIES OF THE MIXTURE, BUT IN PART TO THE ELECTROLYTIC ACTION AND INCREASE OF SURFACE TENSION WHICH REDUCE THE THICKNESS OF MOISTURE FILMS, THUS CREATING GREATER COHESION. THE FOLLOWING EFFECTS OF SODIUM CHLORIDE ON STABILIZED ROAD MATERIALS ARE OBSERVED: (1) NO APPRECIABLE EFFECT IS OBSERVED ON THE PLASTICITY INDEX, BUT THE CLAY TAKES ON A STICKY TEXTURE COMPARABLE TO INCREASED PLASTICITY, (2) THE SHRINKAGE LIMIT OF CLAY IS INCREASED, (3) THE FIELD MOISTURE EQUIVALENT IS DECREASED AND THE SHRINKAGE LIMIT INCREASED THUS BRINGING THESE VALUES CLOSER TOGETHER, (4) MOISTURE CONTENT IS CONSERVED, (5) MOISTURE RETENTION PROPERTIES OF SODIUM CHLORIDE INCREASE AND MAINTAIN COMPACTION AND SURFACE TENSION IN STABILIZED MIXTURES, (6) WELL COMPACTED AND SEASONED MIXTURES OF SODIUM CHLORIDE TREATED STABILIZED ROAD MATERIALS RESIST THE FREE PASSAGE OF EXCESS MOISTURE EITHER UP OR DOWN IN THE STABILIZED MAT, AND (7) CRYSTALLIZATION OF THE SODIUM CHLORIDE SOLUTION FORMS A DENSE HARD MAT WITH THE STABILIZED MIXTURE. PREPARATION OF THE SUBGRADE IS DISCUSSED IN THE CONSTRUCTION OF A STABILIZED ROAD. THE CURING PERIOD IS EMPHASIZED AS BEING IMPORTANT IN THE DEVELOPMENT OF A WELL-STABILIZED SURFACE. MAINTENANCE PROCEDURES ARE DESCRIBED.

Looker, CD Spencer, WT Kushing, JW Allen, H *Highway Research Board Proceedings*

2A 231394

EMBANKMENTS AND EARTH SLOPES

THESE REFERENCES ON EMBANKMENTS AND EARTH SLOPES INCLUDE SELECTIONS ON TREATMENT OF SOFT FOUNDATIONS FOR HIGHWAY EMBANKMENTS, HYDRAULIC FILL SETTLEMENT, USE OF EXPLOSIVES FOR SETTling HIGHWAY FILLS, MUCK DISPLACEMENT, ELECTRO-OSMOTIC STABILIZATION OF SOILS, VERTICAL SAND DRAINS FOR STABILIZATION, CLASSIFICATION OF ORGANIC SOILS, EFFECT OF INTERNAL HYDROSTATIC PRESSURE ON SOIL SHEARING STRENGTH, EQUIPMENT FOR TESTING THE STABILITY AND STRENGTH OF SOIL SUBGRADE AND SOIL FOUNDATIONS, DESIGN OF ENGINEERING WORKS ON ORGANIC TERRAIN, AND SOME EFFECTS OF SOIL, WATER AND CLIMATE UPON CONSTRUCTION, LIFE AND MAINTENANCE OF HIGHWAYS.

Highway Research Information Service

2A 231417

STUDIES OF FILL CONSTRUCTION OVER MUD FLATS INCLUDING A DESCRIPTION OF EXPERIMENTAL CONSTRUCTION USING VERTICAL SAND DRAINS TO HASTEN STABILIZATION

STUDIES WERE CONDUCTED OF FILL CONSTRUCTION OVER MARSH LANDS IN CALIFORNIA TO DETERMINE: (1) METHOD OF CONSTRUCTING THE FILL WITH MINIMUM SLIPPAGE, (2) REQUIRED YARDAGE OF FILL MATERIAL, INCLUDING YARDAGE NECESSARY TO COMPENSATE FOR UNAVOIDABLE LATERAL DISPLACEMENT AND LOSS BETWEEN DREDGER CUT AND FILL, AND (3) PROBABLE RATE OF SUBSIDENCE AND TOTAL SETTLEMENT SUBSEQUENT TO INITIAL CONSTRUCTION DUE TO SLOW DEHYDRATION AND CONSOLIDATION OF THE MUD STRATA. THE DATA FROM DEEP BORINGS, STUDIES OF THE FOUNDATION PRESSURE, AND LABORATORY ANALYSES OF FOUNDATION MATERIAL, INCLUDING THE DETERMINATION OF UNIT WEIGHT, DENSITY, MOISTURE CONTENT, GRAIN SIZE, CONSOLIDATION, COHESIVE STRENGTH, AND ANGLE OF INTERNAL FRICTION, WERE USED IN THE FILL

DESIGN AND CONSTRUCTION TO DETERMINE THE PROBABLE SETTLEMENT AND EMBANKMENT QUANTITIES. A STANDPIPE TEST DEVELOPED BY THE AUTHOR, WAS USED TO CHECK THE ASSUMPTIONS AND THEORETICAL ANALYSES OF FOUNDATION PRESSURES. A HEAVY SIX-IN. DIAMETER CASING WAS DRIVEN THROUGH THE FILL INTO AN IMPERMEABLE CLAY MUD STRATUM, THUS PREVENTING WATER FROM FLOWING READILY UP ALONG THE OUTSIDE OF THE PIPE. THE CASING WAS CLEANED TO THE BOTTOM AND CONTINUOUS UNDISTURBED CORE SAMPLES OBTAINED FROM THE BOTTOM OF THE CASING TO ELEVATION. A TWO-IN. DIAMETER PERFORATED SAND FILLED PIPE WAS PLACED BETWEEN CERTAIN ELEVATIONS TO SERVE AS A FILLER, THUS ALLOWING THE WATER BELOW THE ELEVATION TO PASS UPWARDS THROUGH THE STANDPIPE. THE BOTTOM 2 FT. OF THE 6-IN. CASING WAS ALSO FILLED WITH SAND TO PREVENT MUD FROM ENTERING. THE TEST WAS FOUND SUFFICIENTLY SENSITIVE TO REFLECT THE INCREASED WEIGHT OF THE FILL DURING WET SEASON AND THE LOAD RESULTING FROM PLACEMENT OF SUBGRADE MATERIAL, BASE, AND PAVEMENT. THE HYDRODYNAMIC EXCESS PRESSURE AGREES CLOSELY WITH THE THEORETICAL ANALYSIS MADE PRIOR TO CONSTRUCTION. THE TEST PROMISES TO BE USEFUL FOR MEASURING THE RATE OF CORE SOLIDIFICATION AND THE HORIZONTAL COMPONENT IN HYDRAULIC-FILL DAMS. VERTICAL SAND DRAINS WERE INSTALLED IN THE MARSH FOR TESTING UNDER FIELD CONDITIONS. THREE TEST SECTIONS WERE USED TO MAKE BORINGS AND OBTAIN SOIL PROFILES AND THEORETICAL PRESSURE CONTOURS. SUBSTRATA DRAINAGE WAS FOUND NECESSARY TO RELIEVE HYDRODYNAMIC PRESSURE AND STABILIZE IMPERMEABLE SATURATED GROUND. THEORETICAL ADVANTAGES OF VERTICAL DRAINS IN CONNECTION WITH FILL CONSTRUCTION OVER DEEP MARSH LANDS HAVE BEEN CONFIRMED BY THE EXPERIMENTAL CONSTRUCTION DESCRIBED. IT IS POSSIBLE, WITH PROPER SPACING OF THE DRAINS, TO OBTAIN PRACTICALLY ALL OF THE SETTLEMENT DURING THE 6 MONTHS TO ONE YEAR'S TIME FOLLOWING CONSTRUCTION. WATER USUALLY TRAVELS THROUGH SOIL DEPOSITS MORE READILY HORIZONTALLY (WITH THE BEDDING) THAN VERTICALLY. THE DRAINS MAY ACCELERATE THE RATE OF SETTLEMENT BY PROVIDING AN OUTLET FOR HORIZONTAL MOVEMENT OF EXCESS MOISTURE. DRAINS, WITH A SPACING CONSISTENT WITH THE TYPE OF MATERIAL AND THE DESIRED RATE OF LOADING, READILY RELEASE THE EXCESS WATER, RELIEVE THE HYDRODYNAMIC PRESSURE, AND THUS PREVENT LATERAL DISPLACEMENT DURING FILL CONSTRUCTION.

Porter, OJ *Highway Research Board Proceedings*

2A 231424

THE SCIENCE OF SOIL STABILIZATION

THIS PAPER DEFINES THE SCIENCE OF SOIL STABILIZATION AND VIEWS SOIL SYSTEMS FROM MANY DIFFERENT ANGLES IN ORDER TO LAY THE PROPER FOUNDATION FOR AN UNDERSTANDING OF THE DIFFERENT SOILS ENCOUNTERED BY THE ENGINEER, OF THE DESIRABLE AND UNDESIRABLE PROPERTIES OF THESE SOILS, AND OF THE POSSIBLE SUPPLEMENTATION OF THESE PROPERTIES IN ORDER TO CHANGE THE SOILS INTO CONSTRUCTION MATERIALS. THIS INTRODUCTORY PAPER IS LIMITED TO THE POINTING OUT OF IMPORTANT FUNDAMENTALS AND ALSO TO THE PRESENTATION OF CERTAIN APPROACHES AND DATA THAT ARE NOT NORMALLY FOUND IN SOIL-STABILIZATION LITERATURE. /AUTHOR/

Winterkorn, HF *Highway Research Board Bulletin*

2A 231435

PRINCIPLES OF SOIL STABILIZATION IN ROAD CONSTRUCTION

CONTENTS: SOIL STABILIZATION AS AN ENGINEERING SCIENCE PHYSICAL AND PHYSICO-CHEMICAL SOIL CHARACTERISTICS AS BASIS OF SOIL STABILIZATION DESIGN METHODS

FOR FOUNDATIONS STABILIZATION OF GRANULAR AND COHESIVE SOILS PRINCIPLES AND PRACTICES OF SOIL STABILIZATION WITH BITUMEN, TAR, CEMENT AND OTHER MATERIALS LIME STABILIZATION-PRINCIPLES AND PRACTICAL EXECUTION MOISTURE CONTENT OF SOIL

Winterkorn, HF Aichhorn, W
Road Research Society /Austria/

2A 231439

CALCIUM CHLORIDE SURFACE-CONSOLIDATED ROADS

A DESCRIPTION IS PRESENTED OF THE CONSTRUCTION AND MAINTENANCE METHODS NECESSARY TO OBTAIN A SURFACE CONSOLIDATED ROAD. THE SURFACE STABILIZATION ROAD IS DENOTED BY MANY DIFFERENT TERMS INCLUDING PARTIAL STABILIZATION, SEMI-STABILIZATION, ACCELERATED TRAFFIC BOUND, MAINTENANCE WITH CALCIUM CHLORIDE, SURFACE COMPACTION, AND SURFACE CONSOLIDATION. NECESSARY CONSTRUCTION OPERATIONS ARE DESCRIBED WHEN ROADS LACK BINDER, AGGREGATE, MOISTURE, NEW ROADS, AND DRAINAGE AND CROWN. THE ADVANTAGES OF THIS TYPE OF SURFACE CONSOLIDATION ARE: (1) A VARIETY OF LOCAL SURFACING MATERIALS AVAILABLE IN MOST REGIONS CAN BE UTILIZED, (2) SPECIAL TECHNICAL KNOWLEDGE IS NOT REQUIRED IN THE SELECTION OF THESE MATERIALS, (3) THE COST IS LOW, AND (4) THIS ROAD TYPE FITS WELL INTO A STAGE CONSTRUCTION PROGRAM. /AUTHOR/

Elleman, JH Halbfass, FPG DISCUSSEUR Van, AUKEN WT DISCUSSEUR *Highway Research Board Proceedings*

2A 231451

GRANULAR STABILIZED BASE CONSTRUCTION OF ACCESS AND RELOCATION ROADS BY TENNESSEE VALLEY AUTHORITY

THE EXPERIENCE OF THE TENNESSEE VALLEY AUTHORITY IN THE CONSTRUCTION OF GRANULAR STABILIZED BASE COARSE IS OUTLINED. THE AUTHORITY HAS CONSTRUCTED APPROXIMATELY 128 MILES OF GRANULAR STABILIZED BASE COURSE, OF WHICH 47.5 MILES HAVE BEEN ACCESS ROADS AND 80.7 MILES RELOCATIONS. CALCIUM CHLORIDE HAS BEEN USED IN THE PROPORTION OF ONE LB. PER SQ. YD. PER 3-IN. COMPACTED LAYER. IT HAS BEEN FOUND EFFECTIVE IN INCREASING COMPACTED DENSITY, HOLDING MOISTURE AND INCREASING BONDS. THE MAINTENANCE COST ON THE COMPLETED SURFACE HAS BEEN EXTREMELY LOW AND HAS AVERAGED LESS THAN \$100 PER MILE PER YEAR. THE PERFORMANCE OF THE CRUSHED STONE STABILIZED BASE HAS BEEN CONSIDERABLY BETTER THAN THAT OF THE GRAVEL BASE. STABILIZED GRANULAR BASE COURSES WITH LIGHT BITUMINOUS SURFACES WERE USED TO PROVIDE ACCESS TO 11 DAMS. THE TRAFFIC ON THESE ACCESS ROADS HAS AVERAGED FROM 1,000 TO 1,500 VEHICLES PER DAY FOR PERIODS FROM 2 YEARS TO 5 YEARS. STABILIZED GRANULAR BASE AND LIGHT BITUMINOUS SURFACING HAVE ALSO BEEN USED BY THE AUTHORITY ON BOTH STATE AND COUNTY HIGHWAY RELOCATIONS ON ROADS CONSTRUCTED TO REPLACE EXISTING ROADS THAT WERE FLOODED BY THE VARIOUS RESERVOIRS. THICKNESSES ARE DISCUSSED OF THE STABILIZED BASES. COSTS OF THE STABILIZED BASE CONSTRUCTION ARE DESCRIBED.

Webster, FW Kellogg, FH *Highway Research Board Proceedings*

2A 231462

PROGRESS IN SOIL-CEMENT CONSTRUCTION

A SYMPOSIUM OF PAPERS FROM SIX HIGHWAY DEPARTMENTS (SOUTH CAROLINA, NORTH CAROLINA, MISSISSIPPI, OHIO, MARYLAND, AND OKLAHOMA) COVERS CONSTRUCTION PROCEDURES, SOIL SAMPLING, SOIL CLASSIFICATION, COMPACTION CONTROL, SUBGRADE CONTROL AND COSTS OF SOIL-CEMENT.

Highway Research Board Proceedings

2A 231469

SYMPOSIUM ON SOIL-CEMENT IN ROAD CONSTRUCTION
THE GENERAL PROPERTIES AND ADVANTAGES OF SOIL-CEMENT ARE DISCUSSED, INCLUDING A REVIEW OF EXPERIENCES IN THE UNITED STATES. INDIVIDUAL PAPERS BY ALBERTO LANNE, JUAN GARCIA BALADO, AND VICTOR CARRI ARE ABSTRACTED.

Portland Cement Institute /Argentina/

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231473

CEMENT-TREATED SUBBASES FOR CONCRETE PAVEMENTS
DETAILED INFORMATION ON CEMENT-TREATED SUBBASE FOR HIGHWAY AND AIRFIELD PAVEMENTS IS PRESENTED. INCLUDED ARE DATA ON DESIGN, CONSTRUCTION AND PERFORMANCE OF EXISTING PROJECTS, A LIST OF PROPOSED PROJECTS, A BRIEF SUMMARY OF RESEARCH IN PROGRESS OF THE PCA LABORATORY AND SUGGESTED RECOMMENDATIONS FOR USE OF CEMENT-TREATED SUBBASES ON FUTURE PROJECTS.

Portland Cement Assoc Soil Cement Serv 17 pp, Jan. 1958

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231478

LABORATORY INVESTIGATION OF SOIL-CEMENT MIXTURES FOR SUBGRADE TREATMENTS IN KANSAS

THE INVESTIGATIONS OF THE EFFECT OF CEMENT ON THE PHYSICAL TEST CONSTANTS OF A SOIL ARE DESCRIBED AND THE RESULTS OBTAINED DURING THE INVESTIGATION ARE PRESENTED. PHOTOS SHOWING THE EQUIPMENT USED DURING SOIL-CEMENT-STABILIZED ROAD CONSTRUCTION ARE GIVEN.

Catton, MD *Highway Research Board Proceedings*

2A 231487

FUNDAMENTALS OF SOIL STABILIZATION ON STREET AND ROAD CONSTRUCTION

SOME OF THE BASIC FACTORS INVOLVED IN SOIL-CEMENT STABILIZATION ARE DISCUSSED. THE FOLLOWING CONCLUSIONS WERE REACHED. (1) THE SUCCESS OF STABILIZING CLAY SOILS WITH PORTLAND CEMENT DEPENDS NOT ONLY ON THE PHYSICAL, BUT ALSO ON THE PHYSICO-CHEMICAL FACTORS. (2) CERTAIN EXCHANGE REACTIONS FAVOR STABILIZATION, WHILE OTHERS IMPEDE. (3) THE DIFFERENCE BETWEEN THE SHRINKAGE LIMIT OF A SOIL AND ITS OPTIMUM MOISTURE CONTENT FOR PROCTOR DENSITY INDICATES THE EASE OF SUCH STABILIZATION, BUT THE HIGHER THE SHRINKAGE LIMIT, THE EASIER THE STABILIZATION. (4) THE RESISTANCE OF A SOIL-CEMENT SYSTEM TO CYCLES OF WETTING AND DRYING DEPENDS ON WATER AFFINITY AND ACCESS TO INTERNAL SURFACE. (5) THE RESISTANCE OF A SOIL-CEMENT SYSTEM TO THE WEATHERING EFFECT OF FREEZE-THAW CYCLES DEPENDS ON THE PERMEABILITY OF THE SYSTEM AND, PARTICULARLY, ON ITS PORE SPACE, WHICH IS FILLED WITH FREE, NOT FIXED, WATER. (6) INCREASING DRY DENSITY AT CONSTANT MOISTURE CONTENT IMPROVES THE RESISTANCE OF SOIL-CEMENT SYSTEMS TO MECHANICAL AND WEATHERING FORCES. (7) ADDITIONAL MOISTURE AT CONSTANT DRY DENSITY HAS A GENERALLY FAVORABLE EFFECT. (8) THE PRESENCE OF APPRECIABLE QUANTITIES OF HUMUS IN THE SOIL IS UNDESIRABLE BECAUSE OF ITS DETRIMENTAL EFFECT ON THE QUALITY OF SOIL-CEMENT SYSTEMS. (9) THE QUALITY OF SOIL-CEMENT SYSTEMS IS DETERMINED BY STANDARD FREEZE-THAW AND WET-DRY TESTS DEVELOPED IN THE UNITED STATES, IN WHICH THE FREEZING CYCLE IS IMPORTANT EVEN IN REGIONS WHERE FREEZING OF SOIL DOES NOT OCCUR. THE FREEZING TEST SERVES HERE TO PUMP WATER INTO THE SYSTEM THROUGH THERMOOSMOSIS AND SIMILAR PROCESSES. COMPRESSIVE STRENGTH VALUES SERVE AS SECONDARY CRITERION OF QUALITY.

Winterkorn, HF Aichhorn, W
Austrian Soc Engr & Architects, Vienna 208 pp, 1960

2A 231498

SOIL STABILIZATION TESTS USED IN GREAT BRITAIN
REASONS FOR ADOPTING CRUSHING TEST, BOTH FOR DETERMINING THE SUITABILITY OF A SOIL FOR STABILIZATION WITH CEMENT AND FOR CHECKING THE QUALITY OF THE PROCESSED SOIL IN THE FIELD, ARE DISCUSSED AND ITS APPLICATION TO THE CONSTRUCTION OF TWO EXPERIMENTAL STABILIZED ROADS IS DESCRIBED.

Webb, SB *Intl Conf Soil Mech & Fdn Eng Proc*

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231502

CEMENT STABILIZED BASE IN HIGHWAY CONSTRUCTION
GENERAL INDICATIONS ARE GIVEN ON THE DESIGN OF SOIL-CEMENT BASES. IT IS SUGGESTED THAT IN INDIA LOWER COMPRESSIVE STRENGTH VALUES ARE PERMISSIBLE THAN IN GREAT BRITAIN OR THE UNITED STATES, BUT IT IS IMPORTANT THAT TESTS ON SAMPLES SHOULD BE CARRIED OUT UNDER CONDITIONS OF VAPOR PRESSURE, TEMPERATURE AND HUMIDITY SIMILAR TO THOSE EXISTING ON THE CONSTRUCTION SITE. THE USE OF A SPECIAL CEMENT CONTAINING FINELY DIVIDED LIME IS SUGGESTED FOR THE STABILIZATION OF BLACK COTTON SOILS.

Bhatia, HS *Indian Concrete Journal, Road Abstracts /UK/*

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231505

METHODS FOR DETERMINING THE MOST ECONOMICAL CEMENT CONTENT FOR CEMENT-TREATED SUBBASES AND SUBGRADE IN HIGHWAY CONSTRUCTION
THE ADVANTAGES OF CEMENT-TREATED SUBBASES AND THE METHODS CURRENTLY USED TO DETERMINE CEMENT REQUIREMENTS FOR CEMENT-TREATED SUBBASES AND SUBGRADES ARE DESCRIBED.

Turoff, LW *Southeast Assoc St Hwy Officials Proc* Sept. 1958, 106

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231523

ROAD CONSTRUCTION TEST TRACK BUILT
SECTIONS OF THE TEST TRACK INCLUDED GRAVEL STABILIZED WITH CEMENT, AND A SAND-CLAY MIXTURE STABILIZED WITH CEMENT.

Stanton, TE *California Highways & Public Works*

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231528

STUDIES OF SOIL-AGGREGATE BASE-COURSE MIXTURES--FOR ROAD CONSTRUCTION PURPOSES
THE RESULTS OF LABORATORY STUDIES ARE PRESENTED TO DETERMINE BY MEANS OF COMPRESSION AND CAPILLARY-WATER- ABSORPTION TESTS THE EFFECTS OF VARIABLE GRADATION, MOISTURE CONTENT AND ADMIXTURES UPON THE STRENGTH AND STABILITY OF SOIL-AGGREGATE BASE-COURSE MIXTURES. THE STRENGTH OF CEMENT-STABILIZED MIXTURES INCREASED AS THEIR DENSITY AND CEMENT CONTENT INCREASED. A COMBINATION OF PORTLAND CEMENT (1-4%) WITH 1% RCL ASPHALT IMPROVED BOTH THE STRENGTH AND RESISTANCE TO CAPILLARY WATER ABSORPTION.

Garneau, JB Beland, CE
Roads and Bridges

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231540

USE OF STABILIZED SOIL IN ENGINEERING CONSTRUCTION: SECT.2, RESISTANCE OF CEMENT-SOIL MIXTURE TO ACTION OF WATER, SECT. 3, COMPRESSIVE STRENGTH OF CEMENT-SOIL MIXTURES

THE EFFECT ON THE RESISTANCE OF COMPACTED SOIL MIXTURES TO WATER BY THE ADDITION OF PORTLAND CEMENT WAS STUDIED. THE CEMENT INCREASED THE RESISTANCE TO SOAKING, TO WETTING AND DRYING AND TO EROSION OF A WATER JET. COMPRESSIVE STRENGTHS WERE ALSO INCREASED SO AS TO COMPARE FAVORABLY WITH THAT OF LOCALLY BURNT BRICK FOR USE IN BUILDING CONSTRUCTION.

Mehra, SR Uppal, HL *Indian Roads Congress Journal*

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231544

USE OF STABILIZED SOIL IN ENGINEERING CONSTRUCTION
DATA ARE GIVEN ON THE THERMAL EXPANSION AND THERMAL CONDUCTIVITY PROPERTIES OF SOIL-CEMENT MIXTURES MADE OF FOUR SOIL TYPES. DATA ON THE EFFECT OF CEMENT CONTENT AND DENSITY ARE INCLUDED.

Mehra, SR Uppal, HL *Indian Roads Congress Journal*

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231545

ENGINEERING PROPERTIES OF SOILS--SOIL-CEMENT STABILIZATION

THE MAIN STUDIES UNDERTAKEN WERE: (1) QUANTITY OF CEMENT NEEDED FOR SOIL-CEMENT STABILIZATION, (2) INVESTIGATION OF THE SUITABLE SIZE-GRADING FOR EASILY COMPACTABLE (PLASTIC) SOIL-CEMENT MIX, AND (3) STRENGTH DEVELOPED BY THE DIFFERENT STABILIZERS. SHRINKAGE, PERMEABILITY, DURABILITY AND STRENGTH DATA ARE GIVEN. CHEAP SUBSTITUTES FOR CEMENT WERE INVESTIGATED, SUCH AS BRIQUETTES PREPARED WITH 5% CEMENT, 4% LIME WITH 3% MOLASSES, 4% CHALK WITH 2% RESIN AND 3% LIME WITH 6% SODIUM SILICATE, TESTED AFTER 3, 7, AND 28 DAYS. SOIL STABILIZED WITH 5% CEMENT MAY BE CONVENIENTLY USED FOR HYDRAULIC CONSTRUCTION.

Handa, CL Dhawan, CL Bahri, JC *Indian Concrete Journal*

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231552

SOIL-CEMENT INVESTIGATION IN ENGLAND--RECENT PROGRESS IN SOIL-CEMENT FOR ROAD CONSTRUCTION
THE ROAD RESEARCH LABORATORY (GREAT BRITAIN) IS INVESTIGATING THE PRACTICABILITY OF CONSTRUCTING SOIL-CEMENT ROADS OF A THICKNESS LESS THAN THAT OF GRANULAR BASE ROADS. EXPERIMENTS SHOWED THAT PAVEMENT INCORPORATING A SOIL-CEMENT LAYER USUALLY HAS FLEXURAL STRENGTH AT 7 DAYS OF 30-40 LB PER SQ IN.--NOT ENOUGH TO PREVENT CRACKING ALTHOUGH CRACKS WILL BE FINE AND WILL HAVE LITTLE EFFECT ON STABILIZED LAYER IF COMPRESSIVE STRENGTH DOES NOT EXCEED 250 LB PER SQ INCH. SOIL-CEMENT SHOULD BE COVERED WITH AN IMPERVIOUS SURFACE TO PREVENT SOFTENING BY WATER.

Surveyor and Municipal Engineer /UK/, Public Works

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231580

ON THE EXECUTION OF SOIL-CEMENT BASE CONSTRUCTION IN OSAKA CITY

THE PLATE BEARING VALUE, K, WAS MEASURED AFTER ONE AND SEVEN DAYS. THE CEMENT CONTENTS OF SAMPLES FROM THE TOP, MIDDLE, AND BOTTOM LAYERS WERE MEASURED AFTER EACH PASS OF THE MIXER AND VARIATIONS

ARE SHOWN OF CEMENT CONTENT AFTER EACH PASS OF THE ROTARY MIXER. CEMENT CONTENTS IN THE SOIL- CEMENT SAMPLES WERE MEASURED USING THE SPECIFIC GRAVITY OF THE SOIL-CEMENT SOLUTIONS RATHER THAN THE MORE DIFFICULT ASTM METHOD. THREE PASSES OF THE ROTARY MIXER WERE REQUIRED TO PRODUCE UNIFORM MIXTURES.

Mitsusi, S Kawamura, S Shiotani, K
Semento Gijutsu Nenpo /Japan/, Japan Cement Engineering Assoc

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231584
CONSTRUCTION OF ROAD PAVEMENTS FROM BLAST FURNACE SLAG

AN ILLUSTRATED ACCOUNT IS GIVEN OF AN EXPERIMENTAL ROAD CONSTRUCTION PROJECT IN HUNGARY WHERE BLAST-FURNACE SLAG WAS USED AS AGGREGATE FOR EACH COURSE OF THE PAVEMENT. THE SLAG BASE WAS STABILIZED WITH CEMENT, AND A BITUMINOUS WEARING SURFACE WITH SLAG AGGREGATE WAS PROVIDED.

Bakonyi, F *Melyepitestudományi Szemle /Hungary/, Road Abstracts /UK/*

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231588
DESIGN OF SOIL-CEMENT BASE COURSES FOR MODERN HIGHWAY CONSTRUCTION

COMPRESSIVE STRENGTH, WET-DRY AND FREEZE-THAW RESISTANCE, MODULUS OF RUPTURE AND LOAD-CARRYING CAPACITY DATA ARE GIVEN FOR SOIL-CEMENT MIXTURES MADE OF THREE DIFFERENT SOIL TYPES.

Hall, DJ
Utah State University

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231589
SOIL STABILIZATION; CEMENT-TREATED SOIL MIXTURES. FLEXIBLE-PAVEMENT DESIGN WITH CEMENT-TREATED BASES HIGHWAY ENGINEERING HANDBOOK
SECTION 21-7 TO 21-85 INCLUSIVE COVERS ALL PHASES OF CEMENT-TREATED SOIL MIXTURES INCLUDING TYPES AND PROPER TIES, SAMPLING, LABORATORY TESTING, CONSTRUCTION, FIELD CONTROL TESTING AND FIELD PERFORMANCE. SECTION 25-46 COVERS STRUCTURAL DESIGN OF CEMENT-TREATED BASES.

Johnson, AW
Mcgraw Hill Book Company

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231591
EFFECT OF WATER CONTENT ON THE COMPRESSIVE STRENGTH AND DENSITY OF VARIOUS AGGREGATE-CEMENT MIXES FOR HIGHWAY CEMENT-TREATED BASES

A STUDY WAS MADE TO DETERMINE THE EFFECT OF WATER AND CEMENT CONTENT ON THE COMPRESSIVE STRENGTH AND DENSITY OF LABORATORY TEST SPECIMENS OF CEMENT-TREATED BASES USED FOR HIGHWAY CONSTRUCTION IN THE STATE OF WASHINGTON. RESULTS SHOWED THAT THE COARSEST OF THREE GRADATIONS USED FOR THE TESTS PRODUCED DENSER MIXES AND REQUIRED THE LEAST AMOUNT OF WATER TO ACHIEVE THESE CONDITIONS. COMPACTION CONTROL BECAME MORE CRITICAL AT HIGHER CEMENT CONTENTS AND COMPRESSIVE STRENGTH FELL OFF MORE RAPIDLY ON THE WET SIDE OF OPTIMUM THAN ON THE DRY SIDE.

Maytin, IL
Washington State Institute Technology

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231596
ROAD AND RUNWAY CONSTRUCTION IN SOIL STABILIZED BY BITUMEN- CEMENT

A METHOD HAS BEEN DEVELOPED OF STABILIZING SOIL BY THE ADDITION OF CEMENT AND BITUMEN EMULSION. LABORATORY STUDIES SUGGEST THAT SOIL STABILIZED WITH CEMENT AND BITUMEN EMULSION WILL CONFORM MORE READILY TO INEQUALITIES IN THE SUBBASE THAN SOIL STABILIZED WITH CEMENT ALONE.

James, RL *Road Abstracts /UK/*
Contractors' Record

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231598
PECTOSOL-CEMENT PROCESS FOR SOIL STABILIZATION
THE PROCESS FOR MAKING ROADS CHEAPLY AND QUICKLY IN UNDEVELOPED TERRITORIES OVERSEAS, EVOLVED BY A.S.P. CHEMICAL CO., MAKES USE OF CERTAIN VEGETABLE MATERIALS NORMALLY WASTED, SUCH AS SISAL 'FLESH,' GROUNDNUT HUSKS AND PALM KERNEL HUSKS. LABORATORY TESTS GAVE SATISFACTORY RESULTS WITH MIXTURE OF 1-1/2 PARTS CEMENT TO 100 PARTS SOIL AND STABILIZER TOGETHER.

Engineering /UK/, Engineer, London /UK/, Engineering Index

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231599
SOIL STABILIZATION FOR MILITARY ROAD CONSTRUCTION: LABORATORY TESTS ON THE STABILIZATION OF A HEAVY CLAY WITH CEMENT
LABORATORY TESTS WERE CONDUCTED TO ASSESS THE POSSIBILITY OF STABILIZING A HEAVY CLAY WITH ORDINARY PORTLAND CEMENT WITH OR WITHOUT THE ADDITION OF LIME AND 'VINSOL' RESIN. THE TESTS CARRIED OUT COMPRISED IDENTIFICATION, COMPACTION, C.B. R. AND COMPRESSIVE STRENGTH TESTS. SUFFICIENTLY PROMISING RESULTS WERE OBTAINED WITH CEMENT STABILIZATION TO JUSTIFY FULL-SCALE TRIALS. ALTHOUGH THE LIMITATIONS OF FIELD PROCESSES HAVE NOT YET BEEN STUDIED, THE RESULTS SUGGEST THAT PROPORTIONS OF THE ORDER OF 20% OF CEMENT MIGHT PROVE SATISFACTORY IN PRACTICE. THE ADDITION OF SMALL PERCENTAGES OF LIME SHOWED MARKED IMPROVEMENT, BUT VINSOL-RESIN WAS LESS EFFECTIVE.

Military Eng Exp Establishment /UK/, Road Research Laboratory /UK/

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231601
USE OF STABILIZED SOIL IN ENGINEERING CONSTRUCTION. SECT. 4, SHRINKAGE OF COMPACTED SOILS

STUDIES WERE MADE OF THE EFFECT OF MOISTURE OF COMPACTION ON THE SHRINKAGE OF COMPACTED SOILS ON DRYING. THE SHRINKAGE INCREASED AS THE MOISTURE CONTENT OF COMPACTION INCREASED. THE EFFECT OF ADDING SMALL QUANTITIES OF CEMENT WAS ALSO STUDIED. RESULTS SHOWED THAT THE SHRINKAGE CAN BE PARTLY REDUCED BY ADDITION OF CEMENT. FURTHER STUDIES WERE MADE ON THE EFFECT OF ADDING PLASTER OF PARIS TO THE CEMENT-SOIL MIXTURES. A FURTHER DECREASE IN SHRINKAGE WAS OBTAINED UP TO A CERTAIN LIMIT OF PLASTER OF PARIS, BEYOND THIS LIMIT AN EXPANSION IN VOLUME OF THE CEMENT-SOIL MASS OCCURRED. THE AMOUNT OF EXPANSION VARIED WITH SOIL TYPE. WETTING AND DRYING TESTS, HOWEVER, SHOWED THAT THE PLASTER OF PARIS DECREASED THE WATER-RESISTING QUALITIES OF ALL THE CEMENT- SOIL MIXTURES EXCEPT THE MIXTURE MADE WITH THE LOAM SOIL.

Mehra, SR Uppal, HL *Indian Roads Congress Journal*

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231602

A SUMMARY REPORT ON SOIL STABILIZATION BY THE USE OF CHEMICAL ADMIXTURES

THE RESULTS OF LABORATORY AND FIELD INVESTIGATIONS OF THE SOIL STABILIZING PROPERTIES ON NUMEROUS CHEMICALS ARE PRESENTED WITH RESPECT TO THEIR APPLICABILITY FOR ROAD AND AIRPORT CONSTRUCTION. LABORATORY TESTING PROCEDURES ARE DESCRIBED WHICH WERE DEVELOPED FOR EVALUATING THE VARIOUS CHEMICAL SOIL TREATMENTS STUDIED. CEMENT PROVED TO BE THE MOST GENERALLY SATISFACTORY STABILIZING AGENT INVESTIGATED. THE EFFECTIVENESS OF A NUMBER OF ADMIXTURES WITH SOIL-CEMENT ARE ALSO GIVEN. THE ADMIXTURES INCLUDED WERE: (1) BENEFICIAL-AROCLOR 1271 AND 4065, MONTAR NO 3, PICCOLYTE 125, PICCOUMARON XX-100, GOODRITE RESIN 50, STYMER SOLUTION, CRD 108, CRD 133, CRD 155, RESIN 321, STABINOL, SANTO RESIN, STEROX LF87, CALCIUM STEARATE, MAGNESIUM STEARATE, SODIUM SILICATE, CHLOROSULFONIC ACID, (2) NO IMPORTANT EFFECT-AROCLOR 1171 AND 5060, TRANSPHALT 100, MODIFIED STYRENE 480, PLAST-O-TRETE, STEARIC ACID, POTASSIUM PERMANGANATE, COPPER SULFATE, POTASSIUM DICHROMATE, (3) DETRIMENTAL-AROCLOR 1168 AND 1170, CRD 119, VINSOL, NVX, UFORMITE 552, RESINOX 9672, RESINOX 9673 PLUS HEXA, RESINOX 9671 AND 9819 AND 482, AMBERLITE PLUS HARDENER, RESIMENE M75, ANILINE-FURFURAL, VALITE, ZINC STEARATE, SODIUM OLEATE, CALCIUM CHLORIDE.

Mainfort, RC

Civil Aeronautics Administration /US/, Roads & Engineering Construction

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231605

STABILIZING WEAK AND DEFECTIVE BASES WITH HYDRATED LIME

EXPERIENCES WITH LIME AND LIME-CEMENT STABILIZED ROADS WERE REPORTED UNDER VARIOUS DEGREES OF USAGE AND WEATHER CONDITIONS. SOIL CONSTANTS AND GRADATION WERE GIVEN OF TRIAL MIXES AFTER ADMIXING LIME INCLUDING THE EFFECT OF HYDRATED LIME ON PLASTICITY INDEX.

Fuller, MG Dabney, GW *Roads and Streets, Engineering Index*

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231609

SOIL STABILIZATION FOR HIGHWAYS

THE EFFECT OF POLYVINYL ALCOHOL AND VARIOUS DESPERSANTS ON THE BEHAVIOR OF SOIL-CEMENT MIXTURES WAS INVESTIGATED WITH A VIEW TO FINDING A LOW-COST RESIN OR PLASTIC WHICH WILL IMPROVE THE PROPERTIES OF SOIL-CEMENT MIXTURES.

Mass Inst Tech Dept Pub Wks Jt Hwy Res, Road Abstracts /UK/

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231616

CONSTRUCTION OF SOIL-CEMENT DRAINS

THE TYPE OF SOIL AND THE CEMENT CONTENT TO BE USED IN THE CONSTRUCTION OF SOIL-CEMENT DRAINS FOR RURAL AND SUBURBAN AREAS HAVE BEEN STUDIED BY SUBJECTING SOIL-CEMENT BLOCKS TO PROLONGED ACTION OF ACIDS AND ALKALIS. RESULTS SHOWED THAT 5% OR MORE OF CEMENT GAVE HIGH RESISTANCE TO THE ACTION OF ACIDS AND ALKALIS (SANDY SOILS BEING MORE RESISTANT THAN SILTY SOILS), AND OF SODIUM CHLORIDE AND SODIUM SULFATE SOLUTIONS. AN EXPERIMENTAL DRAIN CONSTRUCTED WITH PRECAST SOIL-CEMENT BLOCKS IN 1952 WAS STILL GIVING EXCELLENT PERFORMANCE AFTER 2-1/2 YEARS.

Mehra, SR Chadda, LR *Indian Concrete Journal, Road Abstracts /UK/*

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231622

SOIL STABILIZATION WITH CEMENT

THE USE OF SOIL-CEMENT FOR ROADS IS DESCRIBED WITH PARTICULAR ATTENTION TO WORK CARRIED OUT AT THE ROAD RESEARCH LABORATORY, HARMONDSWORTH. ITS APPLICATION TO FRENCH CONDITIONS IS DISCUSSED. IT IS THOUGHT THAT THE USE OF FLY ASH WITH THE CEMENT MIGHT CONSIDERABLY REDUCE STABILIZATION COSTS IN FRANCE. OWING TO THE HIGH COST OF CEMENT, THE USE OF SMALL QUANTITIES OF CEMENT FOR IMPROVING SOIL STRENGTH MAY BE PREFERABLE TO THE LARGER QUANTITIES REQUIRED FOR SOIL-CEMENT. AN APPENDIX DESCRIBES TESTS ON THE USE OF CEMENT FOR STABILIZING CHALK. RESULTS INDICATED THAT ALTHOUGH AN ADDITION OF 250/315 PORTLAND CEMENT GAVE RESULTS SUITABLE FOR ENGLISH CONDITIONS, A HIGHER PERCENTAGE OF CEMENT WOULD BE REQUIRED FOR FRANCE.

Peltier, R *Road Abstracts /UK/*
Routes, Paris /France/

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231637

INFLUENCE OF ADDITIONS OF LIME AND CEMENT ON ROAD-BUILDING PROPERTIES OF CLAY SOILS

AN ADDITION OF 4% OF SLAKED LIME RENDERED THE SOIL LESS PERMEABLE, INCREASED ITS BEARING POWER AND PREVENTED DRYING-SHRINKAGE. CEMENTS WERE NOT EFFECTIVE.

Volkov, MI Kusliik, BR *Chemical Abstracts*
Journal Karkhov Highway Inst

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231638

EXPERIMENTS ON STABILIZED GRAVEL-CLAY SURFACES (IN FRENCH)

RESULTS ARE GIVEN OF LABORATORY AND FIELD STUDIES OF STABILIZED GRAVEL-CLAY ROADS, DEMONSTRATING THEIR EFFICIENT PERFORMANCE AND LOW COST. TESTS ARE CONDUCTED USING PORTLAND CEMENT, CALCIUM CHLORIDE AND BITUMEN.

Mayer, A *Ann Inst Tech Batiment Trav Publ /Fr/*

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231642

MODIFICATION OF A GUMBOTIL SOIL BY LIME AND PORTLAND CEMENT ADMIXTURES

THE RESULTS ARE REPORTED OF A LABORATORY STUDY ON THE EFFECT OF VARIOUS PERCENTAGES OF LIME AND PORTLAND CEMENT UPON THE ENGINEERING PROPERTIES OF A HEAVY, STICKY, GUMBO SOIL WHICH IS RATHER FREQUENTLY ENCOUNTERED IN HIGHWAY CONSTRUCTION IN SOUTHWEST IOWA. VARIOUS PERCENTAGES OF UNSLAKED LIME AND PORTLAND CEMENT WERE ADDED TO THE SOIL IN THE DRY STATE AND THE INFLUENCE OF THESE ADMIXTURES WAS OBSERVED BY COMPARING THE RESULTS OF CERTAIN TESTS OF THE MIXTURES WITH THE TEST RESULTS ON THE UNTREATED SOIL. THE PROPERTIES CHOSEN FOR THESE COMPARISONS WERE THE LIQUID LIMIT, PLASTIC LIMIT, PLASTICITY INDEX, SHRINKAGE LIMIT, SHRINKAGE RATIO, LINEAR SHRINKAGE, VOLUMETRIC CHANGE, STANDARD AASHO DENSITY, OPTIMUM MOISTURE CONTENT, AND THE CBR WITH SOIL MOLDED TO STANDARD AASHO DENSITY.

Spangler, MG Patel, OH *Highway Research Board Proceedings*

2A 231649

MODIFYING TENNESSEE CHERTS WITH PORTLAND CEMENT STUDIES AND PRACTICES IN THE STABILIZATION OF CHERTS ARE COVERED. A NUMBER OF TESTS WERE EMPLOYED TO DETERMINE THE EFFICIENCY OF VARIOUS ADMIXTURES WHEN COMBINED WITH POOR SOILS. THE PERCENTAGES OF ADMIXTURES INVOLVED WERE USUALLY 1, 2, AND 4% ON THE BASIS OF WEIGHT FOR THE PORTLAND CEMENT, HYDRATED LIME, LIME-FLYASH, CALCIUM ACRYLATE, AND CALCIUM CHLORIDE, AND 1/2, 1 AND 2% (RESIDUE BASIS) FOR THE CUT-BACK ASPHALT, EMULSIFIED ASPHALT AND ROAD TAR. RESULTS OF THESE TESTS ARE SUMMARIZED FOR TWO CHERT SAMPLES.

Whitehurst, EA *American Road Builders Assoc Tech Bull*

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231651

AN INVESTIGATION TO DETERMINE THE ECONOMY AND PRACTICABILITY OF USING VARIOUS TYPE SOILS TREATED WITH PORTLAND CEMENT OR OTHER ADMIXTURES FOR HIGHWAY CONSTRUCTION

RESULTS OF COMPRESSIVE STRENGTHS OF VARIOUS SOILS UNTREATED AND TREATED WITH THE ADDITION OF PORTLAND CEMENT AND OTHER STABILIZED MATERIALS ARE GIVEN. THE DEVELOPMENT OF TEST PROCEDURES SUITABLE FOR EVALUATING COMPRESSIVE STRENGTHS IS ALSO DESCRIBED.

Mcgee, JD Paquette, RJ
Georgia Inst Technol Eng Exper Station

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231657

ROAD SOIL BASE BOUND WITH CEMENT

THE CONSTRUCTION IN KANSAS IN 1936 OF A 12-IN. SOIL-CEMENT BASE FOR CONCRETE PAVEMENT IS DESCRIBED. THE BASE WAS BUILT IN TWO 6-IN. LIFTS USING FARM EQUIPMENT. THE NEED FOR THE DEVELOPMENT OF HEAVY-DUTY ROAD EQUIPMENT FOR THIS TYPE OF WORK IS INDICATED.

Allen, H *Engineering News-record*

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231658

CONSTRUCTION OF EXPERIMENTAL STABILIZED SOIL-CEMENT HIGHWAY

A DETAILED DISCUSSION IS PRESENTED OF EQUIPMENT AND PROCEDURE IN CONSTRUCTING FIRST STABILIZED SOIL-CEMENT HIGHWAY IN ILLINOIS IN WINNEBAGO COUNTY, SEPTEMBER 1936.

Erickson, RO *Illinois Univ Eng Exp Sta Circulars, Engineering Index*

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231662

STRICTLY HANDMADE, SOIL-CEMENT ROADBUILDING, SIAN-LANCHOW HIGHWAY (CHINA)

AN ACCOUNT IS GIVEN OF CEMENT STABILIZATION OF 18.65 MILES OF THE OLD SIAN-LANCHOW HIGHWAY BUILT ENTIRELY BY HAND LABOR. THE ENTIRE PAVING PROJECT WILL BE 472 MILES CONSISTING OF TWO 10-FT LANES AND A 6-IN ROADBED.

Chen, F *Engineering News-record*

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231664

EARTH ROADS IN SOUTH

THE FOLLOWING TOPICS WERE PRESENTED: PROCESSING OF SOILS WITH TAR AND CEMENT FOR ROAD BASE CONSTRUCTION

IN SOUTH CAROLINA, ROAD SOIL DISTRIBUTION, PIONEERING WITH CEMENT, TOOLS FOR TAR PROCESSING, AND TYPICAL SECTIONS OF STABILIZED EARTH, INCLUDING TAR AND CEMENT PROCESSED SOIL ROADS.

Hill, CS *Engineering News-record, Engineering Index*

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231665

BASE STABILIZATION WITH PORTLAND CEMENT. (NODAWAY COUNTY, MO.)

A DETAILED AND FULLY ILLUSTRATED ACCOUNT IS GIVEN OF STABILIZATION OF SOIL WITH CEMENT OVER A STRETCH OF 4-1/2 MILES IN MISSOURI. THE DESIGN SPECIFIED A UNIFORMLY COMPACTED SOIL-CEMENT-STABILIZED ROADWAY THICKNESS OF 6 IN. 22 FT. IN WIDTH. THE SPECIFIED CEMENT CONTENT WAS 9% BY VOL. OF COMPACTED ROADWAY.

Lancaster, CM *Roads and Streets*

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231666

SINGLE MACHINE METHODS AND CONTROL OPERATIONS CONSTRUCTION PROCEDURES USED IN 1939 ON THE FIRST SOIL-CEMENT ROAD BUILT BY THE OHIO DEPARTMENT OF HIGHWAYS ARE DESCRIBED. A 'SINGLE PASS' MIXING MACHINE WAS USED.

Litchiser, RR Brooks, HE *Highway Research Board Proceedings*

2A 231668

CALICHE-CEMENT STABILIZATION

CONSTRUCTION IS REPORTED ON A PROJECT WHICH CONSISTED OF REMOVING THE ASPHALT TOP FROM A CALICHE BASE, STABILIZING THE CALICHE FOR A DEPTH OF 6 IN. WITH 8% CEMENT BY VOLUME, AND SURFACING IT WITH APPROXIMATELY 3/4 IN. OF CUT-BACK ASPHALT CONCRETE FOR A WIDTH OF 20 FEET.

Texas State Department of Highways & Public Transp

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231673

SOIL-CEMENT FOR ARMY AIRPORTS AND RUNWAYS

RUNWAY CONSTRUCTION OF MANY AIRPORTS EXCLUSIVELY CONTROLLED BY MILITARY AUTHORITIES IS COVERED. USE HAS BEEN MADE OF OVER 8,500,000 SQ. YD. OF SOIL-CEMENT TO MEET DESIGN PROBLEMS PRESENTED AT SEVERAL OF THESE AIRPORTS.

Catton, MD *Military Engineer, Engineering Index*

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231674

SOIL-CEMENT USE ON AIRPORTS

RUNWAYS, TAXIWAYS, PARKING APRONS AND DISPERAL REVETMENTS ARE CONSTRUCTED OF LOW-COST SOIL-CEMENT AS MEANS OF REDUCING FRAGMENTATION EFFECT OF HIGH EXPLOSIVE DETONATIONS WHICH MIGHT OCCUR IN CASE OF ENEMY ATTACK ON AIRPORTS.

Miller, LW
Western Construction News

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231685

PROBLEMS OF SOIL STABILIZATION AND THE SCIENTIFIC CONTROL OF CONCRETE FOR ROAD WORKS

A DETAILED ACCOUNT IS GIVEN OF THE CLOSELY CONTROLLED CONSTRUCTION OF CONCRETE AND CEMENT-STABILIZED HOGGIN ROADS AND FOUNDATION SLABS FOR

PRE-FABRICATED HOUSES ON A HOUSING SITE AT LUDON. METHODS OF CARRYING OUT AND INTERPRETING TESTS ON AGGREGATES, CONCRETE, AND STABILIZED HOGGIN ARE DESCRIBED, AND A LIST IS GIVEN OF EQUIPMENT FOR A FIELD LABORATORY.

Gauntlett, HD *J Inst Munic Engrs /UK/, Road Abstracts /UK/*

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231688

SUB-BASE CONSTRUCTION OF JERSEY MARINE ROAD
THE ONLY MATERIAL AVAILABLE WAS WIND-BLOWN SAND, WHICH WAS STABILIZED WITH CEMENT AND CONSOLIDATED WITH 1-1/4 IN. SURCHARGE INTO 4-IN. THICK SUBBASE. COMPACTION WAS PERFORMED WITH HOLMAN SUBGRADE TYPE COMPACTOR FOLLOWED BY HOLMAN FINISHER. THE FINISHED SUBBASE WAS CURED FOR 3 TO 7 DAYS THEN SPRAYED WITH 55% BITUMEN EMULSION AT THE RATE OF 6 SQ. YDS. PER GALLON.

Roads & Road Construction, London /UK/, Engineering Index

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231694

A TYPICAL OHIO SOIL-CEMENT PROJECT
THE PROJECT INCLUDED CONSTRUCTION OF 10.1 MILES OF 6-INCH SOIL-CEMENT BASE. THE OHIO HIGHWAY DEPARTMENT'S STANDARD INVESTIGATIONS ARE DISCUSSED.

Marshall, H *American Road Builders Assoc Tech Bull*

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231695

SOIL-CEMENT ROAD CONSTRUCTION WITH PARTICULAR REFERENCE TO MIX-IN-PLACE METHODS
THE PRINCIPLES OF SOIL-CEMENT STABILIZATION ARE EXPLAINED WITH A DETAILED ACCOUNT OF MIX-IN-PLACE METHODS AND EQUIPMENT USED ON A HOUSING ESTATE. RECOMMENDATIONS ARE MADE ON SOIL SAMPLING AND TESTING, MIXING METHODS, CONTROLS ON THE SITE, AND PLANT REQUIREMENTS FOR THE RESPECTIVE STAGES OF CONSTRUCTION.

Phillips, N *J Inst Munic Engrs /UK/, Road Abstracts /UK/*

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231696

MECHANICAL CONSTRUCTION OF STABILIZED SOIL ROAD SURFACINGS (IN CZECHOSLOVAKIAN)
THE FOLLOWING ITEMS ARE DISCUSSED: NEW METHODS OF CONSTRUCTION OF BASES AND SURFACES AND THEIR ECONOMY; DEVELOPMENT OF SOIL STABILIZATION IN THE UNITED STATES; AGRICULTURAL AND OTHER SPECIAL EQUIPMENT AND MACHINERY; DESCRIPTION OF SOIL-CEMENT PAVEMENT ON FULL SCALE EXPERIMENTAL ROAD SECTION IN RATISKOVICE, CZECHOSLOVAKIA.

Pospisil, F *Engineering Index*

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231707

SOIL STABILIZATION IN GERMANY. EXTENSIVE DEVELOPMENT AND MACHINERY
INFORMATION OBTAINED DURING THE AUTHOR'S VISIT TO GERMANY IN 1953 SUBSTANTIATED THE CLAIM MADE IN GERMAN TECHNICAL PRESS THAT AT LEAST 100 MILLION SQ. METERS OF SOIL-CEMENT CONSTRUCTION HAD BEEN LAID BY GERMANS ON AIRFIELDS DURING THE PERIOD 1938 TO 1945. MACHINES USED INCLUDED STRABAF, VOEGELE, AND SONTHOFEN MIX-IN-PLACE MACHINES, REISER TRAVEL-MIX TYPE, BUNGARTZ ROTARY TILLERS, STABILO-BAU HOOD AND ROTOR ATTACHMENT. ROAD MATERIALS WERE EMPLOYED.

Clare, KE Foulkes, RA *Engineering /UK/, Engineering Index*

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231708

GERMAN SOIL STABILIZATION
DURING THE WAR OF 1939-45 THE GERMANS CONSTRUCTED MANY AIRFIELDS BY SOIL-CEMENT STABILIZATION, LOCATED IN ALL THE TERRITORIES WHICH AT ONE TIME WERE UNDER GERMAN CONTROL. THE DEVELOPMENT OF THE PROCESS IS TRACED AND A DESCRIPTION GIVEN OF THE SITE ORGANIZATION AND PRELIMINARY LABORATORY WORK CARRIED OUT FOR THE CONSTRUCTION OF A RUNWAY. SEVERAL TYPES OF SOIL STABILIZING MACHINES WERE DEVELOPED STARTING FROM THE PRE-WAR AMERICAN IDEAS. THE GERMAN AIR MINISTRY LAID DOWN A SPECIFICATION FOR A MACHINE CAPABLE OF DOING 10,000 SQ. YDS. PER DAY AND THIS WAS SUCCESSFULLY ACHIEVED. THERE IS LITTLE SOIL STABILIZATION USED NOW IN GERMANY FOR RECONSTRUCTION.

Foulkes, RA

Symp Soil Stabilization /Australia/ pp 15-23, Jan. 1954

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231709

SOIL STABILIZATION IN GREAT BRITAIN
DETAILS PERTAINING TO SOIL-CEMENT STABILIZATION ARE GIVEN ON THE DESIGN, TESTING AND CONSTRUCTION OF EXPERIMENTAL FORWARD AIRFIELDS. GENERAL HARDSTANDS AND ROADS BUILT BY THE ARMY ARE ALSO DESCRIBED. THE LOW COST OF SOIL-CEMENT FOR HOUSING PROJECTS, STREET AND COUNTY ROADS IS DISCUSSED AND THE SAVINGS OVER ALTERNATE TYPES OF PAVING ARE GIVEN.

Foulkes, RA

Symp Soil Stabilization /Australia/ pp 114-137, Jan. 1954

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231722

USE OF SOIL-CEMENT IN ROAD CONSTRUCTIONS (IN SPANISH)

THE PAPER SUMMARIZES ROADWORK EXECUTED IN SOIL-CEMENT BY THE ROAD DEPARTMENT OF THE PROVINCE OF BUENOS AIRES. SEPARATE SECTIONS CONSIDER SOIL-CEMENT AS A BASE FOR CONCRETE PAVEMENTS AND FOR FLEXIBLE PAVEMENTS. CHARACTERISTICS OF THE BASE ARE: LOAD TRANSFER TO THE SOIL, REDUCTION OF VOLUME CHANGES, AND AVOIDANCE OF SWELLING EFFECTS. TECHNICAL AND ECONOMICAL REASONS ARE EXPLAINED FOR THE ADOPTION OF SOIL-CEMENT SUBBASES AS A REPLACEMENT OF GRANULAR BASES. CONSTRUCTION METHODS, ESPECIALLY PULVERIZING, SPRINKLING OF SOIL BEFORE ADDING THE CEMENT, DISTRIBUTION OF THE MIX AND COMPACTION OF SOIL-CEMENT ARE OUTLINED. EXISTING PROJECTS AND NUMERICAL VALUES ARE CITED.

Carri, V

Portland Cement Institute /Argentina/

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231730

SOIL-CEMENT CONSTRUCTION IN NORTH DAKOTA
ALTHOUGH TECHNIQUES AND EQUIPMENT DIFFER, DEPENDING ON JOB CONDITIONS AND SOIL TYPE, SOIL-CEMENT PROCESSING FOLLOWS FOUR BASIC STEPS: INITIAL PREPARATION, SPREADING CEMENT, MIXING, AND COMPACTION. THE TWO STATE PROJECTS COMPLETED IN 1955 AND 1956 ADJOIN; TOGETHER THEY COMPRISE 484,173 SQ. YD. OF SOIL-CEMENT. COST PER SQ. YD WAS \$1.66, WHICH INCLUDES 6-IN. SOIL-CEMENT BASE AND 2-IN. BITUMINOUS SURFACE.

Mccormick, JL *American Road Builders Assoc Tech Bull*

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231732

A HEAVY-DUTY AIRFIELD PAVEMENT EMBODYING SOIL STABILIZATION & DISCUSSION

THE PAPER DESCRIBES THE USE OF CEMENT-STABILIZED SOILS IN A HEAVY-DUTY AIRFIELD PAVEMENT AT A SITE WHERE THE SUBSOIL WAS ALMOST ENTIRELY GRANULAR. THE CONSTRUCTION AND TESTING OF THE TRIAL PAVEMENT AND THE INTERPRETATION OF THE TEST RESULTS IN ASSESSING ITS CAPACITY TO SUPPORT THE PLANNED AIRCRAFT LOADS ARE DESCRIBED. IT IS SUGGESTED THAT A PAVEMENT IN WHICH CEMENT-STABILIZED SOIL IS USED AS A CONSTRUCTION MATERIAL PERFORMS MORE LIKE A FLEXIBLE THAN A RIGID-TYPE PAVEMENT BUT THAT FOR THE SAME STRENGTH, A REDUCED THICKNESS OF PAVEMENT CAN BE USED COMPARED WITH THAT NEEDED FOR PURELY FLEXIBLE-TYPE MATERIALS. AT THE SITE DISCUSSED, THE FACTOR BY WHICH THE NORMAL CBR DESIGN DEPTHS ARE MULTIPLIED IS 0.7. THE FINAL TESTING OF EACH LAYER OF THE PAVEMENT BY REPEATEDLY APPLYING AT THE SAME POINT STATIC LOADS OF VARYING MAGNITUDE THROUGH 18-IN. DIAMETER PLATES AS WELL AS BY ROLLING WITH WHEEL LOADS OF 50,000 LB. IS DESCRIBED AND RESULTS ARE PRESENTED IN DETAIL.

Martin, FR *Inst Civil Engineers Proc London /UK/, Inst Civil Engineers Proc London /UK/*

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231734

SOIL-CEMENT STABILIZED PAVEMENT

THE CONSTRUCTION OF A 12-INCH SOIL-CEMENT BASE ON STATE HIGHWAY 16, FIVE MILES SOUTH OF LISMORE IN THE SHIRE OF GUNDARIMBA, AUSTRALIA, IS DESCRIBED. THE BASE WAS BUILT IN TWO 6-IN. LAYERS.

Constructional Review /Australia/, Indian Concrete Journal

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231735

THE PERFORMANCE OF AN EXPERIMENTAL CEMENT-STABILIZED CHERT BASE

INVESTIGATIONS SHOW THAT MANY SUBSTANDARD MATERIALS, PRINCIPALLY CHERT AND GRAVEL FOUND IN MIDDLE AND WEST TENNESSEE, COULD BE ADEQUATELY USED FOR HIGHWAY BASE CONSTRUCTION IF STABILIZED WITH VERY LOW QUANTITIES OF PORTLAND CEMENT, ABOUT 4% BY WEIGHT.

Whitehurst, EA Goodwin, WA
Tennessee University

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231738

CEMENT-TREATED SUBBASE FOR INTERSTATE 30 PAVEMENT AT GREENVILLE, TEXAS

THE REPORT CONTAINS A DESCRIPTION OF THE CONSTRUCTION OF A SUBBASE UNDER CONCRETE PAVEMENT OF INTERSTATE 30 EXTENDING 14.8 MILES FROM GREENVILLE TO DALLAS, TEXAS.

Cravens, JW *American Road Builders Assoc Tech Bull*

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231741

ORANGE COUNTY EXPERIENCES WITH SOIL-CEMENT USE
THE REPORT DESCRIBES THE INITIATION, ABOUT THREE YEARS AGO, OF A PROGRAM OF SOIL-CEMENT ROAD CONSTRUCTION TO KEEP PACE WITH THE EXPLOSIVE GROWTH OF ORANGE COUNTY, CALIFORNIA.

Koch, AS *American Road Builders Assoc Tech Bull*

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231743

COST ESTIMATE FORM FOR SOIL-CEMENT CONSTRUCTION
ESTIMATES ARE OF PARTICULAR VALUE WHEN CURRENT LOCAL BID PRICES ARE NOT AVAILABLE. TO PROVIDE FURTHER ASSISTANCE AND TO SHOW THE USE OF THE FORM, TWO SAMPLE APPROXIMATE COST ESTIMATES FOR ASSUMED SOIL-CEMENT PROJECTS FOLLOW THESE FORM SHEETS. ONE IS FOR A MIXED-IN-PLACE PROJECT AND THE OTHER FOR A STATIONARY MIXING PLANT JOB.

Portland Cement Assoc Soil Cement Serv

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231744

SUMMARIES OF SOIL-CEMENT CONSTRUCTION TO JAN. 1, 1960

DETAILED TABLES ARE GIVEN FOR SOIL-CEMENT YARDAGE STATISTICS FOR 1959 BY: YEAR AND TYPE, TYPE AND STATE, AND YEAR AND STATE FROM 1935-1959.

Portland Cement Assoc Soil Cement Serv

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231747

A FULL-SCALE SPECIFICATION TRIAL OF A CEMENT-BOUND GRANULAR BASE ON A.11 AT HIGH ROAD, SALWAY HILL, WOODFORD, ESSEX

THE SPECIFICATIONS AND CONSTRUCTION OF A SOIL-CEMENT FOR A HEAVILY-TRAFFICKED ROAD ARE DESCRIBED. THE DESIGN WAS 8 IN. OF SOIL-CEMENT, 2 IN. ROLLED ASPHALT SURFACE, AND A GROUND SUB-BASE DESIGNED TO A THICKNESS BASED ON THE CBR OF THE SUBGRADE.

Broad, BA
Road Research Laboratory /UK/

ACKNOWLEDGMENT: Highway Research Board Bibliography

2A 231766

SUGGESTED SPECIFICATIONS FOR SOIL-CEMENT BASE COURSE

THIS PAMPHLET PROVIDES SUGGESTED SPECIFICATIONS FOR ENGINEERS, ARCHITECTS, CONSULTANTS, CONTRACTORS AND DEVELOPERS INTERESTED IN CONSTRUCTING SOIL-CEMENT ROADS, STREETS, AIRPORTS, PARKING AREAS AND OTHER USES.

Portland Cement Association

ACKNOWLEDGMENT: Portland Cement Association

2A 231770

SOIL-CEMENT INSPECTOR'S MANUAL

FIELD INSPECTION OF SOIL-CEMENT CONSTRUCTION INVOLVES THE CONTROL OF FOUR BASIC FACTORS: CEMENT CONTENT, MOISTURE CONTENT, COMPACTION AND CURING.

Portland Cement Association

ACKNOWLEDGMENT: Portland Cement Association

2A 231772

STUDIES MADE FOR CONSTRUCTION OF COLOMBIAN HIGHWAY, 'LA YE-PLANETA RICA'

STABILIZATION WITH PORTLAND CEMENT OF MATERIALS FROM BURROW PITS OF TREMENTINA, BELLAVISTA Y LIBERIA WAS STUDIED. BASE OF SOIL-CEMENT WAS USED IN HIGHWAY CONSTRUCTION, UTILIZING CLAYEY AND SILTY SAND DEPOSITS FOUND ALONG HIGHWAY. IN DESIGN, TEST FOLLOWED METHODS OF ASTM WITH SOME VARIATIONS, FREEZING TEST WAS DISCARDED BECAUSE OF TROPICAL CLIMATE, AND ONLY 6 CYCLES OF WETTING AND DRYING WERE USED BUT EFFECT OF ABRASION WAS INCREASED WHILE BRUSHING. PLASTICITY REDUCTION OF SOIL STRID WITH PORTLAND CEMENT WAS STUDIED.

Atuesta, J
Pan Am Hwy Congress, Proc

ACKNOWLEDGMENT: Portland Cement Association

2A 231775
THE USE OF GRANULAR SLAG SAND AND FLY ASH IN ROAD CONSTRUCTION BY THE SOIL-CEMENT TECHNIQUE
A MIXTURE OF 50% GRANULAR SLAG, 44% FLY ASH AND 6% SLAG CEMENT HAS BEEN SUCCESSFULLY USED ON ROADS IN FRANCE. THE STABILIZED MATERIAL MIXED IN THE SAME WAY AS SOIL-CEMENT WAS LAID ON A FOUNDATION OF CLAYEY SHALE AND GIVEN A SURFACE DRESSING OF BITUMEN EMULSION AND CHIPPINGS. RESULTS ARE GIVEN OF TESTS ON SAMPLES MADE IN THE LAB AND ON CORES TAKEN FROM THE ROAD.

Chapelle, JA *Road Abstracts /UK/*
Laitiers & Tarmacadam

ACKNOWLEDGMENT: Portland Cement Association

2A 231782
THE INFLUENCE OF SOIL CHARACTERISTICS IN SOIL-CEMENT MIXTURES
THE OPTIMUM PROBABLE PERCENTAGE OF PORTLAND CEMENT REQUIRED FOR SOIL-CEMENT MIXTURES IS DETERMINED. THE STUDY IS BASED ON LOCAL MATERIAL USED IN ROAD CONSTRUCTION IN THE PROVINCE OF BUENOS AIRES. PROCEDURES DEVELOPED AT THE ROAD RESEARCH LABORATORY, HARMONDSWORTH, WERE USED FOR TEST ON CLAYEY SOILS.

Dolorenzo, AH Ocampos, OR *Road Abstracts /UK/*

ACKNOWLEDGMENT: Portland Cement Association

2A 231783
EFFECT OF WATER AND COMPACTION ON THE STRENGTH OF SOIL CEMENT MIXES
THE EFFECT ON THE STRENGTH OF SOIL-CEMENT IS ESTABLISHED FOR TWO TYPES OF TYPICAL SOILS, NAMELY, A SAND AND A SILT WITH CEMENT CONTENTS OF 8 TO 14 AND 6 TO 12%, RESPECTIVE OF 2 FACTORS: MOISTURE CONTENT AND DEGREE OF COMPACTION. THESE CAN VARY AS A FUNCTION OF JOB CONDITIONS SUCH AS CAPACITY OF COMPACTING EQUIPMENT OR SOIL MOISTURE. THIS STUDY WAS INTENDED TO PROVIDE INFORMATION TO SERVE AS A GUIDE TO ENGINEERS IN CHARGE OF SOIL-CEMENT PAVEMENT CONSTRUCTION, WHO, KNOWING THE EFFECT OF THESE FACTORS, COULD BETTER DEFINE THE MEASURES TO BE TAKEN IN COUNTERACTING OR MINIMING THEIR ACTION.

Dutron, P Cloes, R *Intl Conf Soil Mech & Fdn Eng Proc*
Nat Belgian Roads Congress, Pca Foreign Literature Study

ACKNOWLEDGMENT: Portland Cement Association

2A 231786
USES AND PROSPECTS OF THE SOIL-CEMENT STABILIZATION FOR HIGHWAY CONSTRUCTION
THE MAIN TYPES OF SOILS STABILIZED WITH CEMENT ARE EXAMINED: FIRST CLEAN OR SILTY SANDS, AS WELL AS SANDS TREATED IN SITU, THEN SOILS WITH FRIABLE COMPONENTS, PLASTIC AND LEAN GRAVELS. THE BEHAVIOR OF SAND-CEMENTS IN FOUNDATIONS AND GRAVEL-CEMENTS IN HIGHWAY BASE COURSES IS PRESENTED WITH EMPHASIS ON RIGIDITY AND CRACKING SAFETY. AN EXPERIMENTAL STRETCH WAS INVESTIGATED IN FRANCE IN 1960 AND THE RESULTS OBTAINED BY STRENGTHENING THE ROADWAY BY MEANS OF LEAN GRAVELS WITH SLIGHT BATCHING OF CEMENT ARE DESCRIBED. STUDY SHOWS THE POSSIBILITY OF MAKING ECONOMICAL STRENGTHENING WITH GRAVEL-CEMENTS WITHOUT TRAFFIC INTERRUPTION.

Godin, P *Ann Inst Tech Batiment Trav Publ /Fr/, Am Concrete Inst Journal & Proceedings*

ACKNOWLEDGMENT: Portland Cement Association

2A 231791
THE USE OF SODIUM SILICATE AS ADDITIVE TO SOILS STABILIZED WITH CEMENT
SOILS FROM CLUJ REGION ARE STABILIZED AND SUITABLE FOR CONSTRUCTION PURPOSES. THE COMPOSITION OF THESE SOILS IS: SILICATE OXIDE 65.5, ALUMINUM OXIDE 16.6, FERRIC OXIDE 4.5, MAGNESIUM OXIDE 1.6, CALCIUM OXIDE 0.9, POTASSIUM OXIDE 3.2, SODIUM OXIDE 0.8, AND WEIGHT LOSS 7.00%. TO SOILS WITH 8-10% MOISTURE WAS ADDED AN ADDITIONAL 4-12% OF WATER. THE ADDITION OF 2% SODIUM SILICATE TO A SOIL-8% CEMENT MIXTURE GAVE SIMILAR RESULTS AS A SOIL-12% CEMENT MIXTURE (FREE OF SODIUM SILICATE) AND THE ADDITIONS OF 6-7 1. SODIUM SILICATE REDUCES BY 80KG. THE REQUIRED AMOUNT OF CEMENT TO STABILIZE THE SOIL. THE ADDITION OF SODIUM SILICATE ALSO IMPROVES THE SPEED OF HARDENING.

Hossu, T Marusciac, D Pop, V *Rev Matls Constr & Trav Publics /Fr/, Chemical Abstracts*

ACKNOWLEDGMENT: Portland Cement Association

2A 231806
CONTROL OF CEMENT-STABILIZED BASES
METHODS USED IN VARIOUS COUNTRIES FOR CONTROLLING SOILS AND CONSTRUCTION MATERIAL BEFORE, DURING, AND AFTER CONSTRUCTION ARE REVIEWED.

Kirk, JM *Norsk Vegtidskrift /Norway/, Road Abstracts /UK/*

ACKNOWLEDGMENT: Portland Cement Association

2A 231807
THE UNPROCESSED LAYER IN IN-SITU SOIL CEMENT STABILIZATION FOR PAVEMENT CONSTRUCTION
IT IS CONCLUDED THAT IN IN-SITU STABILIZATION OF SOIL WITH CEMENT, THE PENETRATION OF THE CEMENT INTO THE SOIL VOIDS BELOW THE RADIUS OF THE MIXING ROTOVATOR BLADE, WILL DEPEND MAINLY ON 2 FACTORS (1) THE SIZE AND SHAPE OF THE VOIDS OF THE SOIL, AND (2) THE RELATIVE MOVEMENTS OF THE GRAINS OF THE SOIL OUTSIDE THE RADIUS OF THE MIXING BLADE. THE COMBINED EFFECT OF BOTH FACTORS WAS SUCCESSFULLY DETERMINED IN THE TRACER EXPERIMENTS USING THE FLUORESCING COMPOUND ANTHRACENE INSTEAD OF CEMENT. THE MAIN CONCLUSION REACHED FROM THESE TESTS WAS THAT THE FINER THE SOIL GRAINS, THE LESS WILL BE THE PENETRATION OF CEMENT OUTSIDE THE RADIUS OF THE MIXING BLADE OF A ROTOVATOR. THE EXTENSION OF THIS CONCLUSION TO FULL-SCALE WORK DEPENDS ON WHETHER THERE ARE ANY 'MODEL' OR SCALE EFFECTS. SOILS FINER THAN SAND, I.E., 200 MESH, WOULD NOT BE SUITABLE FOR SUCCESSFUL IN-SITU STABILIZATION.

Kolbuszewski, J Tucker, DA *Civil Eng & Public Works Review /UK/*

ACKNOWLEDGMENT: Portland Cement Association

2A 231816
THE EFFECT OF WATER CONTENT ON THE COMPRESSIVE STRENGTH AND DENSITY OF VARIOUS AGGREGATE-CEMENT MIXES FOR HIGHWAY CEMENT TREATED BASES
A STUDY WAS MADE TO DETERMINE THE EFFECT OF WATER AND CEMENT CONTENT ON THE COMPRESSIVE STRENGTH AND DENSITY OF LABORATORY TEST SPECIMENS OF CT BASES USED FOR HIGHWAY CONSTRUCTION IN WASHINGTON STATE. RESULTS SHOWED THAT THE COARSEST OF 3 GRADATIONS USED FOR THE TESTS PRODUCED THE DENSEST MIXES AND REQUIRED THE LEAST AMOUNT OF WATER TO ACHIEVE THESE CONDITIONS. COMPACTION CONTROL BECAME MORE CRITICAL AT HIGHER CEMENT CONTENTS AND COMPRESSIVE STRENGTH FELL OFF MORE RAPIDLY ON THE WET SIDE OF OPTIMUM THAN ON THE DRY SIDE.

Maytin, IL
Washington State Institute Technology Bull 251, 1960

ACKNOWLEDGMENT: Portland Cement Association

2A 231821
BAMBOO-REINFORCED SOIL-CEMENT AS A CONSTRUCTION MATERIAL

BAMBOO-REINFORCED SOIL-CEMENT BASE UNDER THIN CONCRETE PAVEMENT SURFACING IS LIKELY TO EFFECT A SAVING OF THE ORDER OF 30 PERCENT OVER NORMAL PLAIN CEMENT CONCRETE PAVEMENT.

Mehra, SR Ghosh, RK Chadda, LR *Central Road Research Inst India Repts*

ACKNOWLEDGMENT: Portland Cement Association

2A 231823
SOIL STABILIZATION IN THE TROPICS
PART 1: THE NEED FOR SOIL STABILIZATION PART 2: FACTORS AFFECTING THE DESIGN OF STABILIZED SOILS PART 3: FIELD CONTROL OF STABILIZED-SOIL CONSTRUCTION.

Millare, RS Clare, KE Williams, FH *Roads & Road Construction, London /UK/*

ACKNOWLEDGMENT: Portland Cement Association

2A 231829
AN INVESTIGATION TO DETERMINE THE ECONOMY AND PRACTICALITY OF USING VARIOUS TYPE SOILS TREATED WITH PORTLAND CEMENT OR OTHER ADMIXTURES FOR HIGHWAY CONSTRUCTION

THE OBJECTIVE OF THE RESEARCH REPORTED HEREIN WAS TO DETERMINE THE SUSCEPTIBILITY OF WIDELY VARYING SOIL TYPES TO STABILIZATION BY THE ADDITION OF A BITUMINOUS MATERIAL. SELECTED FOR USE IN THIS STUDY WERE 9 REPRESENTATIVE SOILS LOCATED IN THE STATE OF GEORGIA. THE BITUMINOUS MATERIAL CHOSEN AS A STABILIZING AGENT WAS A CUTBACK ASPHALT, RC-3. THE ADDITION OF CUTBACK ASPHALT TO THE SOILS USED IN THIS RESEARCH DID NOT MATERIALLY INCREASE THE STRENGTH PARAMETERS OF THESE SOILS.

Paquette, RJ Gale, WD
Georgia Inst Technol Eng Exper Station

ACKNOWLEDGMENT: Portland Cement Association

2A 231851
REINFORCED SOIL, A NEW CONSTRUCTION MATERIAL
REINFORCED SOIL CONSISTS OF SOIL AND REINFORCEMENTS. REINFORCEMENT IS SUPPOSED TO ACT BY FRICTION IN CONTACT WITH THE SOIL PARTICLES GIVING THE MATERIAL SOME COHESION, THE ANISOTROPY OF WHICH DEPENDS ON THE APPLIED FORCES AND THE DIRECTION OF THE REINFORCEMENTS. IN THE CASE OF SAND, IF FRICTION BETWEEN SAND AND REINFORCEMENT OCCURS WITHOUT SLIDING ACTION AND IF ONE ASSUMES THAT THE PLASTIC DEFORMATION OF SAND TAKES PLACE AT A CONSTANT VOLUME, REINFORCED SOIL CAN BE CONSIDERED AS AN ELASTIC MATERIAL, ITS MODULUS OF ELASTICITY BEING DEPENDENT ON THE MODULUS OF ELASTICITY OF THE REINFORCEMENT AND ON THE COEFFICIENT OF ACTIVE PRESSURE OF THE SAND. THE MOST FREQUENT EXAMPLES OF REINFORCED SOIL CONSTRUCTION IS THE RETAINING WALL. IT IS COMPOSED OF REINFORCEMENTS PLACED HORIZONTALLY AND PERPENDICULARLY TO THE WALL SURFACE, AND OF A SKIN OR FACE, THE PURPOSE OF WHICH IS TO RETAIN THE SOIL PARTICLES NEAR THE WALL SURFACE. REINFORCED SOIL COULD BE USED IN MANY OTHER TYPES OF CONSTRUCTION: AIR-SHAFTS, BEAMS, ETC. ONE OF THE MAIN ADVANTAGES OF REINFORCED SOIL IS ITS ECONOMY COMPARED WITH STANDARD TYPES OF CONSTRUCTION. /L.C.P.C./R.R.L./

Vidal, H *Ann Inst Tech Batiment Trav Publ /Fr/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 231871
SOIL STABILIZATION WITH CEMENT OR LIME /IN FRENCH/
BASIC PRINCIPLES OF SOIL STABILIZATION ARE REVIEWED INCLUDING NEED FOR SCIENTIFIC PRELIMINARY TESTS TO DETERMINE THE NECESSARY CRITERIA, METHODOICAL CONTROL DURING THE EXECUTION OF THE WORKS, AND RATIONAL ORGANIZATIONS OF THE SITE AND EQUIPMENT. DATA ARE GIVEN ON GRAVEL, SAND DEPOSITS, CONSTRUCTION METHODS AND NEW ROAD NETWORKS UNDER CONSTRUCTION IN SWITZERLAND. THE ECONOMIC IMPORTANCE OF CEMENT-STABILIZED GRAVEL FOR THE CONSTRUCTION OF HIGH- QUALITY SUBBASES IMPERVIOUS TO FROST AND WITH A HIGH BEARING CAPACITY, IS DISCUSSED. /LCPC/RRL/

Vogt, K
La Route En Beton /Switzerland

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 231888
THE USE OF LIME AND MIXTURES OF LIME AND PULVERIZED FUEL ASH FOR SOIL STABILIZATION IN BRITAIN

SOIL STABILIZATION IS THE TREATMENT OF LOCALLY OCCURRING NATURAL MATERIALS TO MAKE THEM SUITABLE FOR USE IN THE ROAD STRUCTURE. IN GREAT BRITAIN THERE ARE CONSIDERABLE AREAS IN WHICH THE SOILS ARE UNSUITABLE FOR USE IN THE FORM IN WHICH THEY OCCUR, BUT ON THE OTHER HAND GOOD QUALITY ROADMAKING MATERIALS ARE RARELY FAR AWAY. THE RESULT OF THIS IS THAT THE INCENTIVE TO USE SOIL STABILIZATION TECHNIQUES HAS NOT BEEN AS STRONG IN THIS COUNTRY AS IN AREAS WHERE THERE MAY BE NO ALTERNATIVE MATERIALS FOR HUNDREDS OF MILES. NEVERTHELESS, SOIL STABILIZATION CAN OFFER CONSIDERABLE ECONOMICS IN ROAD CONSTRUCTION AND ANY MATERIALS WHICH MIGHT BE USED FOR THIS PURPOSE ARE WORTH CONSIDERING. LIME AND MIXTURES OF LIME AND PULVERIZED FUEL ASH HAVE BEEN USED AS STABILIZING AGENTS IN OTHER PARTS OF THE WORLD AND PART OF THE PROGRAMME OF RESEARCH AT THE ROAD RESEARCH LABORATORY, WHICH WAS CARRIED OUT IN ASSOCIATION WITH THE CHALK LIME AND ALLIED INDUSTRIES RESEARCH ASSOCIATION /NOW WELWYN HALL RESEARCH ASSOCIATION/, HAS BEEN TO EVALUATE THE POTENTIAL USES OF THESE METHODS FOR SOIL STABILIZATION IN THIS COUNTRY. THE RESULTS OF THIS WORK ARE SUMMARISED IN THIS PAPER. /RRL/AL

Dumbleton, MJ Sherwood, PT Bessy, GE *Chemistry & Industry /UK/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 231896
SOIL CEMENT BASE COURSES IN STREET CONSTRUCTION
INFORMATION IS GIVEN BASED UPON EXPERIENCE GAINED FROM THE USE OF SOIL CEMENT COURSES IN STREET CONSTRUCTION IN THE CITY OF LUANDA. IN ADDITION TO DESCRIBING THE GEOTECHNICAL CHARACTERISTICS OF THE MUCEQUE, THE RESULTS OF THE SOIL CEMENT TEST ON THIS SOIL AND THE STANDARD CONSTRUCTION TECHNIQUES OF SUCH COURSES, SPECIAL REFERENCE IS MADE TO THE LIMITATIONS IMPOSED ON THIS TYPE OF CONSTRUCTION WHEN CARRIED OUT IN A CITY, LIMITATIONS WHICH DO NOT EXIST IN OPEN AREAS. /RRL/LNEC/

Meireles, JM Fomento, Lisbon /Portugal/

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 231899
CONSTRUCTION OF ROADS ON PEAT FOUNDATIONS USING LIGHT-WEIGHT RAFTS
THREE METHODS OF CONSTRUCTING ROADS OVER PEAT USING LIGHT- WEIGHT RAFTS ARE DESCRIBED: (1) FASCINE

FOUNDATION, (2) BRUSHWOOD AND GRAVEL CONSTRUCTION, AND (3) REINFORCED CONCRETE SLAB. MANY CONCRETE ROADS IN COUNTY LONDONERRY WHICH WERE CONSTRUCTED OVER PEAT ARE STILL IN RELATIVELY GOOD CONDITION AFTER MORE THAN 35 YEARS. IT IS SUGGESTED THAT WITH MODERN PLANT AND TECHNIQUES CONCRETE SLAB CONSTRUCTION MAY PROVE TO BE AN ECONOMIC METHOD OF RECONSTRUCTING ROADS OVER PEAT. SOME OBSERVATIONS ARE MADE ON THE MAINTENANCE PROBLEMS WHICH ARISE WITH THIS TYPE OF ROAD. /RRL/A/

Warnock, TA *Inst Hwy Engineers Journal, London /UK/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 231900

PROBLEMS OF ROADS ON PEAT AND ORGANIC SUBSOILS

WHEN A ROAD IS CONSTRUCTED ON SOFT SUBSOILS SUCH AS PEAT THREE TYPES OF SETTLEMENT TAKE PLACE, (1) ELASTIC OR INSTANTANEOUS, (2) CONSOLIDATION, AND (3) CREEP. TWO LATTER TYPES ARE TIME-DEPENDENT. CONSOLIDATION SETTLEMENT STRENGTHENS THE GROUND, WHEREAS CREEP DOES NOT, AND MAY HAVE A DAMAGING EFFECT ON THE SOIL STRUCTURE. IT IS ESSENTIAL TO DISTINGUISH BETWEEN THE THREE TYPES AND TO BE ABLE TO FORECAST THE MAGNITUDE AND RATE OF EACH TYPE. REFERENCE IS MADE TO A RECENT PUBLICATION WHICH SUGGESTS A METHOD OF MAKING THIS FORECAST. THE RELATIVE INFLUENCE OF THE VARIOUS TYPES OF SETTLEMENT IS INDICATED BY THE OBSERVED BEHAVIOUR OF EXISTING ROADS UNDER VARIOUS CONDITIONS SUCH AS THICKNESS OF PAVEMENT AND SOFT SUBSIL, DRAINAGE AND AIR- DRYING. VARIOUS CONSTRUCTION EXPEDIENTS SUCH AS PRECONSOLIDATION, LIGHT-WEIGHT FILL, WATERPROOF SHEETING AND PILES OR PILES FOR ACCELERATING DRAINAGE ARE DESCRIBED. THE ADVANTAGES OF CONCRETE SLAB CONSTRUCTION ARE ALSO DISCUSSED. /RRL/A/

Hanrahan, ET *Inst Hwy Engineers Journal, London /UK/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 231913

COMPACTION OF SOILS FOR ROAD CONSTRUCTION

A BRIEF REVIEW OF THE COMPACTION OF SOILS FOR ROAD CONSTRUCTION IS PRESENTED. THE TEXT INCLUDES A STUDY OF SOIL COMPACTION IN THE LABORATORY, COMPACTION CHARACTERISTICS OF SOME TYPICAL SOILS ENCOUNTERED IN WEST PAKISTAN, FIELD COMPACTION I.E. EARTH WORK OPERATIONS AND EQUIPMENT, AND MEASUREMENT OF COMPACTION IN THE FIELD. /RRL/A/

Qureshi, TH Ud-din, N Ali, H
West Pakistan Government /Pakistan/, West Pakistan Road Res Inst
/Pakistan/

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 231918

COMPACTION IN EARTHWORKS AND ROAD CONSTRUCTION /IN GERMAN/

THE SUCCESS OF EACH COMPACTION OPERATION DEPENDS PARTICULARLY ON THE TYPE OF COMPACTION PROCESS EMPLOYED IN RELATION TO THE MATERIAL TO BE COMPACTED AND THE DEGREE OF CARE INVOLVED. THE AUTHOR DESCRIBES THE COMPACTION OPERATION (REDUCTION OF THE POROSITY OF THE MATERIAL), COMPACTION APPARATUS AND ITS EFFICIENCY, COMPACTION OF SOILS (PLACE-MENT MOISTURE CONTENT, THICKNESS OF INDIVIDUAL FILLING COURSES, COMPACTION TEST), FROST BLANKET COURSE (GRANULOMETRIC GRADATION), BACKFILLING OF STRUCTURES (MATERIAL COMPOSITION, COMPACTION EFFECTIVENESS), SOIL STABILIZATION AND FILLING AND COMPACTION OF CABLE TROUGHING (BACKFILLING OF PIPES, TOP COVERING, FURTHER COMPACTION FROM THE SURFACE). VALUES GAINED FROM EXPERIENCE IN RELATION TO SOIL TYPES ARE INCLUDED. /FG/RRL/

Klinger, B *Tiefbau /Germany/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 231919

EXPERIENCES AND OBSERVATIONS DURING THE CONSTRUCTION OF BITUMINOUS SURFACINGS /IN GERMAN/

PRESENT DAY REQUIREMENTS OF SUBGRADE AND SUBSOIL ARE DISCUSSED WITH REGARD TO CONSTRUCTION AND BEARING CAPACITY. THE IMPORTANCE OF STANDARDIZATION OF CONSTRUCTION, DETAILED SOIL INVESTIGATIONS, SUITABLE MATERIALS, EVEN COMPOSITION AND COMPACTION ARE STRESSED. THE ADVISABILITY OF INTERMEDIATE CONSTRUCTION OF GRAVEL AND CRUSHED STONE BASES TO AVOID LATER SURFACE DAMAGE IS OUTLINED. REVISION OF RELEVANT SPECIFICATIONS WITH RESPECT TO BINDER, FILLER, POROSITY AND GRADING, AND THE IMPROVEMENT OF TEST METHODS ARE RECOMMENDED. IT IS STRESSED THAT SURFACE DAMAGE CAUSED BY TRAFFIC LOADING, STEEL-STUDDED TIRES, DEICING SALTS ETC. CAN BE AVOIDED BY CAREFUL SELECTION AND PREPARATION OF MATERIAL AND GOOD PLACEMENT TECHNIQUES. /FG/RRL/

Zichner, G *Strassenbautechnik, Cologne /Ger/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 231920

THE ADDITION OF SALTS TO THE SOIL DURING EARTH ROAD CONSTRUCTION /IN GERMAN/

THE EFFECTS OF ADDING HYGROSCOPIC SALTS (CALCIUM CHLORIDE, MAGNESIUM CHLORIDE) AND IN SOME INSTANCES SODIUM CHLORIDE TO SOIL ARE OUTLINED: MOISTURE CONTENT IS KEPT AT THE OPTIMUM LEVEL FOR SUBSEQUENT COMPACTION BY TRAFFIC. DUST ON THE ROAD SURFACE IS GREATLY REDUCED, AND TRACKS MADE BY VEHICLE WHEELS PENETRATE LESS DEEPLY. THE ADDITION OF THE SALTS ALSO LOWERS THE FREEZING POINT OF THE SOIL, THUS AVOIDING MUCH FROST DAMAGE. TESTS WERE CARRIED OUT ON 6 ROADS WITH VARYING TYPES OF SOILS; IT WAS FOUND THAT THE SALTS WERE WASHED OUT AFTER 6 MONTHS TO A YEAR, AND HAD TO BE REAPPLIED. /FG/RRL/

Hofmann, U Schembra, FW *Bruecke Und Strasse /Germany/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 231924

THE THEORETICAL WATER DISTRIBUTION AND OPTIMUM MOISTURE CONTENT OF SOILS, STABILIZED SOILS AND CONCRETE /IN GERMAN/

THE AUTHOR DESCRIBES ADMIXTURE OF WATER IN SYNTHETICALLY COMPACTED CONSTRUCTION MATERIALS, THE CALCULATION OF THE SPECIFIC WATER VOLUME AND THE DETERMINATION OF THE VALUE OF THE WATER. THIS IS FOLLOWED BY STATEMENTS ON WATER DISTRIBUTION AND DETERMINATION OF OPTIMUM AMOUNT OF WATER FOR SILTY, SANDY AND GRAVELLY SOILS AND THE GRAPHIC DETERMINATION OF WATER FILM THICKNESS OF SILTY SOILS FOR A PARTICLE SIZE LESS THAN 0.02 MM IN DIAMETER, AND LIKEWISE FOR NON-COHESIVE SOILS. AFTER DEALING WITH THE DETERMINATION OF THE SPECIFIC WATER VOLUME OF NON-COHESIVE SOILS, THE AUTHOR CONSIDERS THE INFLUENCE OF COMPACTION ON THE CALCULATION OF THE OPTIMUM WATER CONTENT FOR SOILS AND THE WATER VOLUME OF COHESIVE AND NON-COHESIVE SOILS. COMPARISONS ARE MADE BETWEEN CALCULATED WATER CONTENTS AND THOSE DETERMINED BY THE SIMPLE PROCTOR METHOD. /FG/RRL/

Kraemer, P *Strassen Und Tiefbau /Germany/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 231925

SOIL STABILIZATION WITH LIME IN EARTHWORKS AND ROAD CONSTRUCTION /IN GERMAN/

THIS BOOK CONTAINS THE FOLLOWING REPORTS, WHICH ARE MAINLY REPRINTS FROM VARIOUS JOURNALS: KUONEN, V., AND R. HIRT, RESULTS OF RESEARCH INTO THE EFFECT OF LIME IN SOIL STABILIZATION; BRAND, W., POSSIBILITIES AND LIMITS OF USING LIME TO STABILIZE COHESIVE SOILS; KLEMPERT, B., CODES OF PRACTICE AND THEIR APPLICATION IN RURAL ROAD CONSTRUCTION IN NORDRHEIN-WESTFALEN; BEHR, H., OBSERVATIONS OF MOISTURE CONTENT IN THE SUBGRADE AND SUBSOIL OF A MOTORWAY; AND KNOLL, B., AND F. STEINMANN, SOIL STABILIZATION WITH LIME IN EARTHWORKS-A NEW, PARTICULARLY EFFICIENT METHOD. THE DEPARTMENT OF FOUNDATIONS OF THE BUNDESANSTALT FÜR STRASSENWESAN REFERS TO THE IMPROVEMENT AND STABILIZATION OF COHESIVE SOILS WITH LIME IN EARTHWORKS FOR ROAD CONSTRUCTION. THERE IS A BIBLIOGRAPHY ON GENERAL PRINCIPLES, THEIR PRACTICAL APPLICATION IN ROAD AND RAIL CONSTRUCTION AND EARTHWORKS, AND THE VALID CODES OF PRACTICE AND SPECIFICATIONS. TWO INDEXED RECORDS OF SOIL STABILIZATION AND IMPROVEMENT OF COHESIVE SOILS WITH LIME CONCLUDE THE BOOK. /FG/RRL/

Bundesverband Kalkindustrie /Germany/ 24 pp. 1966

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 231943

ECONOMICAL ROAD CONSTRUCTION IN MARSHY AREAS /IN GERMAN/

THE AUTHOR DESCRIBES HOW FIRM ECONOMICAL ROADS WERE BUILT UNDER THE MOST DIFFICULT SUBSOIL CONDITIONS IN THE REGION OF THE GREAT MARSH NEAR RENDSBURG IN SCHLESWIG-HOLSTEIN, AND HOW THE SPECIAL PROBLEMS WHICH AROSE WERE SOLVED. ACCORDING TO THE TENDERING, SPECIFICATION CEMENT Z.275 HAD TO BE USED TO SOLIDIFY THE SOIL, AND A GUIDE VALUE OF 140 KG/CUBED SOIL SOLIDIFICATION WAS GIVEN. THE REQUIREMENT WAS A CRUSHING STRENGTH OF 30-40 KP/SQUARED AFTER EIGHT DAYS (A CUBE OF 20 CM EDGE LENGTH AFTER STORAGE ACCORDING TO DIN 1048). SAMPLE MEASUREMENTS SHOWED THAT DURING THE CONSTRUCTION TIME THE REQUIRED MINIMUM CRUSHING STRENGTH WAS NOT ATTAINED, IN SPITE IF 180 KG/CUBED OF CEMENT BEING USED. WITH THE SUBSEQUENT USE OF PECTRACRETE CEMENT Z375 IN A QUANTITY OF 120 KG/CUBED CRUSHING STRENGTHS WERE OBTAINED WHICH WERE GREATER THAN THE REQUIRED MINIMUM VALUE. HUMIC CONSTITUENTS IN THE SAND WERE CHEMICALLY NEUTRALIZED THROUGH THE ADDITION OF CALCIUM CHLORIDE AMOUNTING TO 2 PER CENT OF THE CEMENT WEIGHT, THE CONSTRUCTION IS DESCRIBED IN DETAIL. /FG/RRL/

Simon, P *Strassenbautechnik, Cologne /Ger/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 231948

NEW TYPE OF GROUTING WORK IN FRANCE AND SWITZERLAND (IN GERMAN)

THE POWER STATION TUNNEL IN FRANCE WHICH IS 7858 METERS LONG CUTS THROUGH SLATE AND GNEISS. IT WAS LINED WITH 15-20 CM. OF CONCRETE, AND THEN THE VOIDS BETWEEN THE LINING AND THE ROCK WERE INJECTED WITH MORTAR AND SUBSEQUENTLY WITH CONTACT INJECTION MATERIAL WITH CEMENT-WATER GROUT SO AS TO STABILIZE THE ROCK WHICH IS LIABLE TO FRACTURE. THE GROUTING OPERATIONS WERE STARTED AT A CENTRAL POINT AND CONTINUED OUTWARDS. THEREFORE ACCURATE TESTS OF THE PUMPING CAPACITY OF THE GROUTING MORTAR USED ITS COMPOSITION AND PROPERTIES. THE MAIN REQUIREMENT OF THE MORTAR IS THAT IT SHOULD BE THIXOTROPIC. FOR THE JACKETING OF THE THREE SAG-PIPES, WHICH WERE

LAI D UNDER WATER AT A DEPTH OF 4.50 METERS. THE STORE AND GRAVELLY SAND MIXTURE LYING AROUND THE PIPES WAS STABILIZED WITH MORTAR. STATEMENTS WERE MADE REGARDING THE INJECTION TUBES, (LENGTH AND DISTANCE APART), INJECTION PRESSURE, MORTAR AND EFFICIENCY. THE TEMPERATURE DIFFERENTIAL MEASURING METHOD WAS DEVELOPED FOR DETERMINING THE SURFACE LEVEL OF THE GROUTING MORTAR UNDER WATER. /FG/RRL/

Tiefbau /Germany/

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 231952

COARSE GRAVEL ROADBASES-POSSIBILITIES OF USE /IN GERMAN/

IN THE GERMAN DEMOCRATIC REPUBLIC MORE THAN 2 MILLION TONS OF COARSE GRAVEL ARE USED ANNUALLY IN ROAD CONSTRUCTION, AND YET THERE IS NO STANDARD FOR COARSE GRAVEL ROADBASES. IN ORDER TO REMEDY THIS THE FOLLOWING FACTS ARE ESTABLISHED: (1) THE MAXIMUM GRAIN SIZE OF THE COARSE GRAVEL ACCORDING TO THE PLACEMENT THICKNESS IS 35,5/56 FOR 15CM. COARSE GRAVEL; 35,5/80 FOR 20CM. AND 56,125 FOR 25CM. (EACH SIZE MEASURED IN MM.). (2) AFTER COMPACTION AND FILLING THE VOIDS CONTENT OF THE COARSE GRAVEL ROADBASE SHOULD BE AT MOST 17%. (3) THE COARSE GRAVEL MUST HAVE A GOOD GRAIN CONSTRUCTION, AND MUST BE BROKEN FROM A GOOD, TOUGH ROCK. (4) PLACEMENT SHOULD BE MADE ON WELL-COMPACTED SUBSOIL OR ON A FROST-BLANKET COURSE. (5) BEFORE THE DRY FINE SAND IS VIBRATED THE COARSE GRAVEL MUST BE FIRMLY COMPACTIONED. (6) AS WELL AS VIBRATORY COMPACTION EQUIPMENT A STATIC ROLLER IS NECESSARY TO PRESS DOWN THE COARSE GRAVEL AND MAKE THE JOINTS FIRM. AND (7) THE POSSIBILITY OF COMBINING THE CONSTRUCTIVE ADVANTAGES OF A BONDED ROADBASE WITH THOSE OF THE COARSE GRAVEL ROADBASE IS OFFERED BY THE COARSE GRAVEL FILLED WITH BITUMINOUS SLURRY. /FG/RRL/

Milde, F *Strasse, Berlin /Germany/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 231953

SIGNIFICANCE AND PROBLEMS OF SOIL COMPACTION IN ROAD CONSTRUCTION (IN GERMAN)

WATER CONTENT AND COMPACTION EFFORT DETERMINE THE EFFECT OF THE COMPACTION; LESSER WATER CONTENTS AND GREATER COMPACTION EFFORTS RESULT IN HIGHER DRY DENSITIES. NON-COHESIVE SOILS ARE COMPACTIONED BY VIBRATORY MACHINES; THEIR EFFICIENCY IS AT ITS GREATEST AT ABOUT 15 CM. DEEP, BUT NIL ON THE SURFACE. FOR THE COMPACTION OF GRAVELLY SAND WITHIN A 20-50 CM. THICK FROST BLANKET COURSE ON A YIELDING BASE LIGHTER MACHINES ARE BETTER THAN HEAVY ONES, WHILE FOR ROCK FILLING EXTREMELY HIGH COMPACTION FORCES ARE NECESSARY. /FG/ RRL/

Floss, R *Strassenbau, Dusseldorf /Germany/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 231968

REINFORCED SOIL-CEMENT (IN RUSSIAN)

AN INVESTIGATION INTO THE PROPERTIES OF REINFORCED SOIL-CEMENT SUBJECTED TO SHORT-TERM LOADING, AND ITS APPLICATION TO ROAD CONSTRUCTION IS PRESENTED. THE EFFICIENCY OF THE REINFORCEMENT WAS TESTED ON SOIL-CEMENT SAMPLES MADE WITH LOESS SILTS FROM THE REGION OF VOLGOGRAD, WHICH HAD A LIQUID LIMIT EQUAL TO 31.8 AND 18.1 PER CENT. THE TESTS SHOW THAT, EVEN WITH A LOW PERCENTAGE OF REINFORCEMENT, THE BEARING CAPACITY OF SOIL-CEMENT CAN BE DOUBLED. BECAUSE SOIL-CEMENT HAS A HIGH RESISTANCE TO CRACK-

ING, ITS IMPORTANCE IN THE DISTRIBUTION OF THERMAL STRESSES IN THE PAVEMENT LAYERS TREATED IS EMPHASIZED. THIS CONSTRUCTION METHOD SHOULD PROVE ECONOMICAL FOR THE CONSTRUCTION OF BASE COURSES AS IT ENABLES THE QUANTITY OF SOIL-CEMENT USED TO BE REDUCED; THE COST OF A CUBIC METER OF REINFORCED SOIL-CEMENT IS QUOTED. /LCPC/RRL/

Dobrinskii, LK
Stroitel' Stvoi Arkhitektura /Ussr/

ACKNOWLEDGMENT: Road Research Laboratory /UK/

**2A 231974
CEMENT-STABILIZED MATERIALS FOR THE CONSTRUCTION OF HIGHWAY EMBANKMENTS /IN FRENCH/**

A METHOD IS DESCRIBED OF STABILIZING SILTY SAND EMBANKMENTS WITH CEMENT, BASED ON LABORATORY TESTS CARRIED OUT ON SAMPLES WHICH WERE IMMERSSED IN WATER TWO HOURS AFTER THEIR PREPARATION. REFERENCE IS MADE TO FURTHER LABORATORY TESTS ON LONG-TERM WATER RESISTANCE OF CEMENT-TREATED MATERIALS, THEIR FROST RESISTANCE, EVOLUTION IN STRENGTH, AND CRITICAL VALUES RELATING TO THE PROPORTIONING OF THE BINDER. /LCPC/RRL/

Vogt, K
La Route En Beton /Switzerland/

ACKNOWLEDGMENT: Road Research Laboratory /UK/

**2A 231979
ERRORS IN PAVEMENT CONSTRUCTION PROJECTS /IN RUSSIAN/**

STABILIZATION WITH CEMENT HAS BEEN WIDELY USED IN THE KAZAKST REGION FOR THE CONSTRUCTION OF ROAD-BASES AND SUB-BASES. IN TWO SECTIONS THE UPPER PART OF THE COHESIVE SOIL EMBANKMENT CONSISTED OF 40 TO 50 CM OF DRAINAGE SOIL WHICH WAS ALSO USED AS A FROST BLANKET COURSE. IT IS FREQUENTLY ARGUED THAT GEOLOGICAL STUDIES, THE ORGANIZATION OF THE WORKS, AND STORAGE AND TRANSPORT PROBLEMS DO NOT RECEIVE SUFFICIENT ATTENTION AT THE PLANNING STAGE. /LCPC/RRL/

Kilmatov, R *Avtomobil Nye Dorogi /Ussr/*

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

**2A 231983
STUDY OF THE EFFECTIVENESS AND USE OF SOIL STABILIZATION IN ROAD CONSTRUCTION IN KAZAKHSTAN (IN RUSSIAN)**

OBSERVATIONS ARE RELATED ON THE BEHAVIOR OF 500 KM. OF ROADS BUILT BETWEEN 1956 AND 1964 IN VARIOUS PARTS OF KAZAKHSTAN. A COMPARATIVE STUDY IS MADE OF THE MECHANICAL CHARACTERISTICS OF MATERIALS AND SOIL USED IN 14 DIFFERENT TYPES OF PAVEMENT BUILT IN ACCORDANCE WITH CURRENT SPECIFICATIONS. /LCPC/RRL/

Sas'ko, NF *Trudy Soyuzdornii /Ussr/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

**2A 231989
CONSTRUCTION OF ROADS USING SOIL STABILIZED WITH LIGNOSULPHATE /IN RUSSIAN/**
AN IMPROVEMENT IS REPORTED IN THE BEARING CAPACITY AND IMPERVIOUSNESS OF SOIL RESULTING FROM THE USE OF BY-PRODUCTS OF WOOD PULP MANUFACTURE FOR SOIL STABILIZATION. /LCPC/RRL/

Knyazyuk, KA Soborovskaya, IS Netsai, VL *Avtomobil Nye Dorogi /Ussr/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

**2A 232004
GENERAL REPORTS PRESENTED BY THE USSR AT THE SECOND CONFERENCE ON ROAD CONSTRUCTION PROBLEMS HELD BY SOCIALIST COUNTRIES IN WARSAW, IN 1966 (IN RUSSIAN)**

THIS PUBLICATION CONTAINS THE FOLLOWING REPORTS: (1) METHODS OF SOIL STABILIZATION BY THE COMBINED ACTION OF BINDERS AND CHEMICAL ACTIVATORS, (2) CONSTRUCTION METHODS FOR ASPHALTIC CONCRETE SURFACINGS AND WORK MECHANIZATION, (3) CONSTRUCTION OF ROADS WITH ROUGH SURFACINGS AND COMPOSITION OF NON-SKID LAYERS APPLIED DURING ROAD MAINTENANCE, AND (4) CONSTRUCTION TECHNOLOGY FOR PRESTRESSED CONCRETE SURFACINGS. /LCPC/RRL/

Soyuzdornii /Ussr/

ACKNOWLEDGMENT: Road Research Laboratory /UK/

**2A 232022
TREATMENT OF SILT WITH A THICK LAYER OF QUICKLIME /IN FRENCH/**

THE IN-SITU TREATMENT IS DESCRIBED OF WET SILT WITH A SINGLE THICK LAYER OF QUICK LIME FOR IMPROVING THE SUBGRADE OF A ROAD UNDER CONSTRUCTION. THE MIXING MACHINE USED IS AN AMERICAN REX DEEP MIX WHICH CAN TREAT A LAYER OF SILT APPROXIMATELY 40 CM THICK (MEASURED AFTER COMPACTION). DETAILS ARE GIVEN OF THE PRELIMINARY STUDIES, EQUIPMENT USED, WORK PROGRESS AND OBSERVATIONS MADE DURING CONSTRUCTION. THERE REMAINS TO DEFINE SPECIFICATIONS FOR THE PULVERIZING OF SOIL AFTER MIXING TO DISTINGUISH THE TREATMENT OF SUBGRADES FROM THAT OF EMBANKMENTS, AND TO IMPROVE PRESENT COMPACTION METHODS. /LCPC/A/RRL/

Morenval, P *Bull Liaison Labs Routiers /France/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

**2A 232031
A STUDY ON MOISTURE MOVEMENT IN ALLUVIAL SOILS UNDER ROAD SURFACES FOR ECONOMICAL DESIGN OF PAVEMENTS**

MOST OF THE AREAS IN NORTHERN INDIA HAVE HIGH WATER TABLES WHICH RANGE FROM 4 TO 9 FT DURING THE YEAR. IN THE ABSENCE OF ANY AUTHENTIC INFORMATION ABOUT THE MAXIMUM MOISTURE CONTENTS ATTAINED BY THE SUBGRADES, THE DESIGN OF ROAD PAVEMENTS IN SUCH AREAS IS CARRIED OUT FOR SATURATED CONDITIONS. THIS WILL ADVERSELY AFFECT THE COST OF CONSTRUCTION IF, IN ACTUAL PRACTICE, THE SUBGRADE IS NOT SATURATED. THE PAPER DEALS WITH A FIELD STUDY ON THE MOISTURE CONTENT ATTAINED BY THE SUBGRADES AT DIFFERENT TIMES OF THE YEAR BOTH UNDER SURFACED AND UNSURFACED PAVEMENTS. THE RESULTS INDICATE THAT UNDER SEALED SURFACE THERE IS A TENDENCY FOR THE SUBGRADE MOISTURES FOR A DEPTH OF ABOUT 2 FT TO ATTAIN EQUILIBRIUM, IRRESPECTIVE OF THE WIDE VARIATIONS IN THE MOISTURE CONTENTS OF THE ADJOINING UNSURFACED AREA. THE MAXIMUM MOISTURES ATTAINED ARE WELL BELOW SATURATION UNDER THE SURFACED AREA. RESULTS FURTHER INDICATE THAT THE VERGE EFFECT TRAVELS TO A DISTANCE OF ABOUT 4 FT. /RRL/CA/

Uppal, HL *Australian Road Research Board Proc*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

**2A 232040
USE OF A MATERIAL FORMED BY FERRIC OXIDES IN THE PAVEMENT OF A ROAD: COMPARATIVE STUDY WITH THE OTHER SOLUTIONS**

IN THE SOUTH-EAST OF ANGOLA, FERRIC OXIDE DEPOSITS OCCUR OVER EXTENSIVE REGIONS OF KALAHARI SAND. ITS FORMATION AND CHEMICAL COMPOSITION ARE STUDIED.

CONCLUSIONS ARE GIVEN ON ITS POSSIBLE USE AS A ROAD MATERIAL, BASED ON RESULTS OF GEOTECHNIC TESTS AND FROM EXPERIENCE OBTAINED FROM EXISTING PAVEMENTS. VARIOUS TYPES OF PAVEMENTS ARE STUDIED AND AN ANALYSIS OF CONSTRUCTION COSTS IS MADE. CONCLUSIONS ARE PRESENTED AS TO THE BEST SOLUTIONS. /RRL/

Dasilva, CAF Guimaraes, JM Martins, AA *Soil Mech & Fdn Eng Proc /South Africa/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 232044

PROBLEMS IN THE USE AND TESTING OF CEMENT-STABILIZED SOILS /IN GERMAN/

THE AUTHOR DISCUSSES CEMENT-STABILIZED SOIL AS A CONSTRUCTION ELEMENT IN ROADS CARRYING HEAVY TRAFFIC, WITH PARTICULAR REFERENCE TO ITS COMPRESSIVE STRENGTH; OTHER USES OF CEMENT STABILIZED SOILS IN OTHER COUNTRIES (U.S.A., GREAT BRITAIN, HOLLAND AND SWITZERLAND), AND FINALLY THE USE OF CEMENT-STABILIZED SOILS IN AGRICULTURAL ROAD CONSTRUCTION. A NEW VERSION OF THE RECOMMENDATIONS (OF THE PROVISIONAL NOTE) FOR THE STABILIZATION OF SOIL WITH CEMENT IS RECOMMENDED. /FG/RRL/

Buchholz, H *Strasse Und Autobahn /Germany/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 232050

THE PROBLEM OF FROST PROTECTION IN ROAD CONSTRUCTION /IN GERMAN/

THE UNRELIABILITY OF METHODS USED TO ELIMINATE FLUCTUATIONS IN STRENGTH AND BEARING CAPACITY OF ROADS DUE TO THE ACTION OF FROST IS ESTABLISHED. IT IS SUGGESTED THAT EFFORTS SHOULD BE MADE TO IMPROVE THE DURABILITY OF THE ROAD AGGREGATE RATHER THAN TO INCORPORATE SPECIAL FROST BLANKET COURSES DURING CONSTRUCTION. THIS WOULD BE PARTICULARLY USEFUL IN AREAS WHERE SAND AND GRAVEL IS EXPENSIVE AND DIFFICULT TO OBTAIN. /FG/RRL/

Keil, K *Bruecke Und Strasse /Germany/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 232051

THE PRINCIPLES AND OBJECT OF SOIL STABILIZATION IN ROAD CONSTRUCTION (IN GERMAN)

THE SIGNIFICANCE OF ACTIVE AND PASSIVE SOIL STABILIZATION IN ROAD CONSTRUCTION IS OUTLINED, AND SOIL MECHANICS PRINCIPLES, SUCH AS SOIL AS A THREE-PHASE SYSTEM, GRAIN DISTRIBUTION, INFLUENCE OF WATER AND SIGNIFICANCE OF COMPACTION ARE DISCUSSED. PARTICULAR REFERENCE IS MADE TO SOIL STABILIZATION WITH CEMENT AND THE DEPENDENCE OF THE STRENGTH OF THE STABILIZED SOIL ON THE CEMENT CONTENT AND GRAIN DISTRIBUTION, AND THE IMPORTANCE OF MIXING PROCESSES AND COMPACTION IS STRESSED. MOISTURE CONTENT AND EVAPORATION IN CEMENT STABILIZED SOILS ARE ALSO DISCUSSED. /FG/RRL/

Aichhorn, W
Osterreichische Ingenieur /Aust/

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 232053

MIXED-IN-PLACE OR PLANT-MIXED METHOD FOR SOIL STABILIZATION FOR LOW-COST ROAD CONSTRUCTION? (IN GERMAN)

THE ECONOMICS OF THE MIXED-IN-PLACE METHOD AND THE PLANT-MIXED METHOD ARE COMPARED. IT IS SHOWN THAT THE MIXED-IN-PLACE METHOD IS LESS COSTLY FOR THE STABILIZATION OF SOILS ON OR IN THE REGION OF THE

CONSTRUCTION SITE, AND THEREFORE THIS METHOD IS RECOMMENDED FOR LOW-COST ROAD CONSTRUCTION WHERE WORK IS CARRIED OUT MAINLY WITH LOCAL MATERIALS IN SMALL CONTRACT SECTIONS. IT IS CONCLUDED THAT THE MIXED-IN-PLACE METHOD IS USUALLY CHEAPER FOR SOIL STABILIZATION PROVIDED THAT SUITABLE CONSTRUCTION MACHINERY IS USED. /FG/ RRL/

Fauth, C *Strasse, Berlin /Germany/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 232054

USE OF CEMENT-BOUND MATERIALS IN THE CONSTRUCTION OF HIGHWAY EMBANKMENTS /IN GERMAN/

THE ADMIXTURE OF CEMENT TO SILTY SAND SOILS TO OBTAIN WATERPROOF STABILIZATION BY REDUCING THE WATER ABSORPTION CAPACITY SHORTLY AFTER THE BEGINNING OF HARDENING, AND THUS PREVENTING DAMAGE BY RAINFALL IS DISCUSSED. FURTHER LABORATORY TESTS ARE RECOMMENDED IN ORDER TO CLARIFY LONG TERM WATER RESISTANCE, FROST ACTION, STRENGTH DEVELOPMENT AND LIMIT VALUES FOR BINDER PROPORTIONING. /FG/RRL/

Vogt, K
Betonstrassen /Switzerland/

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 232055

CEMENT-BOUND ROAD BASES IN EUROPE /IN GERMAN/ SOIL STABILIZATION WITH CEMENT IS DISCUSSED. VARIOUS ARTICLES ON CEMENT STABILIZATION BY SPECIALISTS IN THE FIELDS OF ROAD ADMINISTRATION AND CONSTRUCTION ARE INCLUDED. THESE ARE: VOGT, K: SOIL STABILIZATION WITH CEMENT IN SWITZERLAND; SLUIS, F. A. VAN DER: THE USE OF CEMENT-BOUND ROAD FOUNDATIONS IN THE NETHERLANDS; SHARP, D. R., AND BLAKE, L. S.: CEMENT-BOUND ROAD BASES AND SUB-BASES IN GREAT BRITAIN; BONNOT, J: CEMENT-BOUND ROAD BASES IN FRANCE; SCHEIBLAUER, J: EXPERIENCES IN SOIL STABILIZATION WITH CEMENT; AND SOMMER, H: CEMENT-BOUND LAYERS IN WEST EUROPEAN ROAD CONSTRUCTION. /FG/RRL/

Betonstrassen /Switzerland/

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 232063

BITUMEN-STABILIZATION OF SANDY SOILS WITH THE UZF 70 (IN GERMAN)

THE USE OF A SINGLE-PASS SOIL MIXER, UZF 70, TO STABILIZE SANDY SOIL DURING THE CONSTRUCTION OF AN EXPERIMENTAL ROAD IS DESCRIBED. THE PROPORTION OF BINDER NECESSARY (7-11 PERCENT WEIGHT OF CUT-BACK BITUMEN EMULSION) AND THE WATER CONTENT WERE DETERMINED BY COMPUTER AND CONTROLLED BY SUITABILITY TESTS. THE 15-18-CM THICK STABILIZED LAYER WAS PRODUCED WITH MAXIMUM EFFICIENCY. THE COMPACTION WAS CARRIED OUT WITH STATIC ROLLERS, AND RUBBER-TIRED ROLLERS ARE RECOMMENDED. QUALITY TESTS SHOWED THAT COMPRESSIVE STRENGTHS OF 120 KP/CM SQUARED AND MARSHALL STABILITIES OF MORE THAN 400 KP HAD BEEN OBTAINED. THE SECTION WAS ABLE TO BE USED BY THE CONSTRUCTION SITE TRANSPORT AFTER 24 HRS. /FG/RRL/

Konnemund, W *Strasse, Berlin /Germany/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 232065

RURAL ROAD CONSTRUCTION IN STYRIA /IN GERMAN/ PRELIMINARY INVESTIGATIONS INTO THE SUITABILITY OF CLAY-OR WATER-SATURATED LAOMS FOR LIME STABILIZA-

TION ARE DESCRIBED, WITH THE CONSTRUCTION OF AN EXPERIMENTAL ROAD. TO INCREASE THE BEARING CAPACITY OF THE STABILIZED SOIL, A 10 CM THICK ASPHALTIC CONCRETE, HAVING A RELATIVELY HIGH BINDER CONTENT, WAS LAID ON TOP AND SEALED WITH A SPRAYED ON SURFACE DRESSING. THE USE OF A LIME-STABILIZED SOIL GUARANTEES A WEATHER-RESISTANT SUBSOIL FORMATION. /FG/RRL/

Hintsteiner, E *Strasse Und Autobahn /Germany/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 232080

SOIL STABILIZATION ON A NATIONAL ROAD CONSTRUCTION SITE IN TESSIN /IN GERMAN/

THE FILLING OF A 20 M HIGH ROAD EMBANKMENT WHICH WAS REQUIRED TO HAVE OPTIMUM BEARING CAPACITY AND DENSITY IS DESCRIBED. BECAUSE OF THE LIMITED TIME AVAILABLE, WORK HAD TO BE CARRIED OUT IN WINTER ON THE IN-SITU CLAYEY-SILTY GRAVEL MIXED WITH ERRATIC ROCKS, DESPITE THE FACT THAT THE GRAVEL WAS TOO WET TO BE COMPACTED PROPERLY. THE ADMIXTURE OF QUICK-LIME FOR THE PURPOSE OF STABILIZATION BROUGHT ABOUT ALTERATIONS IN THE STRUCTURE AND ALSO DECREASED THE NATURAL MOISTURE CONTENT, THUS ENABLING CONSTRUCTION PROGRAM TO BE DEVELOPED EVEN WHEN THERE WAS HEAVY FROST. IT WAS NOTED THAT DOUBLE THE AMOUNT OF LIME WAS REQUIRED WHEN THERE WAS FOG OR WHEN TEMPERATURES WERE VERY LOW. /FG/RRL/

Boros, J

Austrian Soc Engr & Architects, Vienna, Nat Kom Gesellschaft Bodehmechanick, Donau-europaische Konf.

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 232085

SOIL STABILIZATION WITH BITUMEN /IN GERMAN/

AN EXPLANATION IS GIVEN OF THE STANDARD LEAFLET SNV 640 506-" SOIL STABILIZATION WITH BITUMINOUS BINDERS" IN RELATION TO THE PERTINENT SECTIONS OF THE BASIC STANDARD SNV 640 500-" SOIL STABILIZATION-GENERAL." BITUMEN STABILIZATION UNDERTAKEN IN SWITZERLAND IS SURVEYED AND COMPARED WITH THE HOT MIX METHOD NORMALLY USED FOR SURFACING CONSTRUCTION. SPECIAL REFERENCE IS MADE TO THE VARIOUS TYPES OF SOIL AND BINDER. DATA ARE GIVEN ON THE USE OF BITUMEN-STABILIZED SOIL IN ROAD CONSTRUCTION. THE SUITABILITY TESTING OF THE CONSTRUCTION MATERIALS, ESTABLISHMENT OF BINDER CONTENTS, CHOICE OF LAYER THICKNESSES AND WORKING METHODS AND EQUIPMENT ARE DESCRIBED. /VSS/FG/RRL/

Bissegger, E *Strasse Und Verkehr /Switzerland/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 232086

SOIL STABILIZATION WITH CEMENT AND LIME /IN GERMAN/

A DESCRIPTION IS GIVEN OF (1) THE BINDERS AND THEIR ACTION IN THE SOIL; (2) THE EFFECTS OF SOIL MECHANICS PROPERTIES SUCH AS MOISTURE CONTENT, COHESION, FROST RESISTANCE AND WATER RESISTANCE; (3) CONSTRUCTION METHODS AND CURING; (4) THE EQUIPMENT REQUIRED BY VARIOUS CONSTRUCTION METHODS; (5) THE TESTING OF PROPERTIES OF STABILIZED SOIL. STABILIZATION ENABLES OTHERWISE UNSUITABLE MATERIALS TO BE USED AND SAVINGS ON HIGH-QUALITY GRAVEL TO BE MADE. /VSS/FG/RRL/

Vogt, K

Hoch Und Tiefbau, Zurich /Switz/

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 232090

CEMENT STABILIZATION OF LOGGING ROADS

THE MANUFACTURE OF PULP AND PAPER IS THE LEADING INDUSTRY IN CANADA. IT IS ALSO THE LARGEST USER OF TRANSPORTATION. THERE IS ALSO A GROWING TREND IN THE INDUSTRY TO INCREASE THE PROPORTION OF PULPWOOD TRANSPORTED BY ROAD. THIS ARTICLE REVEALS FINDINGS THAT SOIL CEMENT ROADS COULD IN EFFECT SAVE THE INDUSTRY UPWARDS OF 2 CENTS PER CORD-MILE. TO CARRY THE HEAVIER LOADS AT INCREASED SPEEDS, ROAD BASES MUST BE MADE STRONGER AND SURFACES SMOOTHER. A SOIL CEMENT BASED ROAD PROVIDES GREATER ROAD BEARING CAPACITY, LESS BASED DEFLECTION IN SUBGRADE PRESSURES, CONSIDERABLE STRENGTH GAIN WITH AGE, SPEED OF CONSTRUCTION, AND LOWER COST FOR THE SURFACE COAT. /CGRA/RRL/

Temple, D

Pulp and Paper Magazine /Canada/

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 232099

A STUDY OF GRAVEL AND OTHER SOIL: AGGREGATE MIXTURES FOR THEIR SUITABILITY IN ROAD CONSTRUCTION

ARTIFICIALLY PRODUCED GRAVEL OBTAINED BY MIXING CERTAIN PROPORTIONS OF SOFT AGGREGATES, LIKE BURNED BRICK BALLAST, WITH A PROPERLY GRADED SOIL HAS BEEN USED RECENTLY FOR ROAD CONSTRUCTION IN THE PUNJAB. THIS SPECIFICATION HAS BEEN FOUND UNSATISFACTORY IN AREAS WHICH ARE LIABLE TO WATERLOGGING AND FLOODING. THE OBJECT IS TO INVESTIGATE THE SUITABILITY OF MIXTURE WITH SOIL OF OTHER AGGREGATES SUCH AS KANKER, STONE METAL, SHINGLE AND OTHER SUCH WATER-RESISTANT MATERIAL. THIS WAS UNDERTAKEN TO EVOLVE AN ECONOMICAL SPECIFICATION TO REPLACE THE CONVENTIONAL BRICK OR STONE BOULDER SOLING OR EVEN STONE METAL WEARING COURSE IF POSSIBLE. /RRL/

Uppal, IS Singh, R *Indian Roads Congress Road Res Bull*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 232123

FOUNDATION DESIGN AND CONSTRUCTION

THIS IS A MANUAL ON FOUNDATION CONSTRUCTION FOR DESIGNERS AND CONSTRUCTION ENGINEERS, FIRST PUBLISHED IN 1963. IT CONTAINS CHAPTERS ON THE FOLLOWING SUBJECTS: SITE INVESTIGATIONS AND SOIL MECHANICS, THE GENERAL PRINCIPLES OF FOUNDATION DESIGN, FOUNDATION DESIGN IN RELATION TO GROUND MOVEMENTS, SPREAD FOUNDATIONS, BUOYANCY RAFTS AND BASEMENTS (BOX FOUNDATIONS), PIER AND CAISSON PILES AND PILE GROUPS, PILED FOUNDATIONS, STRUCTURAL DESIGN AND CONSTRUCTION METHODS, FOUNDATIONS CONSTRUCTION, COTTERDAMS, THE CONTROL OF GROUNDWATER IN EXCAVATIONS SHORING AND UNDERPINNING, PROTECTION OF FOUNDATION STRUCTURES AGAINST ATTACK BY SOIL AND GROUND WATER. /RRL/

Tomlinson, MJ

Pitman, Sir Isaac & Sons Ltd /England/

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 232129

PROBLEMS IN THE USE OF IRON-RICH LATERITES IN THE ROADWAY STRUCTURE-S.E. THAILAND

SOIL SURVEY WORK FOR A COASTAL HIGHWAY IN S. E. THAILAND REVEALED AN EXTENSIVE AREA IN WHICH LATERITE AND LATERITIC SOIL PREDOMINATE. THE DEVELOPMENT OBSERVED IS CHARACTERISTIC OF THE LATERITES OF THAILAND IN GENERAL. FOR PROJECT PURPOSES, DIFFERENTIATION OF THE TERMS "LATERITIC SOIL" AND "LATERITE"

WAS CONSIDERED NECESSARY. DETRIMENTAL ENGINEERING PROPERTIES OF THE LATERITIC GRANULAR MATERIALS ENCOUNTERED, ARE THEIR POTENTIALITY FOR DEGRADING UNDER MECHANICAL STRESS, AND THEIR PLASTICITY. THESE PROPERTIES ARE PRIMARILY RESPONSIBLE FOR UNSATISFACTORY PERFORMANCE OF EXISTING ROADS IN THE AREA WHERE LATERITIC GRANULAR MATERIALS ARE USED IN THE PAVEMENT STRUCTURE. IN AN EFFORT TO BRING THE MATERIALS WITHIN PROJECT REQUIREMENTS, STABILIZATION TECHNIQUES WERE STUDIED IN THE LABORATORY. OF THE FOUR TECHNIQUES TRIED, ONLY CEMENT TREATMENT AND BLENDING WITH NON-LATERITIC UNIFORM SAND APPEARED SATISFACTORY. /RRL/A/

Wigginton, WB *Asian Conf Soil Mech & Fdn E Proc /Is/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 232147

THE USE OF SLAG-TREATED MATERIALS IN THE DOMONT BY-PASS /IN FRENCH/

THE PROBLEMS OF DESIGN, APPLICATION AND CONSTRUCTION TIME RESULTING FROM THE VERY LOW QUALITY OF EXCAVATED SOILS AND THE UNEXPECTEDLY HIGH LEVEL OF THE WATER-TABLE DURING THE CONSTRUCTION OF THE DOMONT-PONCELLS BY-PASS ARE OUTLINED. GRANULATED SLAG WAS USED FOR TREATING THE SUB-BASE (FINE SAND) AND BASE COURSE (0/25 SLAG). DETAILS OF THE MATERIALS, PRODUCTION, APPLICATION AND CONTROL METHODS USED FOR EACH LAYER ARE GIVEN. THE COST OF THE MATERIALS UTILIZED IS QUOTED. /LCPC(A)/RRL/

Compere, C Lefort, M Coutant, R *Bull Liaison Labs Routiers /France/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 232170

DEPTH FAILURE OF BRIDGE ABUTMENTS /IN RUSSIAN/

FOUR CASES OF DEPTH FAILURE OF BRIDGE ABUTMENT FOUNDATIONS CAUSED BY THE CONSTRUCTION OF ACCESS EMBANKMENTS SEVEN TO TEN METERS HIGH ARE STUDIED. IN ONE CASE, THE BRIDGE BEARINGS AND END SPANS COMPLETELY COLLAPSED. OBSERVATIONS SHOWED THAT THIS WAS DUE TO INSUFFICIENT PRELIMINARY SOIL INVESTIGATION AND ERRONEOUS INTERPRETATION OF THE RESULTS. ERRORS IN THE ESTIMATION OF THE SOIL MECHANICS CHARACTERISTICS, AND ERRORS IN EVALUATING THE STRESSES ON THE INFRASTRUCTURE OF THE BRIDGE SOLUTIONS ADOPTED IN EACH CASE ARE DESCRIBED. TO PREVENT SIMILAR FAILURES, THE FOLLOWING RECOMMENDATIONS ARE PUT FORWARD: THE RIVER BANK SHOULD NOT BE SUBJECTED TO THE LOADING OF A HIGH EMBANKMENT EVEN IF THIS MEANS CONSTRUCTING AN EXTRA SPAN; THE BRIDGE BEARINGS SHOULD REST ON THE TOP OF THE BANK AND NOT HALF-WAY UP THE SLOPE. EMPHASIS IS LAID ON STRICT CONTROL OF THE STABILITY OF THE BANK AFTER THE CONSTRUCTION OF AN ACCESS EMBANKMENT. /LCPC/RRL/

Luga, AA
Izdatelstvo Transporti, Moscow /Ussr/

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 232193

FIFE MOTORWAY CROSSES INTENSIVE MINING AREA CONSTRUCTIONAL DETAILS ARE GIVEN OF THE SECTION OF THE M90 WHICH CONTINUES THE INVERKEITHING TO PERTH MOTORWAY THROUGH FIFE INTO KINROSS-SHIRE AND IS BUILT ABOVE MINERAL WORKINGS. SPECIAL MENTION IS MADE OF METHODS USED FOR CONSOLIDATING BELOW GROUND CAVITIES AT A NUMBER OF BRIDGE SITES. /RRL/

Contract Journal /UK/

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 232222

TORONTO SUBWAY EXTENSION CUTS ACROSS RIVER VALLEY

THE PROBLEMS CAUSED BY A HIGH WATER TABLE UNDERLYING SILTY FLOOD PLAIN SOILS ARE BEING OVERCOME ON A 2300 FT SECTION OF TORONTO'S SUBWAY. THE JOB CALLS FOR EXCAVATION OF SILTY FILL TO AN AVERAGE DEPTH OF 35 FT PLUS CONSTRUCTION OF THE CONCRETE SUBWAY TUBE SECTIONS. TWO PARALLEL LINES OF SOLDIER PILES WERE DRIVEN, BETWEEN WHICH HEAVY TIMBER LAGGING WAS FITTED FOR SHORING PURPOSES. SOILS ENCOUNTERED WERE GENERALLY DENSE FINE SAND GLACIAL TILL. TO COPE WITH THE DRAINAGE PROBLEM CAUSED BY THE HIGH WATER TABLE, A DEWATERING SYSTEM WAS INSTALLED. THIS SYSTEM IS EFFECTIVE AT MUCH GREATER DEPTHS THAN WITH CONVENTIONAL PUMPS. BECAUSE OF THE HIGH WATER TABLE, THE TUNNEL WILL HAVE A TENDENCY TO FLOAT. CONCRETE BALLAST IS BEING ADDED TO PREVENT THIS. /CGRA/RRL/

Rooke, W *Heavy Construction News /Canada/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 232229

MECHANICAL PROPERTIES OF PEATY GROUND FOR FOUNDATION OF EMBANKMENT

RESULTS OBTAINED FROM A TEST FILL ON SOFT PEATY GROUND DURING THE CONSTRUCTION OF THE TOKYO-NAGOYA MOTORWAY ARE DESCRIBED. THE TEST FILL WAS UNDERTAKEN TO PERMIT EXAMINATION OF THE SLIDING FAILURE OF EMBANKMENTS ON DIFFERENTLY TREATED FOUNDATIONS. THE TWO PHASES OF THE STUDY WERE (1) THE SLIDING FAILURE TEST OF EMBANKMENTS ON UNTREATED PEAT FOUNDATIONS AND THOSE TREATED WITH SPECIAL SAND COMPACTION PILES (COMPOSES PILES), AND (2) THE LONG-TERM OBSERVATION OF THE BEHAVIOR OF PEAT FOUNDATIONS TREATED WITH ORDINARY SAND PILES AND WITH SAND COMPACTION PILES. /RRL/

Yamamoto, M Hoshi, T
Japan Road Association

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 232233

CEMENT-STABILIZED CHALK FOR ROAD CONSTRUCTION LABORATORY AND FIELD TESTS ARE AIMED AT DETERMINING THE SUITABILITY OF CEMENT-STABILIZED SOFT CHALK AS A BASE OR SUB-BASE MATERIAL TO OBTAIN INFORMATION ON PERFORMANCE AND DURABILITY UNDER TRAFFIC. TWO MAJOR PROBLEMS EXPOSED BY THESE TESTS ARE: (1) THE NEED TO REMOVE FLINTS WHICH ARE LIKELY TO DAMAGE THE BLADES OF MIXERS, AND (2) THE SELECTION OF THE MOISTURE CONTENT FOR THE STABILIZED CHALK MIXTURE. EXPERIMENTAL SECTIONS ON THE A30 AT COCKFORD DOWN, HAMPSHIRE, CONSTRUCTED WITH A STABILIZED CHALK SUB-BASE, HAVE PERFORMED SATISFACTORILY. /RRL/

Pocock, RG *Surveyor and Municipal Engineer /UK/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 232244

THE PHENOMENON OF AGGREGATION IN THE STABILIZATION OF SOILS WITH CEMENT

THE PHYSICO-CHEMICAL CHANGES CAUSED BY THE STABILIZATION OF A BLACK COTTON SOIL AND AN ALLUVIAL CLAY WITH PORTLAND CEMENT ARE DESCRIBED. IN BOTH SOILS, THE ADDITION OF CEMENT LEADS TO AN AGGREGATION OF CLAY FRACTIONS TRANSFORMING THEM INTO COARSER PARTICLES AND THEREBY IMPROVING THE MECHANICAL GRADATION OF THE SOIL, AND RENDERING IT SUITABLE FOR USE IN ROAD CONSTRUCTION. /RRL/

Chadda, LR *Indian Concrete Journal*

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

2A 232267

SOIL STABILIZATION WITH LIGNITE FLY-ASH FROM THE KONIN-BASSIN /IN POLISH/
LABORATORY AND IN-SITU TESTS ON EXPERIMENTAL ROADS HAVE SHOWN THAT LIGNITE FLY-ASH FROM THE KONIN BASSIN IN POLAND IS PARTICULARLY SUITABLE FOR IMPROVING THE PHYSICAL AND MECHANICAL PROPERTIES OF SOIL USED IN ROAD CONSTRUCTION BECAUSE OF ITS HIGH FREE LIME CONTENT AND IN SPITE OF ITS HIGH SULPHATE TRIOXIDE CONTENT WHICH CAN REACH UP TO 12 PERCENT. THE BEST RESULTS WERE OBTAINED WHEN A MAXIMUM OF 15 PERCENT ASH WAS ADDED TO THE SOIL. THE ADDITION OF CEMENT TO THE ASH (AND IN THE CASE OF SANDY SOIL, OF SODIUM HYDROXIDE TO THE ASH) INCREASES THE RESISTANCE OF THE SOIL TO FROST. /LCPC/RRL/

Pachowski, J
Prace Cobirted, Warsaw /Poland/

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 232272

THE USE OF SOIL IN THE CONSTRUCTION OF SURFACINGS AND STABILIZED ROAD LAYERS /IN RUSSIAN/
THIS MONOGRAPH DESCRIBES THE EXPERIENCE ACQUIRED BY THE UKRANIAN INSTITUTE FOR ROAD RESEARCH IN THE CONSTRUCTION OF SURFACED AND NON-SURFACED ROADS WITH STABILIZED LAYERS. IT DEALS WITH SURFACINGS AND STABILIZED LAYERS TREATED WITH ORGANIC BINDERS AND MINERAL BINDERS. DETAILS ARE GIVEN OF THE MIXED TREATMENTS OF SOIL AND OF COMPACTED SOIL SURFACINGS COVERED WITH A PROTECTIVE LAYER. MAINTENANCE AND REPAIR ARE ALSO DISCUSSED. /LCPC/TRRL/

Knyazyuk, KA
Avtotransidat /Ussr/ 1961, 92 pp, Figs, 38 Tab, Photos, 19 Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

2A 232302

USE OF A "NON-WOVEN TEXTILE" IN THE CONSTRUCTION OF AN EMBANKMENT OF PEAT /IN FRENCH/
IN THE CONSTRUCTION OF A HIGHWAY EMBANKMENT IN A MARSHY AREA OF DIFFICULT ACCESS, IT WAS FOUND IMPOSSIBLE TO REPLACE THE PEAT WITH BORROW MATERIAL, AND THE EMBANKMENT WAS BUILT ON A BIDIM CARPET. DETAILS ARE GIVEN OF THE PREPARATION OF THE GROUND, THE POSITIONING OF THE CARPET, AND CONSTRUCTION AND COMPACTION OF THE EMBANKMENT, WHICH CONSISTED OF 0/50 RHINE ALLUVIAL GRAVEL. A 40 CM-THICK LAYER OF NON-COMPACTED MATERIAL PREVENTED THE LORRIES SUPPLYING THE MATERIAL FROM SINKING INTO THE GROUND (WITHOUT THE BIDIM CARPET, THE LAYER SHOULD HAVE BEEN 1 M THICK). COMPACTION WAS CARRIED OUT WITH VIBRATORY COMPACTION EQUIPMENT. SETTLEMENT MEASUREMENTS ARE BEING MADE (AFTER THREE MONTHS, MAXIMUM SETTLEMENT REACHED 1 M). A COST-BENEFIT ANALYSIS OF THE METHOD IS PRESENTED. /TRRL/

Devaux, P Guilloud, G *Bull Liaison Labs Routiers /France/* No. 53, July 1971, pp 41-4, 2 Fig, 5 Phot, 3 Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

2A 232309

HUNGARIAN EXPERIENCE IN SOIL STABILIZATION IN ROAD CONSTRUCTION /IN SERBO-CROAT/
THE PRINCIPLES USED IN HUNGARY FOR THE STABILIZATION OF SOIL WITH CEMENT, BITUMEN, LIME, AND FLY-ASH IN ROAD CONSTRUCTION ARE OUTLINED. /TRRL/

Laszlo, G
Puti Saobradaj /Yugoslavia/ No. 6, 1971, 1 Fig, 1 Tab, 5 Phot

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

2A 232310

GRANULAR IMPROVED SUBGRADES, SUB-BASES AND ROADBASES /IN SPANISH/
AFTER A BRIEF OUTLINE OF ROAD CONSTRUCTION DEVELOPMENTS, FLEXIBLE AND RIGID PAVEMENTS ARE DEFINED AND A STUDY IS MADE OF FLEXIBLE PAVEMENTS. DETAILS ARE GIVEN OF THE FLEXIBLE PAVEMENT STRUCTURE USING A PRACTICAL MODEL OF MECHANICAL BEHAVIOR, WHICH ASSUMES THAT PARTICLES ARE IDENTICAL AND SPHERICAL. THE INFLUENCE OF GRADING ON THE STRENGTH OF THE PAVEMENT IS INVESTIGATED TOGETHER WITH ITS EVOLUTION IN TIME WHEN IT CONTAINS MATERIALS WHICH ARE NOT SUFFICIENTLY HARD AND FAIL UNDER LOAD. ATTENTION IS DRAWN TO FINES CONTENT AND THE INFLUENCE OF FINES. IT SEEMS THAT THE STABILITY OF THE PAVEMENT INCREASES WITH THE VOLUME OF THE AGGREGATES. THE MECHANICAL BEHAVIOR OF AGGREGATES, THEIR MANUFACTURE, QUALITY CONTROL, AND APPLICATION ARE EXAMINED TOGETHER WITH THE INFLUENCE OF THE FINES MANUFACTURING PROCESS ON COMPACTION AND THE EQUIPMENT NEEDED. /TRRL/

Navacerrada, G
Mat, Maq Y Met Para La Constr /Spain/ No. 63, June 1969, pp 439-52, 4 Fig

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

2A 232314

GENERAL STUDY OF SOIL COMPACTION AND BITUMINOUS MIXTURES /IN SPANISH/
THE REPORT DISCUSSES THE INFLUENCE OF COMPACTION ON THE MECHANICAL BEHAVIOR OF ROAD CONSTRUCTION MATERIALS AND SHOWS THAT THE DENSITY OBTAINED HAS A DIRECT EFFECT ON THE SUBSEQUENT BEARING CAPACITY. A STUDY IS PRESENTED OF THE PROBLEM OF OBTAINING ON THE CONSTRUCTION SITE THE OPTIMUM DEGREE OF COMPACTION DETERMINED IN THE LABORATORY. THE USE OF A NUMBER OF PARAMETERS SPECIFIC TO EACH TYPE OF MATERIAL AND EACH CONSTRUCTION SITE FACILITATES THE APPROXIMATE EVALUATION OF THE ENERGY REQUIRED TO ACHIEVE THAT OPTIMUM COMPACTION. /TRRL/

Francesio, C
Vialidad /Argentina/ No. 49, Oct. 1969, pp 17-51, 33 Fig, 5 Tab, 10 Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

2A 232339

LATERAL SUPPORT OF DEEP EXCAVATIONS
THE DEVELOPMENT OF CONSTRUCTION METHODS FOR SUPPORTING DEEP EXCAVATIONS IS BRIEFLY REVIEWED. CURRENT DESIGN METHODS ARE DESCRIBED FOR CALCULATING THE EARTH PRESSURE ON SHEETED EXCAVATIONS. THESE PRESSURES DEPEND ON THE TIME OVER WHICH THE EXCAVATION MUST REMAIN OPEN AND IN SUPPORT CONDITION AND THE AMOUNT OF LATERAL YIELDING OF THE SUPPORTS WHICH CAN BE TOLERATED. THE AMOUNT OF YIELDING IS REFLECTED IN THE SETTLEMENT OF THE GROUND SURFACE AROUND THE EXCAVATION. CURRENT CONSTRUCTION PRACTICES, INCLUDING SUPPORT BY SHEET PILING, TIMBER SHEETING, CAST IN SITU DIAPHRAGM WALLING AND CONTIGUOUS BORED PILES. THE EFFICACY OF GROUND-TREATMENT PROCESSES INCLUDING GROUT INJECTIONS AND GROUNDWATER LOWERING IS MENTIONED. /RRL/

Tomlinson, MJ *Inst Civil Engineers Proc, London /UK/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 232350

ARTIFICIAL SOIL FREEZING METHOD FOR SUBWAY CONSTRUCTION
DETAILS OF THE SOIL FREEZING METHOD FOR TUNNEL CONSTRUCTION ARE OUTLINED, TOGETHER WITH A DISCUSSION OF ITS ADVANTAGES AND DISADVANTAGES. THE MAIN

PROBLEMS ASSOCIATED WITH THE SOIL FREEZING METHOD, GROUND WATER FLOW AND VOLUME CHANGE DUE TO FROST HEAVE, ARE DISCUSSED TOGETHER WITH THE HIGH COST OF THE METHOD. THE PAPER SUMMARIZES CONSTRUCTION PROJECTS IN JAPAN, IN WHICH THE SOIL FREEZING METHOD WAS USED, AND PROVIDES A DETAILED ACCOUNT OF ONE MAJOR APPLICATION OF THE METHOD TO TUNNEL CONSTRUCTION UNDER KANASUGI BRIDGE IN TOKYO. /RRL/

Endo, K
Civil Engineering /Japan/

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 232356

HIGHWAYS EARTHWORKS FEATURE

SIX AUTHORS REVIEW ASPECTS OF THE DESIGN AND PRACTICE OF EARTHWORKS, SOIL MECHANICS, RECENT EARTHWORKS PROJECTS, AND EARTHMOVING METHODS. TITLES AND AUTHORS ARE AS FOLLOWS: EARTHWORKS ON MOTORWAYS FROM THE VIEWPOINT OF THE DESIGN ENGINEER, E. J. ARROWSMITH. EARTHWORKS AND THE SPECIALIST CONTRACTOR, D. HAMPTON, EARTHMOVING PROBLEMS ON CONTRACTS C6 AND C7, MIDLAND LINKS MOTORWAYS, K. A. STEUART. SITE INVESTIGATION OR LOOK BELOW BEFORE YOU BUILD, J. C. FINNEGAN. SIZING HAULING EQUIPMENT TO GET MAXIMUM PRODUCTIVITY, R. C. GESSEL. SELECTION OF CORRECT TIRE TREAD FOR EARTHMOVER OPERATIONS, B. MCKINLEY. /TRRL/

Highways and Traffic Engineering /UK/ Vol. 39 No 1736/7, Apr. 1971, pp 18-37, Figs, Photos

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

2A 232373

LIME STABILIZED SOIL-A RELEVANT METHOD FOR ROAD CONSTRUCTION IN NORWAY? /IN NORWEGIAN/
THE DIFFERENT ASPECTS OF LIME AS A SOIL STABILIZING FACTOR ARE REVIEWED TOGETHER WITH ITS EFFECTS. APART FROM IMMEDIATE IMPROVEMENT IN THE WORKABILITY OF THE STABILIZED CLAY, THERE IS SOME EVIDENCE THAT THE LIME HAS A LONG-TERM IMPROVING EFFECT ON THE CLAY BELOW THE STABILIZED LAYER. IT WAS OBSERVED THAT ROADS, WHERE LIME HAD BEEN APPLIED TO STABILIZE THE SUBSOIL, SEEM TO BE LESS SUSCEPTIBLE TO DAMAGE FROM FROST ACTION THAN SIMILAR ROADS IN THE SAME AREA WHERE LIME HAS NOT BEEN APPLIED. THE MAIN REASON FOR USING LIME FOR STABILIZING THE SUBSOIL IS TO ALLOW CONSTRUCTION WORK TO CONTINUE UNDER ADVERSE WEATHER CONDITIONS. /RRL/

Gunleiksrud, T
Bygg /Norway/ Vol. 19 No. 3, Apr. 1971, pp 30-3, 5 Fig, 9 Phot, 6 Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

2A 232374

MOTORWAYS NOT SUBJECT TO SETTLEMENT /IN DUTCH/
SOIL CONDITIONS IN THE WESTERN PART OF THE NETHERLANDS GIVE RISE TO ROAD CONSTRUCTION PROBLEMS BECAUSE OF THE RATHER UNSTABLE SUB-SOIL. IN VIEW OF THE EVER GROWING NEED FOR MOTORWAYS, THE QUESTION ARISES OF HOW FAR IT IS ECONOMICALLY FEASIBLE TO USE A CONSTRUCTION ENTIRELY FOUNDED ON PILES, WHICH IN FACT FORMS A CONTINUOUS VIADUCT. THIS PROBLEM IS THE SUBJECT OF A RESEARCH PROJECT BASED ON AN EXISTING ROUTE. ITS NORTHERN SECTION IS APPROXIMATELY 24 KM (15 M) LONG. THE DESIGN OF THIS SECTION IS BASED ON AN INDUSTRIAL CONSTRUCTION METHOD. PRECAST ELEMENTS ARE USED ON A LARGE SCALE, AND THE RATE OF CONSTRUCTION SHOULD BE 10 KM (6 1/2 M) PER YEAR. THE BUDGET FOR THIS PROJECT HAS SHOWN THAT THIS METHOD FORMS AN ATTRACTIVE ALTERNATIVE TO THE TRADITIONAL ROAD CONSTRUCTION METHOD, FOUNDED ON SOIL. THE ADVAN-

TAGES OF MOTORWAYS NOT SUBJECTED TO SETTLEMENT ARE DISCUSSED: NO REPAIR OF DAMAGE CAUSED BY SETTLEMENT, NO PROBLEM OF OBTAINING LARGE QUANTITIES OF SAND, POSSIBILITY OF MAINTAINING THE EXISTING WATER BALANCE IN THE AREA WHERE THE ROAD IS BEING BUILT. PROBLEMS CONCERNING THE APPEARANCE OF THIS TYPE OF CONSTRUCTION AS WELL AS POSSIBLE TRAFFIC ENGINEERING ASPECTS OF SUCH A SOLUTION ARE OUTLINED AND DISCUSSED. /RRL/

Buggeling, AS Hartmann, JA *Cement, Amsterdam* /Neth/

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

2A 232379

USE OF LIME STABILIZED MOORUM IN THE SCIENTIFIC CONSTRUCTION OF AN AIRFIELD WITH A VIEW TO EFFECTING ECONOMY

THE CONSTRUCTION OF AN AIRFIELD AT KHAJURAH, ACCORDING TO SPECIFICATIONS PROPOSED BY THE CENTRAL ROAD RESEARCH, NEW DELHI, IS DESCRIBED: LOCALLY AVAILABLE MOORUM, STABILIZED WITH LIME IN THE LOWER LAYERS WAS USED FOR ALMOST 2/3 OF THE PAVEMENT THICKNESS. THIS METHOD OF CONSTRUCTION RESULTED IN CONSIDERABLE SAVINGS IN COST, COMPARED WITH CONVENTIONAL METHODS. /RRL/

Uppal, HL Wason, OP *Indian Roads Congress Road Res Bull* No. 14, 1970, pp 101-18, 4 Fig, 4 Tab

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

2A 232387

HIGHWAY MATERIALS, CHAPTER 8; SOIL STABILIZATION
INCLUDED IN THIS CHAPTER ARE THE FOLLOWING: (1) PORTLAND CEMENT STABILIZATION (DESCRIPTIVE TERMS, AND THE STABILIZATION PROCESS); (2) LIME STABILIZATION (STABILIZATION MATERIALS, THE STABILIZATION PROCESS, AND USE IN HIGHWAY CONSTRUCTION); (3) BITUMINOUS STABILIZATION (SAND BITUMENS AND SOIL BITUMEN). /TRRL/

Krebs, RD Walker, RD
Mcgraw Hill Book Company 1971, pp 224-44, 2 Fig, 3 Tab, 30 Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

2A 232399

BITUMINOUS STABILIZATION OF WYOMING HEAT-ALTERED SHALE

WYOMING HAS FUTURE HIGHWAY PROJECTS THAT WILL PASS THROUGH AREAS LACKING FIRST-CLASS AGGREGATES, BUT CONTAINING A QUANTITY OF UNPROVEN HEAT-ALTERED SHALE AGGREGATE. CONSIDERING THE POSSIBLE TRANSPORTATION SAVINGS IF THE SHALE WERE TO BE USED, RESEARCH WAS UNDERTAKEN TO EXPLORE THE POSSIBILITY OF IMPROVING THE UTILITY OF ASPHALT AS A STABILIZER FOR HEAT-ALTERED SHALE BY THE USE OF TRACE QUANTITIES OF CHEMICAL ADDITIVES KNOWN TO REACT WITH ASPHALT, OR WITH SOIL-MINERAL SURFACES. RESULTING MARSHALL DESIGN CONTROL METHODS (ASTM D 1559-58T) AND EFFECTIVE WEATHERING TESTS WERE USED TO EVALUATE THE MATERIALS USED. VARIOUS ASPHALTS AND/OR ADDITIVES WERE WELL ABOVE THE MINIMUM DESIGN CRITERIA FOR ROADS RECEIVING HEAVY TRAFFIC. THUS, CONSTRUCTING ROADS OF HEAT-ALTERED SHALE WOULD BE JUSTIFIED. /AUTHOR/

Slotta, LS *Highway Research Board Bulletin*

2A 232401

A STUDY OF OCCURRENCE OF POTHOLES AND WASHBOARDS ON SOIL- AGGREGATE ROADS
RESULTS ARE PRESENTED OF A STUDY AIMED AT DETERMINING SOME OF THE CIRCUMSTANCES ASSOCIATED WITH THE OCCURRENCE OF POTHOLES AND WASHBOARDS ON

SOIL-AGGREGATE ROADS. THE STUDY CONSISTED OF A STATISTICAL ANALYSIS OF THE QUALITATIVE DATA OBTAINED FROM A ROAD CONDITION SURVEY INVOLVING ROAD SURFACES OF THE COARSE-GRADED AGGREGATE TYPE COMPOSED OF MINERAL AGGREGATE SUCH AS GRAVEL OR CRUSHED STONE AND SOME BINDER MATERIAL. RESULTS OF THE STUDY INDICATE THAT THE OCCURRENCE OF POTHOLES AND WASHBOARDS WAS DEFINITELY ASSOCIATED WITH THE VOLUME OF TRAFFIC, THE TYPE OF SURFACE MATERIAL, AND THE DRAINAGE CONDITION OF THE ROAD SURFACE. ALTHOUGH THE FINDINGS ARE ADMITTEDLY LIMITED TO THE TYPES AND CONDITIONS OF THE ROADS STUDIED, IT IS HOPED THAT THE DATA MAY BE OF VALUE IN FURTHER UNDERSTANDING THE FORMATION OF POTHOLES AND WASHBOARDS. /AUTHOR/

Huang, EY *Highway Research Board Bulletin*

2A 232416

CALIFORNIA EXPERIENCE IN CONSTRUCTION OF HIGHWAYS ACROSS MARSH DEPOSITS

EMBANKMENTS HAVE BEEN CONSTRUCTED ACROSS MARSH DEPOSITS IN CALIFORNIA BY SEVERAL DIFFERENT METHODS INCLUDING CONTROLLED RATE OF PLACEMENT AND USE OF BERMS, REMOVAL OF SOFT COMPRESSIBLE MATERIAL BY STRIPPING OR DREDGING, DISPLACEMENT OF THE WEAK SOIL BY THE EMBANKMENT, AND INSTALLATION OF VERTICAL SAND DRAINS. EXAMPLES OF EACH TYPE OF SIGN ARE CITED, WITH PLOTS OF OBSERVED SETTLEMENT. THE IMPORTANCE OF ADEQUATE EXPLORATION, TESTING AND ANALYSIS IS EMPHASIZED. THE UNCERTAINTIES AND LIMITATIONS OF THE APPLICATION OF THEORETICAL SOIL MECHANICS PRINCIPLES ARE POINTED OUT. USE OF FIELD PERMEABILITIES IS PROPOSED FOR CALCULATING RATES OF SETTLEMENT, AND A METHOD OF MEASURING IN-PLACE PERMEABILITY IS DESCRIBED. CONVENTIONAL METHODS OF PREDICTING SETTLEMENT, DERIVED FROM THE THEORY OF CONSOLIDATION, ARE NOT ALWAYS RELIABLE WHEN APPLIED TO FIBROUS PEAT. EXAMPLES ARE PRESENTED OF EMBANKMENT CONSTRUCTION ACROSS PEAT BEDS, WITH COMPARISONS OF THEORETICAL AND OBSERVED SETTLEMENT. NO ONE METHOD OF CONSTRUCTION ACROSS MARSH DEPOSITS IS SUITABLE OR ECONOMICAL FOR ALL CONDITIONS. AFTER THOROUGH EXPLORATION AND TESTING, THE STABILITY AND SETTLEMENT CAN BE ESTIMATED FOR DIFFERENT DESIGNS BY APPLYING THE PRINCIPLES OF SOIL MECHANICS. THE CHOICE OF DESIGN USUALLY WILL BE BASED ON COST COMPARISONS, TAKING INTO ACCOUNT THE ADEQUACY OF SERVICE TO THE HIGHWAY USER. /AUTHOR/

Root, AW *Highway Research Board Bulletin*

2A 232428

LIME STABILIZATION USING PRECONDITIONED SOILS

THE SCOPE OF THIS INVESTIGATION WAS TO STUDY THE DEVELOPMENT OF A NEW METHOD OF BASE CONSTRUCTION USING LIME STABILIZATION WITH A DIFFERENT CONCEPT THAN THE CONVENTIONALLY ACCEPTED ONES. IN THIS CONSTRUCTION METHOD, A FIRST APPLICATION OF LIME IS USED TO CONDITION THE SOIL CONSTITUENTS, A SECOND, TO STABILIZE THE CONDITIONED MATERIAL. THIS NEW METHOD WAS ADOPTED AFTER A STUDY OF DIFFERENT SOIL-LIME PROJECTS AND THEIR LABORATORY TESTS, THE MAIN OBJECTIVE BEING SUBSEQUENT FAILURES AND THEIR REASONS. ALL TESTS, AND FIELD EXPERIENCE, LED TO THE CONCLUSION THAT TO OBTAIN THE DESIRED PROPERTIES OF STABILIZATION WITH THESE TYPES OF SOILS THEY MUST BE TREATED WITH LIME BEFORE BEING STABILIZED AND MUST BE COMPACTED WITHIN 48 TO 72 HR AFTER THE SECOND APPLICATION OF LIME. A FURTHER TIME STUDY OF THE SOIL-LIME REACTION WAS MADE, BASED ON INFORMATION YIELDED BY THE SOIL CHARACTERISTICS TESTS. THESE TESTS REVEALED THAT LIME HAS AN INITIAL REACTION, TAKING PLACE DURING THE FIRST 48 TO 72 HR AFTER MIXING, AND

A SECONDARY REACTION, WHICH STARTS AFTER THIS PERIOD AND CONTINUES INDEFINITELY. ALSO, AN INVESTIGATION OF MOISTURE-DENSITY RELATIONS OF SOILS POINTED OUT THE EFFECTIVENESS OF CONDITIONING BEFORE STABILIZATION. CONDITIONED MATERIAL PRODUCED HIGHER DENSITIES AT LOWER MOISTURE CONTENTS AFTER STABILIZATION. /AUTHOR/

Taylor, WH Arman, A *Highway Research Board Bulletin*

2A 232430

IMPROVEMENT OF LIME STABILIZATION OF MONTMORILLONITIC CLAY SOILS WITH CHEMICAL ADDITIVES

OVER THE PAST DECADE, RESEARCH HAS SHOWN THAT LIME PRODUCES BENEFICIAL RESULTS WITH CLAYEY MATERIALS, ALTHOUGH THE UNCONFINED COMPRESSIVE STRENGTHS OF CLAYEY SOIL-LIME MIXTURES ARE RELATIVELY LOW. THE INVESTIGATION REPORTED IN THIS PAPER SHOWS THAT LIME IN COMBINATION WITH SMALL QUANTITIES OF AN INEXPENSIVE INORGANIC CHEMICAL MAY BE THE ANSWER TO AN ECONOMICAL STABILIZATION OF CLAYEY SOILS FOR HIGHWAY USAGE. THREE IOWA SOILS RANGING IN CLAY CONTENT FROM 35 TO 74 PERCENT WERE STUDIED IN COMBINATION WITH VARYING AMOUNTS OF BOTH HYDRATED CALCTIC AND HYDRATED DOLOMITIC LIMES AND THREE INORGANIC CHEMICALS-SODIUM PHOSPHATE, SODIUM CARBONATE, AND SODIUM HYDROXIDE. ADDITIONS OF 1 TO 3 PERCENT OF SODIUM HYDROXIDE DOUBLED THE STRENGTH OF SOIL-LIME MIXTURES. ADDITIONS OF SODIUM PHOSPHATE TO SOIL-LIME MIXTURES ACTUALLY DECREASED THE STRENGTH, AND ADDITIONS OF SODIUM CARBONATE GAVE INCONSISTENT RESULTS. IT APPEARS THAT SODIUM HYDROXIDE CAN BE SUCCESSFULLY USED IN SOIL-LIME. A STUDY OF THE EFFECTS OF CURING TEMPERATURE AND THE FREEZE- AND-THAW RESISTANCE OF THE SOIL-LIME AND SOIL-LIME-CHEMICAL MIXTURES IS ALSO REPORTED. /AUTHOR/

Davidson, DT Mateos, M Barnes, HF *Highway Research Board Bulletin*

2A 232451

IMPACT OF STABILIZATION OF LOSSES WITH QUICKLIME ON HIGHWAY CONSTRUCTION

THE POSSIBILITIES OF IMPROVING THE PROPERTIES OF HIGHLY WATER-SENSITIVE LOESS THROUGH THE ADDITION OF QUICKLIME (CAO) ARE DISCUSSED. RESULTS OF LABORATORY TESTS ARE GIVEN TO SHOW THE INFLUENCE OF THE MECHANICAL AND PHYSICAL PROPERTIES OF THE SOIL THROUGH THE ADDITION OF LIME. THESE INCLUDE THE MODIFICATION OF GRAIN SIZE DISTRIBUTION (COAGULATION), MODIFICATION OF PLASTICITY, CHANGE IN COMPACTION CHARACTERISTICS, AND INFLUENCING OF WATER ADSORPTION CAPACITY AND DEPENDENT STRENGTH PROPERTIES. ADDITION OF 3 PERCENT BY WEIGHT OF CAO IMPROVES THE SOIL SO THAT A NEW AND BETTER CONSTRUCTION MATERIAL RESULTS. IMPROVEMENTS IN CONSTRUCTION PROGRESS RESULT BY USING LIME STABILIZATION. WHEREAS CONSTRUCTION WORK AS A RULE WOULD HAVE TO BE STOPPED DURING PERIODS OF RAIN, BUILDING ACTIVITIES CAN BE CONTINUED DURING SUCH PERIODS WHEN LIME IS USED. THE COST OF LIME STABILIZATION IS ONLY A FRACTION OF THE LOSSES WHICH RESULT FROM SUCH DELAY. USE OF LIME STABILIZATION HAS RESULTED IN AN INCREASE OF QUALITY, BUILDING PROGRESS, AND EFFICIENCY IN THE CASE OF THE ROAD CONSTRUCTION WORK DONE ON THE SECTION OF THE NORTHEIM- HANNOVER, AUTOBAHN. /AUTHOR/

Brand, W Schoenberg, W *Highway Research Board Bulletin*

2A 232458

REPORT OF COMMITTEE ON SOIL CEMENT ROADS

A REPORT WAS MADE TO THE COMMITTEE BY THE SEVERAL STATES WHICH REVIEW THE MAINTENANCE COSTS AND

CONDITIONS IN SERVICE OF SOIL-CEMENT ROADS. THE CONSTRUCTION DETAILS, AGE, TRAFFIC AND PRESENT CONDITIONS OF THE SOIL-CEMENT BASE OF THESE PROJECTS PROVIDE A COMPLETE HISTORY. MANY VARIABLES IN THE CONSTRUCTION, CLIMATE AND TRAFFIC INDICATE THAT SIX INCHES OF SOIL-CEMENT BASE PROPERLY CONSTRUCTED IS ENTIRELY ADEQUATE FOR THE PURPOSE. THE COMMITTEE DESIRES THAT RECORDS OF THE CONDITION OF THESE AND OTHER EARLIER SOIL-CEMENT PROJECTS BE CONTINUED BY THE STATES AND THAT SUBSEQUENT STUDIES BE MADE. OTHER USES OF SOIL-CEMENT MIXTURES AND CEMENT-MODIFIED SOIL BINDERS FOR SOIL AGGREGATE MIXTURES WERE CONSIDERED BY THE COMMITTEE AND FURTHER STUDIES RECOMMENDED. /AUTHOR/

Reid, CR *Highway Research Board Bulletin*

2A 232499

ECONOMIC ASPECTS OF VERTICAL SAND DRAINS
THE HIGHWAY ENGINEER HAS A NUMBER OF METHODS TO CONSIDER AS A SOLUTION TO THE PROBLEM OF CROSSING MARSHLAND WITH ROAD CONSTRUCTION. HIS CHOICE OF METHOD WILL DEPEND ON ENGINEERING ASPECTS AND ECONOMIC CONSIDERATIONS. IT IS ASSUMED THAT THE COST OF BRIDGE STRUCTURES WILL GENERALLY EXCEED VARIOUS TYPES OF FILL CONSTRUCTION. HENCE, DISCUSSION IS RESTRICTED TO ECONOMIC CONSIDERATION OF MUD-EXCAVATION, SURCHARGED-MUD, AND SAND-DRAIN METHODS. RELATIONSHIPS ARE DEVELOPED WHICH INDICATE THE CONSTRUCTION COST DIFFERENTIALS INVOLVED IN CONSIDERING MUD EXCAVATION AND THE SAND-DRAIN METHOD. THE PROPER CONSIDERATION OF THE SURCHARGED-MUD METHOD AS A SOLUTION TO THE PROBLEM IS DISCUSSED. SOURCES OF INFORMATION RELATED TO THESE PROBLEMS ARE NUMEROUS AND THE AUTHOR IS CONSCIOUS THAT ECONOMIC STUDIES ARE GIVEN CAREFUL ATTENTION BY ALL HIGHWAY DEPARTMENTS. HOWEVER, WORK TO DATE HAS SHOWN THAT THE ECONOMIC CONSIDERATIONS ARE A FUNCTION OF MANY PARAMETERS, THE EXACT INTERRELATIONSHIPS OF WHICH THE ENGINEER CAN ONLY ESTIMATE. FORMULATION, HOWEVER, PERMITS SOME COMPOUNDING WHICH MAKES THE OTHER PARAMETERS STAND OUT PROMINENTLY. TOTAL COST DIFFERENTIAL INVOLVING COSTS RELATED TO TIME AND MAINTENANCE ARE DISCUSSED. /AUTHOR/

Boyer, WC *Highway Research Board Bulletin*

2A 232511

DEVELOPMENT OF APPROPRIATE METHODS FOR EVALUATING THE EFFECTIVENESS OF STABILIZING AGENTS

A SUMMARY IS PRESENTED OF A STUDY TO IMPROVE EXISTING METHODS OR DEVELOP NEW METHODS FOR MEASURING THE PERFORMANCE UNDER IN-SERVICE CONDITIONS OF STABILIZED MATERIALS USED IN DESIGN AND CONSTRUCTION OF HIGHWAYS. TYPE I PORTLAND CEMENT WAS SELECTED AS A NON-VISCOUS STABILIZING AGENT FOR ONE PART OF THE INVESTIGATION, AND A PENETRATION-GRADE ASPHALT AS A REPRESENTATIVE VISCOUS STABILIZING AGENT FOR THE OTHER PART OF THE STUDY. LABORATORY EXPERIMENTS WERE CONDUCTED ON SEVEN SOILS TO EVALUATE VARIOUS APPROACHES TO THE MEASUREMENT OF THE CHARACTERISTICS OF STABILIZED MATERIALS, FOLLOWED BY A LIMITED AMOUNT OF TEST TRACK STUDY FOR THE PURPOSE OF CORRELATING LABORATORY RESULTS WITH BEHAVIOR OF MODEL PAVEMENTS. THE PROGRAM WAS DESIGNED TO EVALUATE AND DEVELOP TEST PROCEDURES WHICH WILL PRODUCE DEFINITIVE DATA FOR A WIDE RANGE OF MATERIALS HAVING SIMILAR CHARACTERISTICS. FINDINGS FROM THE STUDY ON NON-VISCOUS-STABILIZED MATERIALS INDICATE THAT: (1) MINOR VARIATIONS IN THE RELATIVE DENSITY OF THE MATERIALS WILL HAVE A SIGNIFICANT INFLUENCE ON MANY OF THE PHYSICAL PROPERTIES

OF THESE MATERIALS. (2) FINE GRAINED SOILS SHOW LARGE VOLUME CHANGE CHARACTERISTICS BOTH WHEN FROZEN AND THAWED IN THE PRESENCE OF FREE WATER AND UNDER VERY LOW HUMIDITY CONDITIONS, (3) SOME MATERIALS LOSE SIGNIFICANT STRENGTH WHEN SUBJECTED TO FREEZE-THAW CYCLES EVEN THOUGH THESE MATERIALS SHOWED LITTLE OR NO LOSS DURING THE STANDARD FREEZE-THAW DURABILITY TEST, AND (4) THE FLEXURAL STRENGTH OF NON-VISCOUS MATERIALS CAN BE ESTIMATED FROM THE COMPRESSIVE STRENGTH TEST, BUT A RELATIVELY LARGE NUMBER OF TESTS ARE NECESSARY TO OBTAIN A REALISTIC ESTIMATE. CREEP STRAIN TEST RESULTS WERE CONVERTED FROM THE TIME DOMAIN TO THE FREQUENCY DOMAIN BY THE USE OF FOURIER TRANSFORM. THIS PERMITTED A DETERMINATION OF THE DYNAMIC RESPONSE OF THESE MATERIALS UNDER LOAD FOR THE ENTIRE FREQUENCY RANGE WITH ONLY A SINGLE TEST. MINOR VARIATIONS IN THE TEMPERATURE AT THE TIME OF THE TEST CAUSED SUBSTANTIAL CHANGES IN THE STIFFNESS OF THE MIXTURES.

Barenberg, EJ *Highway Research Board Nchrp Reports*

2A 232515

A STUDY OF SPLIT TUBE AND OREGON PILE TEST BLOW COUNTS VS. FRICTION PILE RESISTANCE

AN ATTEMPT IS MADE TO CORRELATE CONSTRUCTION PILE DRIVING RESISTANCE WITH: (1) THE DRIVING RESISTANCE OF THE STANDARD SPLIT BARREL SAMPLER AS INDICATED BY A STANDARDIZED BLOW COUNT, AND (2) THE AVERAGE DRIVING RESISTANCE OF A 5 FOOT CYLINDRICAL STEEL TAPERED PILE PENETROMETER, AS INDICATED BY AN AVERAGE RESISTANCE VALUE. BOTH OF THESE TESTS REFLECT SOIL MOISTURE AND NATURAL DENSITY OR SOIL STRUCTURE. THE PILE DRIVING RECORDS WERE TAKEN FROM BRIDGE CONSTRUCTION PROJECTS AS PLOTTED ON STANDARDIZED FORMS AND CORRELATED WITH THE DRIVING RESISTANCES OF BOTH TREATED TIMBER AND STEEL PILING WITH THE PRE-PLANNING FOUNDATION DENSITY AS OBTAINED FROM STANDARD SPLIT-BARREL PENETRATION VALUES AND FROM THE OREGON 5-FOOT TAPERED PILE TEST PENETRATION VALUES. THE RESISTANCE OF COMPARATIVE PROTOTYPE PILE DRIVING IS DETERMINED ON CONSTRUCTION PROJECTS BY USE OF THE ENGINEERING NEWS FORMULA, MODIFIED WHERE DIESEL HAMMERS ARE USED. A STATISTICAL EVALUATION IS MADE FROM THE DATA OBTAINED DURING THE PAST SEVERAL YEARS. THE CORRELATION DEVELOPED IS BELIEVED TO BE WELL WITHIN THE BROAD LIMITS IMPOSED UPON PILE DRIVING BY SUCH VARIABLES AS WEATHER, HAMMER EFFICIENCY, CONDITION OF THE PILE, PILE FORMULA ACCURACY AND SOIL AND MOISTURE CONDITIONS.

Oregon State Highway Department

2A 232525

FIELD EVALUATION OF LIME-FLYASH-SOIL COMPOSITIONS FOR ROADS

A NUMBER OF FIELD PROJECTS HAVE BEEN STUDIED IN WHICH LIME-FLYASH-SOIL COMPOSITIONS HAVE BEEN USED IN THE CONSTRUCTION OF ROADS, PARKING AREAS, AN AIRFIELD RUNWAY, AND AN EARTHWORK WALL. PERFORMANCE HAS BEEN EVALUATED BY PHYSICAL INSPECTION, BY THE USE OF SONIC PROCEDURES AND BY TESTING OF UNDISTURBED SPECIMENS WHICH HAVE BEEN REMOVED FROM THE BASE. THESE RESULTS WERE COMPARED WITH LABORATORY STUDIES INVOLVING POZZOLANIC ACTIVITY TESTS CONDUCTED AT ELEVATED TEMPERATURE AND BEARING TESTS MADE ON SPECIMENS WHICH WERE SUBJECTED TO ALTERNATE WETTING AND DRYING CYCLES. THE RESULTS OF THE SURVEY HAVE BEEN QUITE FAVORABLE, EXCEPT FOR MINOR INDICATIONS OF DISTRESS ON A FEW OF THE PROJECTS INVOLVING UNSATISFACTORY SUBGRADE OR DRAINAGE CONDITIONS, THE BASES COVERED WITH BITUMI-

NOUS WEARING COURSE ARE IN EXCELLENT CONDITION. A RECOMMENDED LABORATORY EVALUATION PROCEDURE FOR THE LIME-FLYASH COMPOSITIONS IS PRESENTED. /AUTHOR/

Minnick, LJ Williams, R *Highway Research Board Bulletin*

2A 232529

AN APPRAISAL OF SAND DRAIN PROJECTS

IN THE PAST 18 YEARS, THE NEW YORK STATE DEPARTMENT OF TRANSPORTATION HAS USED SAND DRAINS ON NINE PROJECTS AS A METHOD OF STABILIZING SOFT FOUNDATION SOILS FOR THE PURPOSE OF SUPPORTING HIGHWAY EMBANKMENTS. FOUR MAJOR PROJECTS WERE INVESTIGATED IN DETAIL TO DETERMINE THE EFFECTIVENESS OF SAND DRAIN DESIGN, CONSTRUCTION AND PERFORMANCE. ON THREE OF THESE PROJECTS, THE TREATMENT WAS SUCCESSFUL FROM THE STANDPOINT OF PROVIDING FOUNDATION STABILITY AND ELIMINATING DETRIMENTAL PAVEMENT SETTLEMENT. ON THE FOURTH PROJECT, SERIOUS POST-CONSTRUCTION SETTLEMENTS DEVELOPED AFTER THE ROAD WAS OPEN TO TRAFFIC. UNDISTURBED SAMPLES WERE OBTAINED IN THE STABILIZED AREAS ONE TO TWO YEARS AFTER CONSTRUCTION AS PART OF THE INVESTIGATION. THE PRINCIPAL FINDINGS OF THE APPRAISAL WERE AS FOLLOWS: (1) THE SAND DRAIN DESIGN PROCEDURES DEVELOPED BY R. A. BARRON, (2) THE USE OF DISPLACEMENT METHODS TO INSTALL SAND DRAINS CAN ALTER THE STRUCTURAL PROPERTIES OF SENSITIVE SILTY CLAY AND ORGANIC CLAY SOILS RESULTING IN DECREASED HORIZONTAL PERMEABILITY AND INCREASED MAGNITUDES OF SETTLEMENT. THIS DISTURBANCE DURING INSTALLATION WAS THE CAUSE OF UNSATISFACTORY PERFORMANCE OF ONE PROJECT. (3) THE SAMPLING, TESTING AND DESIGN METHODS USED BY THE DEPARTMENT OF TRANSPORTATION ARE ADEQUATE FOR THE DESIGN OF SAND DRAIN PROJECTS WITH THE EXCEPTION OF THE DETERMINATION OF HORIZONTAL PERMEABILITY. LABORATORY TEST PROCEDURES SHOULD BE IMPROVED AND AUGMENTED WITH FIELD TESTS TO ATTEMPT TO DETERMINE THE TRUE FIELD VALUE OF HORIZONTAL PERMEABILITY, (4) THE CHANGE IN MOISTURE CONTENT OF SAMPLES TAKEN BEFORE AND AFTER CONSTRUCTION ACCURATELY REFLECTED THE OBSERVED SETTLEMENT, (5) THE GAIN IN SHEAR STRENGTH BETWEEN SAMPLES TAKEN BEFORE AND AFTER CONSTRUCTION WAS GREATER THAN THE PREDICTED STRENGTH INCREASE USED FOR DESIGN ANALYSIS. THE FINAL SECTIONS OF THE REPORT DISCUSS DESIGN AND CONSTRUCTION CONSIDERATIONS FOR SAND DRAIN PROJECTS AND IS INTENDED TO SERVE AS A GUIDE TO INDIVIDUALS AND ORGANIZATIONS INVOLVED WITH THE DESIGN AND CONSTRUCTION OF SAND DRAIN PROJECTS. /AUTHOR/

Moore, LH
New York State Dept Transportation

2A 232562

METHODS FOR FINISHING CEMENT TREATED SUBBASES
CONTRACTORS AND HIGHWAY AND AIRFIELD ENGINEERS ARE PRESENTED INFORMATION ON THE VARIOUS METHODS USED TO FINISH CEMENT-TREATED SUBBASES TO ACCURATE GRADE. STEP-BY-STEP PROCEDURES ARE OUTLINED FOR A VARIETY OF EQUIPMENT PRESENTLY ON THE MARKET.

Portland Cement Association

ACKNOWLEDGMENT: Portland Cement Association

2A 232573

FIELD CONTROL IN THE CEMENT STABILIZATION OF POOR AGGREGATES
NEW ZEALAND JOURNAL ARTICLES ON CEMENT STABILIZATION OFTEN MERELY STATE THAT A SUITABLE BASIS OF DESIGN IS 250 LB/SQ. IN. UNCONFINED COMPRESSIVE STRENGTH AT 7 DAYS. TO TRANSLATE THESE APPARENTLY

SIMPLE DESIGN STANDARDS INTO FIELD PRACTICE IS BY NO MEANS EASY. ELSEWHERE, THERE ARE VARIOUS DEPOSITS OF SOFTER RIVER GRAVELS, POORLY GRADED PLASTIC NUDDSTONES AND ARGILLITES, AND ALSO SOFT SANDSTONES. THE STRENGTHENING OF THESE POORER MATERIALS WITH CEMENT MAKES THEM ATTRACTIVE FOR USE IN AREAS WITHOUT GOOD MATERIALS. A TABLE GIVES THE PHYSICAL PROPERTIES OF SOILS CEMENT STABILIZATION. CONSTRUCTION, LABORATORY TESTING, AND FIELD CONTROL ARE DISCUSSED.

Goodman, HB Newman, MD
New Zealand Cement Stab Symp pp 78-86, Aug. 1964

ACKNOWLEDGMENT: Portland Cement Association

2A 232632

GROUT REACTS WITH WATER AND REQUIRES NO CATALYST

A NEW GROUT, DEVELOPED BY A JAPANESE COMPANY, CALLED TAKENAKA AQUA-REACTIVE CHEMICAL SOIL STABILIZATION (TACSS) IS SOMEWHAT MORE EXPENSIVE THAN CONVENTIONAL MATERIALS, BUT CAN TURN WATER-BEARING SAND INTO A SOLID MASS WITH A COMPRESSIVE STRENGTH UP TO 150 PSI. TACSS DOES NOT GEL INSTANTLY. IT DISPERSES THROUGHOUT THE WATER-BEARING SOIL AS A LIQUID, BUT WHEN IT STARTS TO GEL IT TURNS INTO A SOLID MASS WITHIN SEVERAL HOURS TIME. IT EXPANDS DURING THE GELLING PROCESS, PREVENTING WASH-AWAY BY WATER DURING THE PROCESS. WHEN INJECTED INTO WATERY SAND WHERE THE WATER IS STILL, TACSS CREATES A VOLUME OF GELATINIZED SAND 7.5 TIMES THAT OF THE FLUID INJECTED. THE GROUT HAS BEEN USED IN SEVERAL BUILDING PROJECTS, IN A SEWER TUNNEL AND IN A SUBAQUEOUS RAILROAD TUNNEL. IT HAS ALSO BEEN USED FOR INSTALLATION OF EARTH ANCHORS, AND CAN BE SPRAYED OVER WET GROUND TO PRODUCE A HARD SURFACE.

Engineering News-record

2A 232636

LIME STABILIZATION OF SOILS FOR HIGHWAY PURPOSES
A LIME SOIL STABILIZATION PROJECT WAS CONDUCTED TO DETERMINE IF LIME CAN BE ECONOMICALLY AND EFFECTIVELY USED TO STABILIZE ILLINOIS SOILS FOR SUBSEQUENT USE IN PAVEMENT CONSTRUCTION. FIELD TESTS WERE CONDUCTED ON ILLINOIS LIME-MIXTURES TO DEVELOP FINAL SPECIFICATIONS FOR ALL SOIL TYPES THAT CAN BE ECONOMICALLY STABILIZED WITH LIME. THE STUDY CONCLUDED THAT: (1) ALL MEDIUM AND FINE-TEXTURED ILLINOIS SOILS ARE BENEFITTED IN SOME WAY BY LIME TREATMENT, (2) THE STABILIZATION OF REACTIVE SOILS WITH QUALITY LIME PRODUCES HIGH QUALITY LIME-SOIL MIXTURES THAT CAN BE USED AS STRUCTURAL PAVING MATERIALS, (3) LIME STABILIZATION OF SOILS THAT DO NOT REACT TO PRODUCE SUBSTANTIAL STRENGTH INCREASE IS BENEFICIAL, (4) THE MIXTURE DESIGN PROCESS AND SUGGESTED TESTING METHODS DEVELOPED ARE SATISFACTORY AND CAN BE UTILIZED FOR ANALYZING TYPICAL ILLINOIS SOILS, (5) PROJECT INFORMATION PERTAINING TO THE PROPERTIES OF LIME-SOIL MIXTURES CAN BE OF GREAT VALUE IN DEVELOPING THICKNESS DESIGN PROCEDURES AND EVALUATING PROBABLE FIELD PERFORMANCE AND BEHAVIOR, AND (6) GENERAL-LIME CAN BE USED TO SUCCESSFULLY STABILIZE MANY ILLINOIS SOILS.

Thompson, MR *Ill Univ Hwy Res Lab Civil Eng Studies*

2A 232639

CONSTRUCTION METHOD AND STABILITY OF EMBANKMENTS OF MUSKEG

A METHOD FOR THE DESIGN AND CONSTRUCTION OF RELATIVELY THICK HIGHWAY EMBANKMENTS ACROSS MUSKEG DEPOSITS IS DESCRIBED. USING THEORETICAL SOIL-MECHANICS CONCEPTS IT IS PREDICTED THAT THE LONG-TERM

STABILITY OF THE MUSKEG NECESSITATES THE USE OF BERMS DESPITE THE FACT THAT AN UNDRAINED STRENGTH ANALYSIS BASED ON IN SITU VANE TESTS MAY PREDICT A REASONABLE FACTOR OF SAFETY. CONSIDERATION OF BOTH THEORETICAL SOIL-MECHANICS CONCEPTS AND PRACTICAL CONSIDERATIONS SUGGESTED THAT THE INTERACTION BETWEEN THE SOIL AND THE BERM DICTATES THAT BERM CONSTRUCTION SHOULD BE FROM THE OUTER LIMITS TOWARDS THE CENTER AND SHOULD BE PLACED PRIOR TO THE CENTRAL FILL. SEVERAL CASE RECORDS ARE PRESENTED TO SUPPORT THE CONCLUSIONS DRAWN AND FURTHERMORE SUGGEST THAT THE WIDTH OF THE BERMS SHOULD BE 1 1/2 TO 2 TIMES THE THICKNESS OF THE MUSKEG (PEAT PLUS LAKE MARL). /AUTHOR/

Raymond, GP *Canadian Geotechnical Journal*

2A 232640

A NOTE OF AN APPROXIMATE METHOD FOR CONSOLIDATION UNDER CONSTRUCTION LOADING
AN APPROXIMATE METHOD OF SOLVING CONSOLIDATION UNDER TIME DEPENDENT LOADING IS PRESENTED. AN EQUATION FOR THE DEGREE OF CONSOLIDATION HAS BEEN ESTABLISHED, BASED ON THE PRINCIPLE OF SUPERPOSITION AND THE RESULTS OBTAINED THUS HAVE BEEN COMPARED WITH THE THEORETICAL SOLUTION GIVEN BY LUMB (1963). A GOOD CORRELATION HAS BEEN OBSERVED, AND FORMS THE BASIS FOR THE RECOMMENDATION OF THE METHOD. SOLUTIONS FOR THE CONSTRUCTION TYPE OF LOAD CAN BE DERIVED BY THE APPLICATION OF THE SUPER-POSITION PRINCIPLE TO THE TERZAGHI SOLUTION UNDER A SUDDENLY APPLIED LOAD. /AUTHOR/

Madhav, MR Rao, KK
J Indian Natl Soc Soil Mech & Fdn Engr

2A 232656

SOIL AND FOUNDATION ENGINEERING IN THE UNION OF SOVIET SOCIALIST REPUBLICS
CONTENTS: INTRODUCTION DEVELOPMENT OF USA-USSR EXCHANGE ITINERARY FOR THE DELEGATION SEMINARS OBSERVATIONS AND IMPRESSIONS GENERAL STATUS OF SOIL ENGINEERING IN USSR EDUCATION AND RESEARCH SUMMARY ACADEMIES, RESEARCH AND DESIGN INSTITUTES INSTITUTE OF FOUNDATION ENGINEERING RESEARCH, ACADEMY OF CONSTRUCTION AND ARCHITECTURE, MOSCOW INSTITUTE FOR DESIGN OF HYDROPOWER PLANTS, MOSCOW INSTITUTE OF FOUNDATION DESIGN, ACADEMY OF CONSTRUCTION AND ARCHITECTURE, MOSCOW RESEARCH INSTITUTE OF FROST STUDIES, USSR ACADEMY OF SCIENCES, MOSCOW CITY TRUST OF GEOLOGICAL ENGINEERING AND MAPPING, MOSCOW UKRAINIAN ACADEMY OF CONSTRUCTION AND ARCHITECTURE, KIEV LOCAL BRANCH, ACADEMY OF CONSTRUCTION AND ARCHITECTURE, LENINGRAD UNIVERSITIES AND ENGINEERING INSTITUTES GENERAL MOSCOW UNIVERSITY MOSCOW CIVIL ENGINEERING INSTITUTE KIEV POLYTECHNIC INSTITUTE KIEV CIVIL ENGINEERING INSTITUTE LENINGRAD POLYTECHNIC INSTITUTE CONSTRUCTION JOBS HIGHWAY CONSTRUCTION STALINGRAD HYDROELECTRIC STATION VOLGA-DON CANAL DRIVING OF BEARING AND SHEET PILES AND CAISSON SHELLS APARTMENT BUILDING CONSTRUCTION

Highway Research Board Special Reports

2A 232678

DISCUSSION OF GROUND FREEZING IN CONSTRUCTION
THE DISCUSSEER ACKNOWLEDGES THAT THE TREATMENT OF THE DESIGN OF A FREEZING SYSTEM GIVEN BY SANGER IS A BIG ADVANCE. SEVERAL YEARS AGO THE WRITER HAD TO PRODUCE A VASTLY OVERSIMPLIFIED METHOD OF DESIGN WHICH NEVERTHELESS GAVE AN ESTIMATE OF FREEZING TIME IN REASONABLE ACCORD WITH THE FACTS OBSERVED LATER. CHECKED NOW BY SANGER'S METHOD, THE WRITER'S METHOD GAVE A SLIGHTLY LONGER TIME ESTIMATE AS

SHOWN HEREIN. THE APPROACH IS BASED ON THE ANALOGY OF THE ARTESIAN CASE OF WATER LOWERING FOR WHICH THE MATHEMATICS ARE SIMILAR. THE WRITER'S METHOD IS DEVELOPED. REFERENCES: GROUND FREEZING IN CONSTRUCTION, FREDERICK J. SANGER, ASCE, (PROC. PAPER 5743), JANUARY, 1968.

Golder, HQ *Am Soc Civil Engr J Soil Mech Div*

2A 232703

CLOSURE ON GROUND FREEZING IN CONSTRUCTION
GOLDER'S REPORT ON A METHOD USED TO SOLVE A FREEZING PROBLEM SHOWS HOW ACCEPTABLE SOLUTIONS CAN BE REACHED IN HEAT CONDUCTION IN SOILS BY THE USE OF BASIC PRINCIPLES AND REASONABLE ASSUMPTIONS. DISCUSSION IS MADE OF SHUSTER'S DISCUSSION, POINTING OUT A DISCREPANCY IN THE COEFFICIENT OF THERMAL CONDUCTIVITY FOR SOIL. THE COEFFICIENT OF THERMAL CONDUCTIVITY OF SOILS IS A DIFFICULT PARAMETER TO EVALUATE AND MEASURE. THE PROBLEM OF COST-ESTIMATING IN ARTIFICIAL GROUND FREEZING IS DISCUSSED. REFERENCES: GROUND FREEZING IN CONSTRUCTION, FREDERICK J. SANGER, ASCE PROC. PAPER 5743, JANUARY, 1968.

Sanger, FJ *Am Soc Civil Engr J Soil Mech Div*

2A 232739

BITUMINOUS STABILIZATION LABORATORY STUDY
THE PROJECT WAS INITIATED IN AN ATTEMPT TO DEVELOP A PROCEDURE USING STANDARD LABORATORY TESTS FOR DESIGNING SOIL-BITUMINOUS MIXTURES FOR USE AS A SUB-BASE OR SUBGRADE MATERIAL ON HIGHWAY CONSTRUCTION PROJECTS. HVEEM STABILOMETER AND COHESIOMETER AND UNCONFINED COMPRESSION TESTS WERE EVALUATED FOR THIS PURPOSE USING SEVERAL TYPES OF SOILS AND BITUMINOUS MATERIALS. STUDIES WERE CONDUCTED TO DETERMINE MIXING AND MOLDING PROCEDURES, FOR DETERMINING THE DESIRED MIXING MOISTURE CONTENTS AND FOR CONDITIONING THE SPECIMENS BEFORE TESTING. IT WAS CONCLUDED THAT: (1) SUBMITTING SPECIMENS TO A 3-DAY OVEN CURE AT 140 F RESULTED IN MAXIMUM STRENGTH, (2) A 4-DAY IMMERSED SOAK AND 6 CYCLES OF FREEZE-THAW FOLLOWING OVEN CURE RESULTED IN MINIMUM STRENGTH AND MAXIMUM WATER ABSORPTION, AND (3) THE BEST METHOD OF PREDICTING THE MIXING MOISTURE CONTENT WHICH WILL PRODUCE SPECIMENS WITH MAXIMUM STABILOMETER AND COHESIOMETER STRENGTH IS TO DETERMINE THE MOISTURE CONTENT WHICH PRODUCES MAXIMUM STRENGTH IN UNTREATED SPECIMENS. THE STABILOMETER SEEMS TO BE SATISFACTORY FOR DESIGNING SOIL-BITUMINOUS MIXTURES FOR ALL SOIL TYPES; THE USE OF THE COHESIOMETER SHOULD BE LIMITED TO USE WITH PLASTIC SOILS; THE UNCONFINED COMPRESSION TEST SHOULD NOT BE USED FOR THIS PURPOSE.

Korfhage, GR *Clearinghouse Fed Sci & Tech Info*
Minnesota Department of Highways

CFSTI PB 183-445, 1P62207382

2A 232791

THERMAL DESIGN IN PERMAFROST SOILS
METHODS OF CALCULATING THE THERMAL REGIME FOR THERMAL DESIGN IN PERMAFROST SOILS ARE DISCUSSED, AND A SET OF EXAMPLES PRESENTED TO ILLUSTRATE SOME DESIGN PROCESSES. THE OCCURRENCE OF PERMAFROST IS SCHEMATICALLY SHOWN IN A FIGURE WHERE PERMAFROST IS THAT SOIL WHICH IS NEVER WARMER THAN 32 F DURING THE YEAR. THE ACTIVE LAYER AT THE GROUND SURFACE IS SEASONALLY THAWED AND FROZEN, AND THE SOIL BELOW THE PERMAFROST LAYER HAS VERY LITTLE SEASONAL VARIATION AND IS ABOVE FREEZING. MANY DESIGN PROBLEMS CAN BE PROPERLY SOLVED BY USING RELATIVELY SIMPLE STEADY STATE HEAT FLOW CALCULATIONS. THE GREAT ADVANTAGE TO STEADY STATE ANALYSIS IS THAT SUPERPO-

SITION CAN BE APPLIED. A USEFUL, ANALYTICAL METHOD USING SUPERPOSITION BY AN EASY GRAPHICAL METHOD IS DESCRIBED. THIS METHOD IS CALLED THE TWO-LANE ROAD CASE BECAUSE HEAT FLOW LINES ARE SEGMENTS OF CIRCLES AND ISOTHERMS ARE EQUALLY SPACED RADIAL LINES. TWO SOLUTIONS OF THIS TYPE CAN BE SUPERIMPOSED WHERE THE DISTURBANCE CAUSED BY THE HEATED REGION IS ADDED TO THE ORIGINAL UNIFORM SOIL TEMPERATURE. THE ISOTHERMS ARE THEN CONSTRUCTED BY CONTOURING THE MANY INDIVIDUAL POINTS OF EQUAL TEMPERATURE AT INTERSECTIONS OF RADIAL LINES. THIS TYPE OF SOLUTIONS ASSUMES A HOMOGENEOUS SOIL, AND A LAYERED SYSTEM OF SOILS WITH VARIABLE THERMAL CONDUCTIVITY WILL HAVE A DIFFERENT THERMAL REGIME. THE LAYERED CASE CAN BE SOLVED BY SUPERPOSITION, BUT NOT DIRECTLY BY THIS METHOD. ANOTHER STEADY STATE SOLUTION IS THE CASE OF HEATED PIPELINE SUCH AS ONE CARRYING WARM CRUDE OIL. A SOLUTION HAS BEEN ANALYTICALLY SOLVED IN CLOSED FORM. PROBLEMS WHICH REQUIRE A THREE-DIMENSIONAL SOLUTION ARE CONSIDERABLY MORE DIFFICULT TO ANALYZE. AN EXCELLENT ANALYTICAL PROCEDURE WITH MANY APPLICATIONS HAS BEEN DEVELOPED BY LACHENBRUCH, 1958. THIS PROCEDURE ALLOWS A RATHER COMPLETE DETERMINATION OF THE THERMAL REGIME UNDER DISTURBED GROUND SURFACE AREAS OF ANY SHAPE AND IS APPLICABLE TO PROBLEMS ASSOCIATED WITH BUILDINGS, ROADS, AIRFIELDS, LAKES, AND SHORELINES. SEVERAL NUMERICAL TECHNIQUES ARE AVAILABLE FOR SOLVING STEADY STATE PROBLEMS, HOWEVER, ONLY RELAXATION IS DISCUSSED. THE TWO-DIMENSIONAL CASE IS USED AS AN EXAMPLE, AND IT IS SEEN THAT THE THREE DIMENSIONAL CASE IS A SIMPLE EXTENSION. SINCE ROAD CONSTRUCTION INCREASES THE MEAN ANNUAL SOIL SURFACE TEMPERATURE AND THE VARIATION OF SEASONAL SOIL TEMPERATURE, BOTH OF WHICH INCREASE THE DEPTH OF SEASONAL THAW AND CAN CAUSE PERMAFROST THAWING, THE SOLUTION IS TO APPLY ENOUGH INSULATION BENEATH THE ROAD SURFACE TO PREVENT PERMAFROST DEGRADATION.

Peyton, HR
Canadian Conf Proc On Permafrost

2A 232793
STABILIZATION OF ILLINOIS MATERIALS DEVELOPMENT OF GUIDELINES AND CRITERIA

RESEARCH WAS CONDUCTED TO DEVELOP, FOR TYPICAL ILLINOIS MATERIALS, GUIDELINES AND CRITERIA FOR DETERMINING THE APPLICABILITY OF CURRENT MATERIALS BENEFICIATION TECHNIQUES. THE RESEARCH PROCEDURE WAS: (1) TO CONDUCT A LIMITED LITERATURE SURVEY, (2) SELECT AND SAMPLE TYPICAL ILLINOIS MATERIALS, AND (3) CONDUCT A LABORATORY TESTING PROGRAM TO DETERMINE THE RESPONSE OF THE MATERIALS TO DIFFERENT STABILIZATION TREATMENTS. THE USE OF VARIOUS COMMON STABILIZATION PROCEDURES (CEMENT, LIME, BITUMINOUS, LIME-FLY ASH, AND COMBINATIONS) SHOWS GREAT POTENTIAL FOR UPGRADING TYPICAL LOCAL ILLINOIS HIGHWAY CONSTRUCTION MATERIALS. ANALYSIS OF THE LITERATURE SURVEY AND THE RESULTS OF THE LABORATORY DATA INDICATE THAT MOST MATERIALS IN ILLINOIS CAN BE UPGRADED WITH ONE OR MORE (INCLUDING COMBINATIONS) OF THE VARIOUS STABILIZATION PROCEDURES AVAILABLE. GUIDELINES AND CRITERIA WERE DEVELOPED TO PROMOTE THE OPTIMUM UTILIZATION OF THESE VARIOUS PROCEDURES IN THE TREATMENT OF HIGHWAY CONSTRUCTION MATERIALS. GUIDELINES AND CRITERIA ARE PRESENTED FOR OPTIMUM USES OF INDIVIDUAL STABILIZERS. HOWEVER, IN MANY CASES MORE THAN ONE STABILIZER MAY BE SUITABLE FOR TREATMENT OF A GIVEN MATERIAL.

Robnett, QL Thompson, MR *Ill Univ Hwy Res Lab Civil Eng Studies*

2A 232834
DECOMPOSED LITHIC SANDSTONE AS A FEASIBLE PAVEMENT MATERIAL

THE SANDSTONE USED FOR PAVEMENT CONSTRUCTION IN THE WINTON REGION COMES FROM A BORROW AREA IN THE IMMEDIATE VICINITY OF THE TOWN. THIS SOFT PLASTIC SANDSTONE DOES NOT MEET THE USUAL SPECIFICATION REQUIREMENTS FOR A PAVING MATERIAL. THE METHODS ADOPTED IN INVESTIGATING THE MATERIAL AND THE DEVELOPMENT OF CONSTRUCTION TECHNIQUES TO PRODUCE A PAVEMENT ARE DESCRIBED. THE EFFECT OF MOISTURE CHANGES IN THE SANDSTONE MUST BE REDUCED TO THE EXTENT THAT CRACKING AND MOISTURE INGRESS ARE ELIMINATED. COMPACTION AND HEAVY PRIMING ALONE WILL NOT PREVENT THE FAILURE MECHANISM WHICH COMMENCES WITH CRACKING. THE ALTERNATIVE (ARMOURING) WHICH REDUCES THE AMOUNT OF SANDSTONE IMMEDIATELY IN CONTACT WITH SEAL, AND ANY MOISTURE INGRESS THROUGH SEAL, APPEARS TO OFFER THE BEST SOLUTION SHORT OF COSTLY MECHANICAL OR ADMIXTURE STABILIZATION. IT APPEARS THAT THE REDUCTION OF PLASTIC SANDSTONE BY SUBSTANTIAL REPLACEMENT WITH ARMOURING STONE IMMEDIATELY BENEATH THE SEAL IS SUFFICIENT TO PREVENT THE ONSET OF THE FAILURE MECHANISM. ROLLING IN OF THE ARMOURING STONE MUST TAKE PLACE IMMEDIATELY AFTER COMPACTION OF THE SANDSTONE WHILE THE PAVEMENT IS STILL DAMP IN DEPTH. A 20-MILE SECTION OF ROAD IN THE THIRD YEAR OF SERVICE EVIDENCES NO PAVEMENT FAILURE. FURTHER TEST PAVEMENTS ARE UNDER CONSIDERATION IN AN ATTEMPT TO ELIMINATE THE ARMOURING.

Andrews, JH Vlasic, Z Pryor, AJ DISCUSSEER Dickinson, EJ DISCUSSEER Grant, K DISCUSSEER *Australian Road Research Board Proc*

2A 232837
THE PERFORMANCE OF COMPACTION PLANT

FOLLOWING EARLIER STUDIES ON A RANGE OF VIBRATING ROLLERS IN COMPACTING THREE ROAD MATERIALS IN LOOSE THICKNESSES OF 9 IN. AT A SPEED OF 1.7 M.P.H., TESTING WAS CARRIED OUT ON SIMILAR MATERIALS WITH SIMILAR ROLLERS AT MOISTURE CONTENTS NOT COVERED IN THE ORIGINAL PROGRAM WITH THE OBJECT OF DETERMINING WHETHER THE EARLIER CONCLUSIONS ARRIVED AT WOULD APPLY TO THESE MOISTURE CONTENTS. IN ADDITION A HIGHER SPEED OF TRAVEL, 3.5 M.P.H. WAS USED IN SOME CASES TO ASSESS ITS EFFECT AND A PILOT STUDY WAS MADE OF THE COMPACTION OBTAINABLE THROUGH A THICKER LIFT OF CRUSHED ROCK. CONCURRENTLY WITH THESE INVESTIGATIONS THE PERFORMANCES OF HEAVY 7-WHEELED, PNEUMATIC-TIRED ROLLERS, AT DIFFERENT WHEEL LOADS AND TIRE PRESSURES, AND OF A DRAWN STEEL WHEEL ROLLER, BALLASTED UP TO 400 LB. PER LINEAL IN., WERE ASSESSED ON THE SAME MATERIALS. /AUTHOR/

Tynan, AE Morris, PO Williams, FH DISCUSSEER Tope, AR DISCUSSEER Brown, MW DISCUSSEER Reilly, LA DISCUSSEER Chester, LR DISCUSSEER Haussmann, GA DISCUSSEER Boori, L DISCUSSEER *Australian Road Research Board Proc*

2A 232840
FIELD COMPACTION CONTROL

FACTORS AFFECTING THE ASSESSMENT AND ACCEPTANCE OF FIELD COMPACTION ARE REVIEWED WITH PARTICULAR REFERENCE TO ERRORS IN MEASUREMENT AND SAMPLING. THE COMPACTION OF MATERIALS IN ROAD STRUCTURE IS PRIMARILY AIMED AT ENSURING THAT THE LAYER COMPLY WITH THE DESIGN REQUIREMENTS OF STRENGTH AND POROSITY. THE FOLLOWING TWO APPROACHES MAY BE FOLLOWED TO ENSURE THAT THESE CONDITIONS ARE SATISFIED: THE SO-CALLED METHOD AND END RESULT TYPES OF SPECIFICATIONS. THE END RESULT TYPE OF SPECIFICATION IS

ALMOST EXCLUSIVELY USED, PARTICULARLY IN SOUTH AFRICAN ROAD PRACTICE. THE END CONDITION IS SPECIFIED AS A BULK DENSITY IN THE CASE OF BITUMINOUS MATERIAL AND AS A DRY DENSITY FOR THE OTHER ROAD CONSTRUCTION MATERIALS. SOME OF THE FACTORS ARE EXAMINED OF QUALITY CONTROL, WHICH ACTUALLY CONSISTS OF THE TWO SEPARATE FUNCTIONS OF PROCESS CONTROL AND ACCEPTANCE CONTROL. A COMBINATION OF THE METHOD AND END RESULTS METHOD IS USED TO SPECIFY THE FINAL DENSITY, THE FINAL MOISTURE CONTENT AND THE TIME THAT MUST ELAPSE BETWEEN THE APPLICATION OF THE BINDER AND FINAL COMPACTION. THE FACTORS IN A ROAD MATERIAL WHICH AFFECT THE ASSESSMENT OF COMPACTION ARE ITS STRENGTH AND VOIDS CONTENT. SINCE DENSITY IS RELATED TO BOTH THE STRENGTH AND THE VOID CONTENT OF A COMPACTED MATERIAL, THE DEGREE OF COMPACTION CAN USUALLY BE DETERMINED BY MONITORING THIS PARAMETER. TEST METHODS CURRENTLY IN USE FOR MEASURING THE DENSITY OF BITUMINOUS-BOUND, GRANULAR AND STABILIZED MATERIALS ARE REVIEWED. IT IS EMPHASIZED THAT MORE ATTENTION WILL HAVE TO BE GIVEN TO THE USE OF RAPID TEST METHODS SINCE STATISTICAL CONTROL DEMANDS THAT AN ADEQUATE NUMBER OF TEST RESULTS ARE NECESSARY FOR MEANINGFUL DECISIONS.

Kuhn, SH Marais, CP
Cncl Scient & Indus Res /S Africa/

2A 232852
ASPECTS OF THE DESIGN AND CONSTRUCTION OF RURAL ROADS

A SUMMARY IS PRESENTED OF CONCLUSIONS REACHED FROM A REVIEW OF THE LONG-TERM PERFORMANCE OF MANY ROADS IN VARIOUS PARTS OF AUSTRALIA. AND WHERE, IN MANY CASES, VERY MANY OBSERVATIONS OF SUBGRADE MOISTURE AND DENSITY HAVE RECENTLY BEEN MADE. IT POINTS OUT THE GREAT EFFECT OF TYPE OF CONSTRUCTION AND ENVIRONMENT ON SUBGRADE EQUILIBRIUM MOISTURE CONTENT. THIS PARAMETER IS OF PARAMOUNT IMPORTANCE IN DETERMINING THE PAVEMENT THICKNESS REQUIRED AND THE CONCLUSION IS REACHED THAT IT IS IMPOSSIBLE AT PRESENT TO DETERMINE IT IN ADVANCE WITH ANY REASONABLE ACCURACY, PARTICULARLY IN THE AREAS INLAND OF THE COASTAL RANGES; UNLESS, OF COURSE, ADJOINING OLD ROADS ON SIMILAR SOILS ARE AVAILABLE FOR INVESTIGATION WITH COMPETENT STAFF. SUGGESTIONS ARE MADE AS TO METHODS FOR ECONOMICALLY ENSURING REASONABLY HIGH DENSITIES AND LOW MOISTURE CONTENTS FOR SUBGRADES OF ROADS IN THE CATEGORY BEING EXAMINED. INTERIM PROPOSALS ARE GIVEN INVOLVING THE TRIAL AND OBSERVATION APPROACH OF STAGE CONSTRUCTION FOR 'TAILORING' THE PAVEMENT THICKNESS TO THE ACTUAL SUBGRADE CONDITIONS. AN IMPORTANT SECTION OF THE REPORT DEALS WITH A WIDE VARIETY OF PAVEMENT MATERIALS WHICH HAVE BEEN SATISFACTORILY USED FOR ROAD PAVEMENTS, OFTEN UNDER VERY HEAVY TRAFFIC, ALTHOUGH MANY ARE UNUSUAL AND FALL OUTSIDE STANDARD SPECIFICATIONS. /AUTHOR/

Loder, LF *Australian Road Research Board Bulletin* Mar. 1970

2A 232877
USE OF LIME IN THE CONSTRUCTION AND MAINTENANCE OF SASKATCHEWAN HIGHWAYS 1962-1968
PROJECTS INCLUDED LIME STABILIZATION AND MODIFICATION OF HIGHLY PLASTIC LACUSTRINE CLAY SOILS. ON THE SINGLE LIME STABILIZATION PROJECT, LIME FAILED TO PROVIDE A COHERENT STABILIZED SLAB. THE LIME MODIFICATION TEST SECTION SHOWED THAT A MINIMUM OF 12 INCHES OF TREATMENT WAS REQUIRED TO DELAY DEVELOPMENT OF TRANSVERSE RIDGING IN A PAVEMENT ON AN EXPANSIVE SOIL SUBGRADE. LIME SLURRY CRACK FILLING

AND INJECTION TECHNIQUES HAD NO EFFECT ON THE FLUCTUATION OF TRANSVERSE RIDGES. USE OF LIME FOR SUBGRADE DRYING AND FOR AGGREGATE MODIFICATION FOR ASPHALTIC CONCRETE WAS SUCCESSFUL. /AUTHOR/

Culley, RW
Saskatchewan Dept Hwys, Regina /Canada/ Apr. 1970

2A 232898
IMPROVEMENT OF SUBGRADES
BECAUSE THERE IS GREATER KNOWLEDGE OF PROCESSED SURFACING MATERIALS THAN OF THE NATURAL MATERIALS UNDERLYING A ROAD, ENGINEERS HAVE ATTEMPTED TO DESIGN HIGHWAY PAVEMENTS STRONG ENOUGH TO OVERCOME SUBGRADE DEFECTS. IT IS NOW KNOWN THAT THIS PROCEDURE IS IMPRACTICAL, AND NO MATTER HOW STABLE THE SUPERSTRUCTURE MAY BE, SERVICE QUALITIES WILL DEPEND LARGELY UPON THE SOIL STRUCTURE BENEATH. MUCH HAS YET TO BE LEARNED ABOUT SOIL MECHANICS, BUT MANY PHENOMENA WHICH ARE KNOWN ARE STILL DISREGARDED IN SUBGRADE CONSTRUCTION. MANY A PAVEMENT FAILURE MAY BE ATTRIBUTED TO THE PLACING OF GRANULAR MATERIALS ON CLAYS IN SUCH FASHION THAT GRAVITY WATER IS IMPOUNDED. ANOTHER NATURAL LAW NEGLECTED IS IN THE BULKING OF DAMP SAND WHEN DISTURBED AND MANIPULATED. /AUTHOR/

Porter, HC *Highway Research Board Proceedings* 1937

2A 232903
AN EXPERIMENTAL SOIL-CEMENT ROAD IN ILLINOIS
THE FIRST SOIL-CEMENT ROAD TO BE CONSTRUCTED IN ILLINOIS WAS IN 1936 AND WAS ENTIRELY EXPERIMENTAL. PRELIMINARY SOIL SAMPLES WERE TAKEN BEFORE THE GRADING WORK WAS COMPLETED. DATA WAS GIVEN ON THE LABORATORY SOIL TESTS WHICH INCLUDED PHYSICAL TEST CONSTANTS AND GRAIN SIZE, MOISTURE-DENSITY TESTS, MOISTURE-PENETRATION TESTS, DURABILITY TESTS, WETTING AND DRYING TESTS, FREEZING AND THAWING TESTS, AND CHECK AND COMPRESSION TESTS. EQUIPMENT USED ON THE PROJECT WAS LISTED. A DESCRIPTION OF CONSTRUCTION PROCEDURE INCLUDED (1) SCARIFYING, PULVERIZING, AND SHAPING, (2) APPLYING, CHECKING AND MIXING THE CEMENT, (3) APPLYING WATER, (4) SHAPING AND COMPACTING, AND (5) CURING. CONSTRUCTION COSTS WERE GIVEN.

Glover, VL *Highway Research Board Proceedings* 1937

2A 232919
SOIL STABILIZATION USING ASPHALT CUT-BACKS AS BINDERS
A METHOD OF DESIGN AND A RECOMMENDED PROCEDURE FOR HIGHWAY CONSTRUCTION USING SOILS AND ASPHALT CUT-BACKS OR SOILS, AGGREGATES AND ASPHALT CUT-BACKS TO PRODUCE BASES FOR PAVEMENT CONSTRUCTION ARE BRIEFLY PRESENTED. THE HUBBARD-FIELD STABILITY TESTING APPARATUS WAS USED IN THE LABORATORY TESTS.

Roediger, JC Klinger, EW *Highway Research Board Proceedings* 1938

2A 232933
EFFECT OF NONLINEAR MATERIAL RESPONSE ON THE BEHAVIOR OF PAVEMENTS UNDER TRAFFIC
A REVIEW OF LABORATORY TEST DATA REVEALS THAT MOST COMMON HIGHWAY MATERIALS, UNDER CONDITIONS REPRESENTATIVE OF MOVING TRAFFIC ON AN INSERVICE PAVEMENT, EXHIBIT A NONLINEAR RESPONSE TO STRESS. THE REPORTED STRESS-STRAIN RESPONSE OF PAVEMENTS CONSTRUCTED WITH SUCH MATERIALS VARIES FROM THE STRESS-SOFTENING TO THE STRESS-STIFFENING TYPE, IN ACCORDANCE WITH THE RESPONSE OF THE CONSTITUTENT MATERIALS. A NONLINEAR ELASTIC INCREMENTAL FINITE ELEMENT ANALYSIS OF A UNIFORM SAND MASS SUBJECTED TO A UNIFORM CIRCULAR SURFACE LOAD, USING A CONSTI-

TUTIVE EQUATION BASED ON PUBLISHED LABORATORY DATA, REVEALED A PRONOUNCED STIFFENING RELATIONSHIP BETWEEN THE APPLIED PRESSURE AND SURFACE DEFLECTION AND SLIGHTLY NONLINEAR RELATIONSHIPS BETWEEN THE APPLIED PRESSURE AND THE VERTICAL STRESSES INDUCED IN THE MASS. AN APPROXIMATE NONLINEAR ELASTIC ANALYSIS OF A FULL-DEPTH ASPHALT CONCRETE PAVEMENT OVER A SANDY CLAY SUBGRADE, USING STRESS-STRAIN COEFFICIENT MATRICES MEASURED IN LABORATORY TRIAXIAL TESTS ON THE MATERIALS, GAVE ALMOST LINEAR RELATIONSHIPS BETWEEN THE APPLIED PRESSURE AND THE RESULTING DEFLECTION, AND DISTRIBUTIONS OF STRESSES AND STRAINS WITH THE STRUCTURE VERY SIMILAR TO THOSE YIELDED BY A LINEAR ELASTIC ANALYSIS USING STRESS-STRAIN COEFFICIENTS AT REALISTIC STRESS LEVELS. TO AN ENGINEERING APPROXIMATION, A LINEAR ANALYSIS WAS SUFFICIENTLY ACCURATE IN THE CASE OF THIS PARTICULAR FULL-DEPTH ASPHALT CONCRETE PAVEMENT BUT APPEARED UNACCEPTABLE IN THE CASE OF A PAVEMENT WITH UNBOUND GRANULAR MATERIALS CLOSE TO THE SURFACE. /AUTHOR/

Dehlen, GL Monismith, CL *Highway Research Record, Hwy Res Board* 1970

2A 232959
FACTORS AFFECTING THE TENSILE STRENGTH OF CEMENT-TREATED MATERIALS

RECENT THEORETICAL AND ANALYTICAL ADVANCES CONCERNED WITH PAVEMENT FAILURES DUE TO EXCESSIVE TENSILE STRESSES OR STRAINS OR BOTH WITHIN THE SOIL-PAVEMENT SYSTEM HAVE PLACED ADDED EMPHASIS ON THE INVESTIGATION OF TENSILE PROPERTIES OF HIGHWAY CONSTRUCTION MATERIALS. THIS STUDY EVALUATES THE FACTORS AND INTERACTIONS AFFECTING THE TENSILE CHARACTERISTICS OF CEMENT-TREATED MATERIALS. NINE FACTORS WERE INVESTIGATED: CEMENT CONTENT, MOLDING WATER CONTENT, AGGREGATE GRADATION, CURING TIME, CURING TEMPERATURE, TYPE OF AGGREGATE, TYPE OF CURING, TYPE OF COMPACTION, AND COMPACTIVE EFFORT. THE FIRST FIVE WERE INVESTIGATED AT 3 LEVELS AND THE LAST FOUR AT 2 LEVELS IN A STATISTICALLY DESIGNED FRACTIONAL FACTORIAL EXPERIMENT. THE PARAMETER CONSIDERED AS A PRIMARY INDICATOR OF THE TENSILE PROPERTIES OF CEMENT-TREATED MATERIALS WAS THE INDIRECT TENSILE STRENGTH. AN ANALYSIS OF VARIANCE WAS USED TO DETERMINE THE SIGNIFICANCE OF ALL MAIN FACTORS, 2-FACTOR INTERACTIONS, AND 3-FACTOR INTERACTIONS IN THE EXPERIMENT. THE HIGHLY SIGNIFICANT EFFECTS THAT ARE ALSO OF PRACTICAL SIGNIFICANCE TO THE ENGINEER ARE DISCUSSED, AND TABLES OF ALL ADDITIONAL FACTORS AND INTERACTIONS SIGNIFICANT AT ALPHA LEVELS OF 1 AND 5 PERCENT ARE SHOWN. A REGRESSION EQUATION THAT PREDICTS VALUES OF INDIRECT TENSILE STRENGTH WITHIN THE FACTOR SPACE DEFINED BY THE EXPERIMENT IS PRESENTED. /AUTHOR/

Moore, RK Kennedy, TW Hudson, WR *Highway Research Record, Hwy Res Board* 1970

2A 233040
RESEARCH ON THE UTILIZATION OF SCREENINGS IN SUB-BASES OF ROAD PAVEMENTS

THE SHORTAGE OF SANDY TOP-SOIL AND GRAVEL DEPOSITS IN URBAN AREAS OF GUANABARA DURING 1969 AND 1970 HAS RESULTED IN A STUDY ON THE PERFORMANCE OF SCREENINGS FROM QUARRIES AND THEIR USE AS SUBBASE OF ROAD PAVEMENTS. /RRI/

Danciger, F
Road Research Institute /Brazil/ 1970

ACKNOWLEDGMENT: Road Research Institute /Brazil/

2A 233078
FACTORS INVOLVED IN STABILIZING SOILS WITH ASPHALTIC MATERIALS

SOIL PROPERTIES ARE INVESTIGATED FOR DATA TO BE USED IN THE DESIGN OF SOIL-ASPHALT MIXTURES FOR STRUCTURAL USE. A SERIES OF CONSTANTS IS DEVELOPED TO GIVE INFORMATION ON THE PROPERTIES OF SOIL IN THE HIGHLY COMPACTED STATE IN WHICH IT IS EMPLOYED IN EARTH CONSTRUCTIONS. PRINCIPALS OF SOIL DESIGN ARE CONSIDERED. /AUTHOR/

Holmes, A Roediger, JC Wirsig, HD Snyder, RC Goldbeck, AT
DISCUSSER Conner, CN DISCUSSER *Highway Research Board Proceedings* 1943

2A 233100
CLAY TECHNOLOGY AND ITS APPLICATION TO SOIL STABILIZATION

A BRIEF SURVEY OF MODERN TRENDS IN COLLOID REASONING AND ITS RELATIONSHIP TO CLAY TECHNOLOGY IS PRESENTED. THE APPLICATION OF THESE TEACHINGS TO THE USE OF SOILS WITHIN MODERN CONSTRUCTION IS BROUGHT OUT. SUCH FACTORS AS MINERALOGICAL COMPOSITION AND PARTICLE DISTRIBUTION AFFECT RESULTS TO AN EXTENT WHERE THESE VARIABLES NO LONGER CAN BE IGNORED. RESULTS INDICATE THAT A RANGE OF PROPERTIES IS POSSIBLE IN SYNTHETIC GRADED SOIL MIXTURE WHEN ANY OF THE FOLLOWING FACTORS IS VARIED: (1) CLAY MINERAL; (2) PARTICLE SIZE OF THE CLAY MINERAL; OR (3) COUNTER-ION ASSOCIATED WITH COLLOIDAL PORTION OF CLAY MINERAL. THE THERMAL METHOD OF IDENTIFICATION OF THE CLAY MINERALS AFFORDS AN EASY AND RAPID TEST. /AUTHOR/

Johnson, AL Davidson, DT *Highway Research Board Proceedings* 1947

2A 233114
IMPORTANCE OF VOLUME RELATIONSHIPS IN SOIL STABILIZATION

STABILIZED SOILS IN COMMON WITH OTHER POROUS CONSTRUCTION MATERIALS ARE THERMODYNAMICALLY UNSTABLE UNDER CONDITIONS OF NORMAL CLIMATIC EXPOSURE. THIS INSTABILITY IS NOT TOO IMPORTANT, SINCE SUCH MATERIALS ARE NOT EXPECTED TO LAST FOREVER; HOWEVER, IT IS IMPORTANT THAT THEY DO POSSESS AN ECONOMICALLY JUSTIFIABLE SERVICE LIFE. THEREFORE, THE RATE OF DETERIORATION IS THE REALLY SIGNIFICANT FACT. INTERNAL DETERIORATION DEPENDS ON THE PRESENCE OF DETERIORATING AGENTS WITHIN THESE POROUS SYSTEMS. SINCE WATER ITSELF IS OFTEN AN IMPORTANT DETERIORATING AGENT, OR AT LEAST A VEHICLE FOR OTHER DETERIORATING AGENTS, THE RATE OF WATER INTAKE INTO SUCH SYSTEMS IS OF MAJOR IMPORTANCE. THIS RATE IS A FUNCTION OF THE POROSITY AND SIZE OF THE PORES AS WELL AS OF THE WATER AFFINITY OF THE INTERNAL SURFACE, AND OF THE SURFACE TENSION OF WATER. GENERAL FORMULAE ARE DERIVED FOR THE RATE OF CAPILLARY WATER PENETRATION AND TESTED BY MEANS OF SLAKING EXPERIMENTS ON CLAY AND SAND-CLAY SYSTEMS. THE IMPORTANCE OF VOLUME RELATIONSHIPS IS DEMONSTRATED BY THE RESULTS OF STABILIZATION TESTS ON SYNTHETIC SALINE SOILS MADE WITH BEACH SAND AND CONTAINING ILLITE, KAOLINITE AND MONTMORILLONITE, RESPECTIVELY, AS CLAY FRACTION. /AUTHOR/

Winterkorn, HF Choudhury, AN *Highway Research Board Proceedings* 1949

2A 233119
SOILS ENGINEERING IN RAILWAY CONSTRUCTION AND MAINTENANCE

THE INVESTIGATION BY THE RAILROAD INDUSTRY INTO SOIL AND BALLAST PROBLEMS AFFECTING THE STABILITY OF ROADBEDS IS DESCRIBED. THE PROBLEMS ARE VERY SIMILAR BASICALLY TO THOSE ENCOUNTERED IN HIGHWAY AND AIRPORT CONSTRUCTION. ROADWAY STABILIZATION NOW IS

MAINLY A PROBLEM OF MAINTENANCE. NEW CONSTRUCTION IS LIMITED PRINCIPALLY TO LINE AND GRADE REVISIONS. ON THESE, CONTROL OF THE SOIL STRUCTURES IN ACCORD WITH MODERN AND STANDARD PRACTICE. THE RESULTS OF STUDY, HOWEVER, INDICATE THAT THIS TYPE OF CONTROL FOR SOME SOILS IS NOT SUFFICIENT TO OBTAIN THE EXPECTED RESULTS AND SECTIONS WITH ABNORMALLY HIGH MAINTENANCE MAY APPEAR AFTER OPERATIONS BEGIN. TREATMENT OF NEW GRADES TO RESTORE ORIGINAL STABILITY, OF COURSE, IS A MAINTENANCE PROBLEM. /AUTHOR/

Smith, R *Highway Research Board Proceedings* 1950

2A 233128
TREATMENT OF SOFT FOUNDATIONS FOR HIGHWAY EMBANKMENTS

SOFT FOUNDATION MATERIALS USUALLY FOUND IN SWAMPS, MARSHES, BOGS, RIVER AND LAKE BOTTOMS, AND LACUSTRINE CLAY AREAS REQUIRE TREATMENTS TO OVERCOME PROBLEMS OF FLAT TOPOGRAPHY, POOR DRAINAGE, AND FINE-GRAINED OR ORGANIC SOILS. THE METHODS OR TREATMENTS USED FOR CONSTRUCTING EMBANKMENTS ON SOFT FOUNDATIONS MUST CONSIDER THE ECONOMICS AND THE PERFORMANCE OF THE END RESULTS DESIRED. THE CHOICE OF THE BEST METHOD IS DEPENDENT ON THE EVALUATION OF ALL THE CONTRIBUTING FACTORS SUCH AS EMBANKMENT DIMENSIONS, CHARACTERISTICS OF FOUNDATION SOIL, CONSTRUCTION MATERIALS AVAILABLE, CONSTRUCTION SCHEDULE PLANNED, LOCATION, AND CLASS OF HIGHWAY.

Sinacori, MN Hofmann, WP Emery, AH *Highway Research Board Proceedings* 1952

2A 233141
FIELD OBSERVATIONS ON SAND DRAIN CONSTRUCTION ON TWO HIGHWAY PROJECTS IN ILLINOIS

THERE HAS BEEN INCREASED USE OF SAND DRAINS FOR FILL CONSTRUCTION OVER SOFT AND COMPRESSIBLE SUBSOILS, MARSH AREAS, TO ACCELERATE THE PROCESS OF CONSOLIDATION IN THE SUBSOIL UNDER THE WEIGHT OF THE FILL. THE RESULTING REDUCTION IN WATER CONTENT OF THE SUBSOIL LEAD TO AN INCREASE IN THE SHEAR STRENGTH. THE SAND DRAIN SHORTENED THE TIME INTERVAL REQUIRED FOR CONSOLIDATION AND SETTLEMENT AND INCREASED THE STRENGTH OF THE SUBSOIL AS A RESULT OF THE CONSOLIDATION. FIELD AND LABORATORY INVESTIGATIONS WERE MADE OF TWO HIGHWAY PROJECTS INVOLVING SAND DRAIN CONSTRUCTION, (1) THE RELOCATION OF HIGHWAY U. S. 51, LASALLE, ILLINOIS, AND (2) HIGHWAY ILLINOIS 11, BARRINGTON, ILLINOIS. THE LASALLE PROJECT INVOLVED THE CONSTRUCTION OF AN EMBANKMENT 25 TO 30 FEET HIGH OVER THE FLOOD PLAIN OF THE ILLINOIS RIVER, A SECTION LENGTH OF 3 MILES. THE BARRINGTON PROJECT INVOLVED A DUAL LANE, DIVIDED HIGHWAY LOCATED OVER SEVERAL PEAT DEPOSITS. THE HIGHWAY CONSISTED OF TWO PARALLEL EMBANKMENTS FOR THE TWO DIRECTIONS OF TRAFFIC, AND ALTHOUGH THE FILL NOWHERE EXCEEDED 15 FEET IN HEIGHT, THE SOFTNESS OF THE PEAT PRESENTED SERIOUS PROBLEMS DURING CONSTRUCTION. SUBSOIL CONDITIONS AND A HISTORY OF CONSTRUCTION WERE GIVEN. PORE-WATER PRESSURE AND SETTLEMENT WERE MEASURED AND THE RESULTS WERE PRESENTED. TRIAXIAL AND CONSOLIDATED TESTS WERE PERFORMED. THE OBSERVATIONS AT LASALLE LEFT LITTLE DOUBT THAT THE SUBSOIL BEHAVIOR WAS IN GENERAL AGREEMENT WITH THE THEORY OF CONSOLIDATION AND THAT CONSOLIDATION WAS ACCOMPANIED BY AN INCREASE IN STRENGTH. AT BARRINGTON, THE STUDIES INDICATE THAT THE PERFORMANCE OF THE SUBSOIL REPRESENTED A DEPARTURE FROM THE THEORY OF CONSOLIDATION. THE WEIGHT OF THE FILL PRODUCED LITTLE OR NO CONSOLIDATION IN THE SUBSOIL. THE LARGE SETTLEMENTS, THEN, PROBABLY MUST

BE ATTRIBUTED TO A PLASTIC FLOW OF THE SUBSOIL IN A LATERAL DIRECTION. DATA ON SAND DRAIN CONSTRUCTION WAS PRESENTED WITH THE HOPE THAT A BETTER UNDERSTANDING OF THE SUBSOIL BEHAVIOR UNDER SUCH CONDITIONS WOULD BE OBTAINED.

Wu, TH Peck, RB *Highway Research Board Proceedings* 1956

2A 233172
DURABILITY AND STRENGTH CHARACTERISTICS OF LIME-FLYASH- SOIL MIXTURES FOR ROAD CONSTRUCTION
THE OBJECT IS TO ASSESS THE SUITABILITY OF LOCALLY AVAILABLE SOILS FOR STABILIZATION WITH LIME AND FLYASH. SUITABLE PROPORTIONING OF LIME: FLYASH: SOIL IS DETERMINED ON THE BASIS OF THE UNCONFINED COMPRESSIVE STRENGTH OF THE TEST SPECIMENS. THE PERFORMANCE OF THESE MIXES UNDER THE ADVERSE WEATHERING CONDITIONS, SUCH AS IMMERSION IN WATER AND FREEZING-THAWING HAS BEEN STUDIED BY LABORATORY TESTS. TWO TEST PAVEMENTS HAVE BEEN LAID IN THE FIELD WITH SELECTED LIME: FLYASH: SOIL PROPORTIONS. FIELD CBR AND PLATE BEARING TESTS, BOTH REPETITIVE AND NON-REPETITIVE, HAVE BEEN CONDUCTED ON THESE PAVEMENTS. THE PAVEMENTS HAVE EXHIBITED SEMI-RIGID CHARACTERISTICS AND CONSIDERABLE IMPROVEMENT IN LOAD CARRYING CAPACITY. /AUTHOR/

Arora, MG Khanna, SK Vasan, RM *Indian Roads Congress Road Res Bull* 1970

2A 233182
LATERITE AND LATERITIC SOILS AND OTHER PROBLEM SOILS OF AFRICA

THE DEVELOPMENT OF ENGINEERING STANDARDS AND CRITERIA FOR THE USAGE OF LATERITE, LATERITIC SOILS, AND OTHER PROBLEM SOILS (INCLUDING TROPICAL BLACK CLAYS) IS REPORTED IN CONNECTION WITH THE CONSTRUCTION OF ROADS, HIGHWAYS AND AIRFIELDS IN ALL OF TROPICAL AFRICA, WITH EMPHASIS ON GHANA. THE AASHO CLASSIFICATION SYSTEM CAN BE APPLIED AS WELL WITH TROPICAL SOILS AS IT CAN WITH TEMPERATE ZONE SOILS. CEMENT STABILIZATION IS A PRACTICAL MEANS OF IMPROVING LATERITIC GRAVEL UNLESS THE CLAY CONTENT AND PLASTICITY INDEX ARE GREATER THAN 15. A PAVEMENT CONDITION SURVEY WAS PERFORMED IN GHANA AND THE IVORY COAST TO EVALUATE LATERITIC AND TROPICAL MATERIALS AS STRUCTURAL COMPONENTS OF EXISTING ROADS. DESIGN CHARTS WERE DEVELOPED FOR BASE COURSE THICKNESS OF SIX AND EIGHT INCHES. A CBR VALUE OF 30 WAS ADOPTED FOR THE SUBBASE. MATERIAL SPECIFICATIONS THAT ARE APPROPRIATE TO THE TRAFFIC WERE DETERMINE FROM THE RESULTS OF THE PAVEMENT CONDITION SURVEY. /AUTHOR/

Lyon Associates Inc. June 1971

2A 233213
SLURRY WALLS FOR BART CIVIC CENTER SUBWAY STATION
DEEP EXCAVATIONS IN DIFFICULT GROUND HAVE LONG BEEN AN ENGINEERING CHALLENGE. WITH THE SHARP INCREASE IN MASS RAPID TRANSIT SUBWAY CONSTRUCTION IN URBAN AREAS DURING THE 1960'S, MORE THAN EVER BEFORE DEEP EXCAVATIONS ARE BEING PLANNED AND CARRIED OUT IN DIFFICULT GROUND CONDITIONS. NEW TYPES OF STRUCTURES ARE BEING PROPOSED AND EXECUTED WITH NEW METHODS OF CONSTRUCTION AND IMPROVED GROUND-WATER CONTROL, AND ARE MORE FREQUENTLY BEING MEASURED TO MONITOR PERFORMANCE. GREAT EFFORT IS BEING MADE TO IMPROVE PREDICTION OF LATERAL EARTH PRESSURES. AT THE SAN FRANCISCO CIVIC CENTER STATION IT WAS NECESSARY TO CARRY OUT AN EXCAVATION APPROXIMATELY 700 FT LONG, 60 FT TO 99 FT WIDE, AND UP TO 78 FT DEEP. BECAUSE OF ADJACENT COMPRESSIBLE SOILS AND THE SENSITIVE STRUCTURES AROUND THE EXCAVATION, THE GROUND-WATER

LEVEL HAD TO BE MAINTAINED AS NEAR THE PRECONSTRUCTION LEVEL AS POSSIBLE. A CONSTRUCTION METHOD WAS ADOPTED AND COMPREHENSIVE FIELD INVESTIGATIONS WERE CARRIED OUT, WITH LABORATORY TESTS AND ANALYSES TO ASSIST IN PREDICTING THE LATERAL SOIL PRESSURES. CRITERIA FOR STRUCTURAL DESIGN AND CONTROL OF CONSTRUCTION WERE DEVELOPED. THE STRUCTURE WAS INSTRUMENTED AND THE MEASURED DATA WERE EVALUATED AND COMPARED WITH PRECONSTRUCTION ESTIMATES.

Thon, JG Harlan, RC *Am Soc Civil Engr J Soil Mech Div* Sept. 1971

2A 233303

SOIL COMPACTION /IN PORTUGUESE/

DATA ON SOIL COMPACTION, COMPACTION EQUIPMENT, COMPACTION CONTROL METHODS, AND NEUTRAL PRESSURE OBTAINED DURING THE CONSTRUCTION OF 21 DAMS IN BRAZIL AND 3 DAMS IN PORTUGAL IS PRESENTED. /RRI/

Cruz, PT Bezerra, DM
Geotecnica- Cesp /Brazil/ 1971

ACKNOWLEDGMENT: Road Research Institute /Brazil/

2A 233311

STABILIZATION STUDIES: AFGHANISTAN SOILS

THE FEASIBILITY OF STABILIZING OR OTHERWISE IMPROVING FOR CONSTRUCTION PURPOSES THREE UNSUITABLE SOILS FOUND IN AFGHANISTAN WAS STUDIED. THE STABILIZING AGENTS USED WERE LIME AND CEMENT COMMERCIALY AVAILABLE IN AFGANISTAN. TEST RESULTS INDICATED THAT ALL THREE SOILS CAN BE EFFECTIVELY STABILIZED WITH THE ADDITION OF LIME OR CEMENT. ALL THREE SOILS ARE REACTIVE WITH LIME OR CEMENT AND WILL READILY COMBINE TO INCREASE STRENGTH AND DURABILITY WITH THE RESULTING STABILIZED SOILS BEING SUITABLE FOR CONSTRUCTION. DURABILITY TESTS INDICATED THAT THE ADDITION OF LIME OR CEMENT ALSO INCREASES THE SOILS' RESISTANCE TO MOISTURE AND ICE PENETRATION.

Aufmuth, RE
Construction Eng Res Lab, Army Ce /US/ June 1972, 10 pp, 10 Fig, 5 Tab, 7 Ref

2A 233315

STABILIZATION STUDIES OF SOUTHEAST ASIAN SOILS: VIETNAM

THIS REPORT SUMMARIZES THE RESULTS OF AN INVESTIGATION TO DETERMINE PHYSICAL, CHEMICAL, AND SELECTED ENGINEERING PROPERTIES OF SIX SOUTHEAST ASIAN SOILS ENCOUNTERED IN PAVEMENT FACILITY CONSTRUCTION. LIME AND CEMENT MANUFACTURED IN THE UNITED STATES WERE USED TO STABILIZE OR OTHERWISE IMPROVE THE ENGINEERING CHARACTERISTICS (PLASTICITY, MOISTURE-DENSITY, AND CALIFORNIA BEARING RATIO) OF THE SOILS. TEST RESULTS INDICATE THAT FIVE OF THE SIX SOILS EVALUATED ARE REACTIVE AND WILL SHOW STRENGTH INCREASES IN EXCESS OF 100% OF THE NATURAL UNCONFINED COMPRESSIVE STRENGTH WITH EITHER LIME OR CEMENT AS THE STABILIZING MATERIAL. THE SIXTH SOIL, RECENT ALLUVIUM, CONTAINING 2.5% ORGANIC MATERIAL AND MONTMORILLONITE AS THE PRIMARY CLAY MINERAL, SHOWED IMPROVEMENT ONLY IN CERTAIN ENGINEERING PROPERTIES WITH THE ADDITION OF LIME OR CEMENT.

Aufmuth, RE
Construction Eng Res Lab, Army Ce /US/ June 1972, 11 pp, 15 Fig, 8 Tab, 10 Ref

2A 233318

DEEP-PLOW LIME STABILIZATION FOR PAVEMENT CONSTRUCTION

DEEP-PLOW LIME STABILIZATION EQUIPMENT AND PROCEDURES FOR TREATING SUBSTANTIAL THICKNESSES OF IN

SITU SUBGRADE SOIL ARE DESCRIBED. FIELD STUDY DATA AND RESULTS ARE SUMMARIZED, AND POTENTIAL FIELD APPLICATIONS ARE CONSIDERED. IT IS CONCLUDED THAT DEEP-PLOW LIME STABILIZATION PROCEDURES CAN BE SUCCESSFULLY UTILIZED IN PAVEMENT CONSTRUCTION IF APPROPRIATE CONSIDERATION IS GIVEN TO STABILIZATION OBJECTIVES AND QUALITY CONTROL REQUIREMENTS. /AUTHOR/

Thompson, MR *Am Soc Civil Engr J Transportation Eng* May 1972

2A 233340

CURRENT PRACTICE IN ABUTMENT AND FOUNDATION TREATMENT

THE CURRENT PHILOSOPHY AND PRACTICE OF BECHTEL INCORPORATED IN THE TREATMENT OF ABUTMENTS AND FOUNDATIONS OF HIGH EMBANKMENT DAMS ON ROCK ARE CONSIDERED, WITH SPECIAL REFERENCE MADE TO THE RECENTLY COMPLETED NEW DON PEDRO DAM IN CALIFORNIA. THE INFLUENCES OF SITE GEOLOGY AND TOPOGRAPHY ON DAM DESIGN, INCLUDING GROUTING, STRIPPING, ROCK REINFORCEMENT, AND DETERMINATION OF ACCEPTABLE ROCK FOUNDATION SURFACE ARE CONSIDERED. FOUNDATION BENEFICIATION SUCH AS THE USE OF DENTAL CONCRETE AND INSTALLATION OF FRENCH DRAINS AND RELIEF WELLS AND INSTRUMENTATION SUCH AS PIEZOMETERS AT NEW DON PEDRO AND OTHER DAMS ARE USED TO ILLUSTRATE THE STEPS TAKEN TO ENSURE SATISFACTORY FOUNDATIONS FOR HIGH EMBANKMENTS ON ROCK FOUNDATIONS.

Burke, HH Content, CS Kulesza, RL *Am Soc Civil Engr J Soil Mech Div* Vol. 98 No Sm 10, Oct. 1972, pp 1033-52, 19 Fig

2A 233369

ENGINEERING PROPERTIES OF COMPACTED FLY-ASH-DISCUSSION

EXPERIENCES GAINED FROM FLY ASH UTILIZATION IN CIVIL ENGINEERING, AND INVESTIGATIONS ON ENGINEERING PROPERTIES OF COMPACTED FLY ASH AND LIME, AND PORTLAND CEMENT STABILIZED FLY ASHES ARE REVIEWED. INVESTIGATION OF LAGOONED ASH WITH HIGH CALCIUM OXIDE CONTENT FROM TWO COAL FIRED POWER STATIONS, REVEALED IN ITS UPPER PARTS, HIGH WATER CONTENT AS WELL AS THE PROPERTY OF BEING EASILY COMPACTED AND STABILIZED BY MEANS OF PORTLAND CEMENT. TEST DATA FOR MIXTURES OF SPECIMENS WITH DIFFERENT QUANTITIES OF PORTLAND CEMENT COMPACTED IN NATURAL WATER CONTENT CONDITIONS UNTIL A SPECIFIC DRY DENSITY WAS REACHED ARE TABULATED. TESTS REVEALED RELATIVELY HIGH VALUES OF UNCONFINED STRENGTH AND AN IMPRESSIVE INCREASE IN STRENGTH WITH TIME. DESPITE THEIR HIGH WATER CONTENT THE SPECIMENS SHOWED A RELATIVELY SMALL LINEAR SHRINKAGE AFTER DRYING EQUAL TO 0.22 PERCENT THE PROPERTIES OF COARSE-GRAINED LAR (86 PERCENT FINES 2 MM TO 0.05 MM; 13 PERCENT 0.05 TO 0.005 MM; AND 1 PERCENT FINES SMALLER THAN 0.005 MM) WITH A SPECIFIC GRAVITY OF 2.53 G PER CU CM ARE DESCRIBED AND COMPARED WITH LAS. AN EXPERIMENTAL ROAD SECTION BUILT WITH A 20-CM THICK LAYER OF LAR 5 PERCENT CEMENT MIXTURE WITHOUT ASPHALTIC COVER SHOWED NO FROST DEFORMATIONS AND IS IN EXCELLENT CONDITION AFTER 3 YEARS. LABORATORY INVESTIGATIONS ON LAR ARE IN PROGRESS. POWER PLANT ASHES ARE THUS DEMONSTRATED TO BE USEFUL CONSTRUCTION MATERIAL.

Evstatiev, D DISCUSSEER *Am Soc Civil Engr J Soil Mech Div* Vol. 99 No. smz, Feb. 1973, pp 221-3, 2 Tab, 1 Ref

2A 233380

CURRENT PAVEMENT DESIGN IN AUSTRALIA /IN JAPANESE/

THE PRINCIPAL DIFFERENCES IN SOIL PROPERTIES, SOIL TYPES, CLIMATE, TERRAIN, TRAFFIC DENSITY, POPULATION DENSITY, AND ROAD CONSTRUCTION COSTS BETWEEN JAPA-

NESE AND AUSTRALIAN CONDITIONS ARE OUTLINED. THE USE OF STAGE CONSTRUCTION IN ESTABLISHMENTS OF A ROAD NETWORK IN AUSTRALIAN CONDITIONS, AND THE APPLICATION OF CBR AND SOIL SUCTION METHODS TO PAVEMENT DESIGN ARE DETAILED. MORE RECENT WORK ON RESILIENCE MODULUS AND CURRENT STABILIZATION PRACTICE ARE ALSO MENTIONED. THE PROBLEMS OF ROAD CONSTRUCTION ASSOCIATED WITH EXPANSIVE CLAYS AND EDGE CRACKING ARE DESCRIBED, AS WELL AS THE EFFICIENCY OF VARIOUS TYPES OF COMPACTION MACHINERY IN AUSTRALIAN CONDITIONS. THE WORK OF THE AUSTRALIAN ROAD RESEARCH BOARD IS PARTICULARLY NOTED AND COMMENDED. /CSIRO/

Ingles, OG
Pavements /Japan/ Vol. 6 No. 9, 1971, pp 34-6

ACKNOWLEDGMENT: Commonw Scient Indus Res Org /Austral/

2A 233403

DENSIFICATION OF SAND FOR DRYDOCK BY TERRA-PROBE DYNAMIC PENETROMETERS USUALLY DO NOT PROVIDE A POSITIVE MEANS FOR ELIMINATING THE DRIVE PIPE FRICTION PART OF THE SOIL RESISTANCE MEASUREMENT. THE USE IS DESCRIBED OF THE STATIC CONE PENETRATION TEST WHEREIN THE OPERATOR DOES NOT DRIVE THE CONE WITH A HAMMER BUT INSTEAD ADVANCES IT WITH A CONSTANT SPEED OF 1 CM/S TO 2 CM/S. THE EQUIPMENT ALSO INCLUDES CASING PROTECTION AGAINST BUCKLING AND SOIL FRICTION FOR THE RODS USED TO ADVANCE THE CONE TIP. ELECTRIC RESISTANCE SENSING ELEMENTS MAY ALSO BE PLACED WITHIN THE TIP. THE STATIC CONE PENETRATION TEST MAY ALSO BE USED IN COHESIONLESS SOILS TO CONTROL COMPACTION, ESTIMATE RELATIVE DENSITY, AND ESTIMATE SETTLEMENT. IN COHESIVE SOILS THE TEST PERMITS ESTIMATING SHEAR STRENGTH AND COMPRESSIBILITY. THE SPEED, ECONOMY, AND THE CONTINUOUS OR NEAR CONTINUOUS VERTICAL RESISTANCE PROFILE DATA OBTAINED, HAVE MADE THESE TESTS PARTICULARLY USEFUL IN THE EVALUATION OF UNIFORMITY OF SOIL CONDITIONS AT A SITE. THE USE OF THE RATIO OF LOCAL FRICTION TO CONE BEARING, CALLED THE "FRICTION RATIO", PERMITS ESTIMATION OF THE SOIL TYPES PENETRATED. THE USE OF OTHER FORMS OF SOIL EXPLORATION SUCH AS STATIC CONE OR FRICTION-CONE SOUNDINGS, WILL DEPEND ON THE SOIL CONDITIONS IN THAT AREA.

Janes, HW *Am Soc Civil Engr J Soil Mech Div* Vol. 99 No. nsm6, June 1973, pp 451-70, 13 Fig, 8 Ref

2A 233409

RECOMMENDATIONS FOR SOIL COMPACTION ASSOCIATED WITH ROAD CONSTRUCTION
THE RECOMMENDATIONS WERE DRAWN UP BY THE WORKING COMMITTEE ON SOIL COMPACTION. AFTER AN EXPLANATION OF MECHANICS PRINCIPLES AND PRELIMINARY INVESTIGATIONS WHICH HAVE TO BE CARRIED OUT, REFERENCE IS MADE TO THE PRACTICAL USE OF COMPACTION EQUIPMENT AND IN PARTICULAR TO THE DIFFERENT STATIC, DYNAMIC AND VIBRATING ROLLERS AND TAMPERS. SOIL TYPE, MOISTURE CONTENT AND SUITABILITY FOR COMPACTION ARE DISCUSSED TO AID IN THE CORRECT SELECTION OF EQUIPMENT FOR A PARTICULAR JOB. THE QUALITY REQUIREMENTS OF COHESIVE AND NON-COHESIVE SOILS AND OF EMBANKMENTS AND CUTTINGS ARE GIVEN. IN CONCLUSION REFERENCE IS MADE TO STANDARDS AND SPECIFICATIONS WHICH DEAL WITH THE TESTING OF COMPACTED SOIL. /TRRL/

Forschung Fur Das Strassenwesen /Ger/ R&d Rpt 1972, 32 pp, 22 Fig, 1 Tab, 36 Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

2A 233439

SANDWICKS CONSOLIDATE MOTORWAY EMBANKMENT
THIS ARTICLE DESCRIBES THE INSTALLATION OF SOME 600 SANDWICKS (PRE-PACKAGED SAN DRAINS FOR DISSIPATING PORE WATER PRESSURE AND ACCELERATING SOIL CONSOLIDATION) IN A SOFT ALLUVIUM AREA NEAR MANCHESTER IN CONNECTION WITH THE CONSTRUCTION OF A MOTORWAY EMBANKMENT. THE SANDWICKS WERE INSTALLED TO AN AVERAGE DEPTH OF 23FT, ON A SQUARE GRID SPACING OF 15FT. THEY WERE PLACED INTO HOLES DRILLED BY USING THE WASH BORING METHOD. BRIEF DETAILS ARE ALSO GIVEN OF SIMILAR CONSOLIDATION OPERATIONS CARRIED OUT FOR A NEW MOTORWAY EMBANKMENT IN YUGOSLAVIA. /TRRL/

Ground Engineering /UK/ Vol. 5 (Mar. 1972, 15 pp 1 Fi, g, 1 Phot

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/IRRD 201 609, 3C62232351

2A 233454

PROCEEDINGS OF WORKSHOP ON EXPANSIVE CLAYS AND SHALES IN HIGHWAY DESIGN AND CONSTRUCTION
THESE PROCEEDINGS ARE COMPRISED OF TECHNICAL PAPERS, REPORTS REMARKS AND DISCUSSIONS PRESENTED AT THE WORKSHOP ON "EXPANSIVE CLAYS AND SHALES IN HIGHWAY DESIGN AND CONSTRUCTION," IN DENVER, COLORADO. THE PROCEEDINGS COVER THE STATE OF THE ART ON HIGHWAY DESIGN AND CONSTRUCTION ON EXPANSIVE CLAYS AND SHALES. VOLUME 1 CONTAINS PAPERS, REPORTS AND DISCUSSIONS REGARDING: (1) FUNDAMENTAL MECHANISMS INVOLVED IN EXPANSION OF CLAYS AND CLAY SHALES, INCLUDING THE GEOLOGIC ORIGIN AND DISTRIBUTION OF EXPANSIVE CLAYS; (2) LABORATORY AND FIELD TESTING OF EXPANSIVE CLAYS; AND (3) METHODS FOR PREDICTION OF HEAVE OR DISTRESS IN ENGINEERING STRUCTURES FOUNDED ON OR IN EXPANSIVE CLAY OR SHALE. /AUTHOR/

Lambdr, Hanna, SJ
Wyoming University Vol. 1 May 1973, 363 pp, Figs, Tabs, Refs

2A 233457

EXPANSIVE SOILS AND CALIFORNIA HIGHWAYS (RESEARCH FINDINGS)

THIS RESEARCH WAS PROMPTED BY SEVERAL SPECIFIC LOCATIONS IN CALIFORNIA OF DISTRESS IDENTIFIED AS BEING CAUSED BY EXPANSIVE SOILS. IN PARTICULAR, THE DRAMATIC EMERGENCE OF SEVERE LOCALIZED CRACKING AND JOINT SEPARATION ON PORTIONS OF NEWLY CONSTRUCTED ROADS THROUGH THE SACRAMENTO VALLEY SERVED AS IMPETUS TO INVESTIGATE THE PROBLEM. THE OBJECTIVES OF THE RESEARCH WERE: (1) TO DEFINE THE EXTENT OF THE PROBLEM; (2) EVALUATE THE EFFECTIVENESS (AND SHORTCOMINGS) OF PRESENT PROCEDURES; AND (3) FID IMPROVED MEANS (EMPIRICAL OR RATIONAL) OF IDENTIFYING SOILS WITH DISTRESS CAUSING POTENTIAL. IN FORMULATING AN APPROACH FOR THE EXPANSIVE SOIL PROBLEM AND CALIFORNIA HIGHWAYS, THE RESEARCH WORK PLAN WAS DIVIDED INTO TWO GENERAL PHASES. THE FIRST PHASE WAS INTENDED TO DEFINE THE PROBLEM FURTHER. FIRST, AN INVENTORY OF LOCATIONS OF EXPANSIVE SOIL TYPE PAVEMENT DISTRESS WAS OBTAINED. FROM THOSE, A LARGE REPRESENTATIVE SAMPLE (50-100) WAS SELECTED FOR A FIELD SURVEY OF PAVEMENT CONDITION AT THESE SITES. ALSO, THE RIDING CONDITION OF THE ROADWAY IN THE VICINITY OF THE REPORTED DISTRESS WAS EVALUATED USING A PCA ROADMETER. THE OBJECTIVE WAS TO DETERMINE, IF POSSIBLE, THE EFFECT OF THE EXPANSIVE SOILS ON RIDING QUALITY OF THE ROADWAY. CONCURRENTLY, THE PROJECT RECORDS (AND OTHER PUBLICLY AVAILABLE DATA) WERE EVALUATED TO SEE IF INFORMATION WHICH COULD BE UTILIZED TO MINIMIZE OR PREVENT THE PROBLEM WAS BEING OVERLOOKED OR NOT UTILIZED TO THE BEST ADVANTAGE. THE SECOND OR ANALYTICAL PHASE

INVOLVED AN INTENSIVE ANALYSIS OF APPROXIMATELY 25 LOCATIONS SELECTED FROM THE INITIAL FIELD SURVEY. THOSE WERE REPRESENTATIVE OF THE RANGE OF DISTRESS OBSERVED, AS WELL AS GEOGRAPHICALLY DISTRIBUTED. THIS PORTION OF THE INVESTIGATION INCLUDED TAKING SOIL SAMPLES THROUGH THE ROADWAY, AND AN INTENSIVE "SHOTGUN" PROGRAM OF LABORATORY TESTING. THE DATA WERE ANALYZED TO DETERMINE THE RELATIONSHIP, IF ANY, BETWEEN THESE FACTORS AND THE OBSERVED DISTRESS. THE FOLLOWING CONCLUSIONS WERE REACHED: (1) EXPANSIVE SOIL TYPE DISTRESS IN CALIFORNIA IS PREVALENT ENOUGH TO BE CLASSED AS A SIGNIFICANT PROBLEM. (2) THE PROBLEM IS HIGHLY LOCALIZED. POTENTIAL PROBLEM SITES ARE APT TO BE MISSED BY "RANDOM SAMPLING" TYPE FOUNDATION INVESTIGATIONS, AS CONDUCTED FOR ROUTINE STRUCTURAL DESIGN PURPOSES. (3) SOILS HAVING MORE THAN 40 PERCENT PASSING THE NO. 200 SIEVE, OR MORE THAN 10 PERCENT OF CLAY SIZED FRACTION (LESS THAN 1.0 MICRON) HAVE A HIGH POTENTIAL FOR CAUSING DISTRESS. OTHER PARAMETERS HAVING USEFUL ASSOCIATIONS ARE CLAY MINERAL IDENTIFICATION, ATTERBERG LIMITS, LINEAR EXPANSION AND SHRINKAGE, AND INTERNAL SURFACE AREA. (4) THE U.S. DEPARTMENT OF AGRICULTURAL SOILS BULLETINS SHOULD BE RESEARCHED WHEN EVALUATING A ROADWAY LOCATION FOR EXPANSIVE SOILS.

Smith, RE
Workshop Proceedings Vol. 1 May 1973, pp 255-74, 3 Fig, 1 Tab, 1 Ref

2A 233458
THE CURRENT PRACTICE OF BUILDING LIGHTLY LOADED STRUCTURES ON EXPANSIVE SOILS IN THE DENVER METROPOLITAN AREA

THE CURRENT PRACTICE OF BUILDING LIGHTLY LOADED STRUCTURES ON EXPANSIVE SOILS IN DENVER HAS BEEN RELATIVELY SUCCESSFUL. METHODS AND TECHNIQUES HAVE BEEN DEVELOPED THROUGH EXPERIENCE TO HELP COPE WITH THE PROBLEMS CREATED BY SWELLING SOILS. SOME FOUNDATION SYSTEMS HAVE BEEN OVER-DESIGNED AND A FEW FOUNDATIONS HAVE NOT PERFORMED SATISFACTORILY BECAUSE THE ASSUMPTIONS AND THE JUDGMENTS MADE BY THE SOIL ENGINEER WERE NOT CORRECT. SITES THAT WERE CONSIDERED NOT USEABLE IN THE PAST MUST NOW BE BUILT UPON BECAUSE OF LOCATION AND ECONOMICS. THUS THE DEMANDS IMPOSED UPON THE SOIL ENGINEER BY OWNERS AND BUILDERS ARE EVER INCREASING. IT IS OBVIOUS THAT NEW TECHNIQUES MUST BE DEVELOPED TO BETTER UNDERSTAND THE NATURE OF EXPANSIVE SOILS IN ORDER TO MET THESE DEMANDS.

Sealy, CO
Workshop Proceedings Vol. 1 May 1973, pp 295-314, 4 Fig, 6 Ref

2A 233469
LIGHTLY TRAFFICKED ROADS--FRANCE

THE POTENTIAL USE OF VARIOUS TYPES OF SOFT MATERIALS FOR THE CONSTRUCTION OF LIGHTLY TRAFFICKED ROADS IS DESCRIBED. THE GRADING AND METHOD OF COMPACTION OF VOLCANIC SCORIAE, AND THE TYPE OF PAVEMENT FOR WHICH IT COULD BE UTILIZED, IS INDICATED. USE CAN BE MADE OF THE POZZOLANIC PROPERTIES OF SOME OF THESE SCORIAE. DETAILS ARE GIVEN OF THE USE OF SHELLS MIXED WITH SAND, AND THE USE OF CORALS. THE TREATMENT OF CHALK WITH LARGE PERCENTAGES OF SLAG, RENDERS IT NONSUSCEPTIBLE TO FROST. METHODS OF TREATMENT ARE DESCRIBED WHICH ENABLE THEM TO BE USED AS BASE COURSES FOR LIGHTLY TRAFFICKED ROADS. ATTENTION IS DRAWN TO THE USE OF SILTS IN THE ROAD BED OF RURAL HIGHWAYS. SUCCESSIVE TREATMENTS OF SUCH MATERIAL WITH LIME AND CEMENT IMPARTS FROST RESISTANCE. THE PERFORMANCE OF LOW-COST ROADS UNDER TRAFFIC AND THE STRENGTHENING OF PAVEMENTS IN TROPICAL AND SUBTROPICAL CLIMATES WAS INVESTIGATED. STUDY OF THE PROBLEMS OF SEMI-RIGID PAVEMENTS WITH UPPER COURSE

BINDERS MUST TAKE INTO ACCOUNT POISSON'S COEFFICIENT. THE INTERACTION OF THE CHARACTERISTICS OF UPPER COURSES WITH BINDERS AND LOWER COURSES WITHOUT BINDERS MUST BE TAKEN INTO CONSIDERATION BY DESIGNERS. A METHOD OF ANALYZING THE BEHAVIOR OF PAVEMENTS IS PRESENTED. IT IS BASED ON THE PRODUCT OF THE RADIUS OF CURVATURE MULTIPLIED BY THE DEFLECTION. AN APPARATUS IS DESCRIBED WHICH MEASURES BOTH THE DEFLECTION AND THE CURVATURE. A STUDY OF THE ROAD SYSTEMS IN WEST AFRICA AND MADAGASCAR IS REPORTED AND THE OBSERVATIONS MADE ARE RECORDED. THE INFLUENCE OF SECONDARY ROADS ON THE NATIONAL REVENUE IS REVIEWED. SUGGESTIONS ARE MADE FOR A MODEL OF THE BEHAVIOR OF THE PRODUCER-CONSUMER, AND THE APPLICATION OF THE MODEL IS DESCRIBED. OBSERVATIONS ARE MADE ON THE ASPECT OF INITIAL TRAFFIC IN A DEVELOPING AREA.

Joneaux, R Bonnot, J Cambournac, M Lepetit, P Remillon, A Perm
Intl Assoc Road Congresses Proc Vol. 2 1971, 40 pp, 8 Fig

2A 233470
LIGHTLY TRAFFICKED ROADS--FEDERAL REPUBLIC OF GERMANY

THE LEAVING IN PLACE OF THE LOCAL TOPSOIL IN A ROAD CONSTRUCTION PROJECT IS REPORTED. ALTHOUGH SOIL STABILIZATION MAY BE NECESSARY, FINANCIAL ADVANTAGES MAY BE EXPECTED FROM THE SAVING IN REMOVAL AND TRANSPORT COSTS AND THE FACT THAT AN ADDITIONAL DRAINAGE SYSTEM IS OBIATED. EXAMINATION AFTER 5 TO 6 YEARS OF TEST SECTIONS USING LOCAL TOPSOILS (ORIGINATING FROM LOESS AND STABILIZED BY DIFFERENT METHODS) DID NOT REVEAL UNFAVORABLE EFFECTS. THE ROAD TRAFFIC ON THE SECTIONS CONSISTED OF LIGHT TO MEDIUM AGRICULTURAL VEHICLES. THE BEHAVIOR OF A LOW COST ROAD UNDER TRAFFIC WAS STUDIED AND WAS FOUND TO BE CONSIDERABLY DAMAGED BY HORIZONTAL FORCES. THE SUB-BASE OF THE ROAD CONSISTED FO A 100 MM THICK CEMENT STABILIZATION APPLIED ON TOP OF A COMPRESSED SAND COURSE. THE LATTER WAS COVERED BY A 25 MM THICK WEARING COURSE OF BITUMINOUS SAND. THE DAMAGE, WHICH WAS LOCATED IN THE DRIVING TRACKS OF THE RIGHT-HAND FRONT WHEELS BUT NEVER ON THE CENTER OF THE ROAD, CONSISTED OF STRONG WAVE FORMATION COMBINED WITH SHIFTS AND OBLIQUE SPILTS. THE CAUSE OF THIS DAMAGE IS EXPLAINED. IN ORDER TO ACHIEVE A BETTER ADHESION BETWEEN THE WEARING COURSE AND THE SUB-BASE, THE CEMENT STABILIZATION WAS REPLACED BY A BITUMINOUS COURSE. A KIND OF "DOWELLING" FROM CRUSHED MATERIAL IS ARRANGED BETWEEN THE TWO COURSES, AND THE WEARING COURSE IS STRENGTHENED BY MODIFYING ITS COMPOSITION. GENERAL DATA ON THE ABSORPTION OF HORIZONTAL STRESSES ARE PRESENTED, AS ARE ALSO THE RESULTS OF EVALUATIONS OF THE LIFE OF THE ROADS DESCRIBED.

Kubler, G *Perm Intl Assoc Road Congresses Proc* Vol. 2 1971, 15 pp, 7 Fig

2A 233471
LIGHTLY TRAFFICKED ROADS--GREAT BRITAIN

THE REPORT DEMONSTRATES THAT THE PROPERTIES OF LOWGRADE MATERIALS (THOSE WHICH ON THE BASIS OF ESTABLISHED CRITERIA WOULD BE REJECTED FOR USE IN A PARTICULAR PAVEMENT) CAN BE IMPROVED TO ACCEPTABLE STANDARDS BY THE USE OF SMALL PROPORTIONS OF ADDITIVES SUCH AS CEMENT, LIME OR BITUMEN. SATISFACTORY PERFORMANCE MAY ALSO BE OBTAINED BY THE USE OF SOUND SELECTION AND CONSTRUCTION METHODS AND BY THE CONTROL OF FACTORS SUCH AS MOISTURE CONTENT. AGGREGATES WHICH SATISFY TEST CRITERIA BUT SUBSEQUENTLY DECOMPOSE IN SERVICE, MAY BE IDENTIFIED BY A SODIUM SULPHATE TEST OR BY PETROLOGICAL EXAMINATION TO DETERMINE THE SECONDARY MINERAL CONTENT. A PAVEMENT DESIGN PROCEDURE WHICH INCORPORATES

STAGE-CONSTRUCTION PRACTICES HAS BEEN DEVELOPED FOR AREAS WHERE A HIGH RATE OF TRAFFIC IS EXPECTED IN THE FUTURE. FOR ASSESSING THE STRENGTH OF SUB-GRADE, IT IS RECOMMENDED THAT THE CBR SHOULD BE MEASURED AT THE HIGHEST MOISTURE CONTENT IT IS EXPECTED TO ATTAIN. FULL-SCALE PAVEMENT-DESIGN EXPERIMENTS WITH STABILIZED AND UNSTABILIZED BASES, AND METHODS OF DETERMINING THE OPTIMUM CEMENT CONTENT IN SOIL-CEMENT PAVEMENTS IS DISCUSSED. A PRACTICAL METHOD OF ASSESSING THE RESIDUAL STRENGTH OF EXISTING PAVEMENTS, TO DETERMINE WHEN STRENGTHENING IS REQUIRED, IS CONSIDERED TO BE THE MEASUREMENT OF TRANSIENT DEFLECTIONS UNDER A MOVING LOAD. INVESTIGATIONS ARE IN PROGRESS TO DEVELOP SURVIVOR CURVES FOR TROPICAL CONDITIONS. THE NEED FOR FULL-SCALE EXPERIMENTS TO ASSESS THE PERFORMANCE UNDER TROPICAL CONDITIONS OF DIFFERENT BITUMINOUS MIXTURES IS EMPHASIZED. METHODS OF PREVENTING EROSION OF EMBANKMENTS, ROAD SHOULDERS AND DRAINS ARE REVIEWED. RESEARCH IN THE EFFICIENT USE OF TRANSPORT INVESTMENT FUNDS FOR THE RESOLUTION OF RURAL DEVELOPMENT PROBLEMS IS REPORTED. THE DEVELOPMENT OF MATHEMATICAL MODELS TO PREDICT THE TRANSPORTATION NEEDS OF CERTAIN LEVELS AND TYPES OF AGRICULTURAL DEVELOPMENT IS DISCUSSED, AND METHODS ARE SUGGESTED FOR RELATING GROWTH IN TRAFFIC DEMANDS TO GENERAL SOCIO-ECONOMIC INDICATORS.

Millard, RS White, CB Hudson, NW Sharman, FA Tingle,
ED Wilson, RL Woodrow, EH *Perm Intl Assoc Road Congresses Proc*
Vol. 2 1971, 33 pp, 6 Fig, 3 Tab, 32 Ref

2A 233473

LIGHTLY TRAFFICKED ROADS--ITALY

THE USE OF SAND AS A MATERIAL FOR THE CONSTRUCTION OF ROAD BASE AND SUB-BASE COURSES IS REPORTED (IN THE APPENDIX), AND THE DEVELOPMENT OF A MODEL WHICH, GIVEN THE ENVIRONMENTAL CONDITIONS AND TRAFFIC FLOW DATA, COULD BE USED TO PREDICT ROAD SURFACE CONDITION AND TRANSPORT COSTS IS DESCRIBED. THE DEVELOPMENT OF SUCH A MODEL WILL INVOLVE THE PERFORMANCE OF APPROPRIATE TESTS AND THE INVENTORYING OF THE HIGHWAY NETWORK. FOR LIGHTLY TRAFFICKED ROADS, ESPECIALLY WHEN THE PAVEMENT IS NOT PROTECTED BY A WEARING COURSE, EMPHASIS MUST BE GIVEN TO RUTS AND TO THE CONFIGURATION OF THE CROSS MICROPROFILE. IN A CONSIDERATION OF THE INFLUENCE OF SECONDARY ROADS ON SOCIO-ECONOMIC DEVELOPMENT, ATTENTION IS DRAWN TO THE USE OF COST-BENEFIT ANALYSIS AS A TOOL IN THE ACHIEVEMENT OF ECONOMIC EFFICIENCY. THE SHORTCOMINGS OF THE TOOL ARE DISCUSSED. THE FORMULATION OF A SOCIAL WELFARE FUNCTION ESTABLISHED ON THE BASIS OF ETHICAL CRITERIA, AND THE DEVELOPMENT OF A TOOL TO MAXIMIZE THAT FUNCTION IS URGED. A DEFINITION IS PROPOSED FOR THE CONCEPT OF MAINTENANCE WORK. THE COST TO THE ROAD USER IN TRANSPORTING MERCHANDISE IS REVIEWED. IT IS ESTIMATED THAT AXLE LOADING ABOVE THE USUAL LIMITS OF "EQUIVALENCE FACTORS" RESULTS IN INCREASED COSTS. THE IMPOSITION OF RESTRICTIONS ON MAXIMUM AXLE LOAD IS NEEDED TO CHECK THE TENDENCY OF FREIGHT AUTHORITIES TO OVERLOAD TRUCKS.

Borgia, E *Perm Intl Assoc Road Congresses Proc* Vol. 2 1971, 21 pp, 4 Fig

2A 233477

LIGHTLY TRAFFICKED ROADS-POLAND

IN THE FIELD OF UTILIZATION OF NON-TRADITIONAL LOCAL MATERIALS FOR ROAD CONSTRUCTION, PROGRESS IS BEING MADE IN POLAND IN THE USE OF LIGNITE FLY ASH REPLACING CEMENT AND LIME. MIXTURES OF FLY ASH OF LIGNITE AND COAL ARE GIVING GOOD RESULTS. MANY WASTE PRODUCTS ARE BEING USED AS FILLERS FOR COATED MATERIALS,

INCLUDING REFINED RESIN POWDERS, FLOTATION POWDERS, AND CEMENT DUST HELD BY ELECTRO-FILTERS. CHALK IS ALSO BEING USED AS A FILLER. THE BEHAVIOR OF CARRIAGEWAYS IS APPRECIATED VISUALLY BUT DOUBTFUL SECTIONS ARE CHECKED BY AXLE-WEIGHTS AND SPECIAL NOTING OF HEAVY LORRIES. THE PROBLEM OF FIGHTING EROSION IS DEALT WITH ON THE BASIS OF RESEARCH CARRIED OUT ON DISTRICT ROADS. THE EROSION OF EMBANKMENT SLOPES CREATES THE GREATEST DIFFICULTY. THE FAILURE OF THE COVERING LAYER IS THE MAIN CAUSE OF DAMAGE. FINE AND SMOOTH SANDS ARE SOILS MOST SUSCEPTIBLE TO EROSION. THE MOST EFFECTIVE METHOD IS THE PROTECTION OF EMBANKMENT SLOPES BY MEANS OF BITUMINOUS IMPREGNATION. AS REGARDS THE INFLUENCE OF SECONDARY ROADS ON SOCIAL AND ECONOMIC DEVELOPMENT, AN EXAMPLE IS DESCRIBED OF DISTRICT DEVELOPMENT WHICH HAS CONSIDERABLY IMPROVED ITS ROAD NETWORK DURING THE LAST TEN YEARS. PARTICULARLY NOTICEABLE HAVE BEEN CULTURAL AND SOCIAL CHANGES IN VILLAGES WHICH HAVE BEEN LINKED BY ROADS TO TOWNS.

Rolla, S Pachowski, J Skalmonski, W Kalabinska, M Filipoto, W
Perm Intl Assoc Road Congresses Proc Vol. 2 1971, 11 pp, 1 Tab

2A 233478

LIGHTLY TRAFFICKED ROADS--PORTUGAL

ON ACCOUNT OF THE DIFFERENCE IN THE DEVELOPMENT AND CLIMATIC CONDITIONS OF THE TERRITORIES CONSIDERED, THERE ARE VERY GREAT DIFFERENCES IN THE PROBLEMS OF LIGHTLY-TRAFFICKED ROADS. THE PRESENT REPORT THEREFORE STUDIES THESE PROBLEMS SEPARATELY FOR EUROPE (PORTUGAL) AND AFRICA (ANGOLA AND MOZAMBIQUE). THE USE OF LOCAL MATERIALS NOT NORMALLY ACCEPTED FOR PAVEMENT CONSTRUCTION IS VERY EXTENSIVE IN ANGOLA AND MOZAMBIQUE, ESPECIALLY IN THE CASE OF MECHANICALLY STABILIZED SOILS, SOIL CEMENT, LIMESTONE AND LATERITIC SOILS. SPECIFICATIONS AND RESULTS OF THE PERFORMANCE OF SOILS IN PAVEMENTS ARE GIVEN. FOR STUDIES ON THE PERFORMANCE OF PAVEMENTS, THE IMPORTANCE OF SYSTEMATIC VISUAL INSPECTION IS UNDERLINED. DEFLECTOGRAPHS HAVE BEEN LATELY USED. AFTER BRIEFLY REFERRING TO THE METHODS OF STUDYING AND CONSTRUCTING PAVEMENT REINFORCEMENTS IN MOZAMBIQUE, DIFFERENT ASPECTS OF THE FIGHT AGAINST EROSION ARE DEVELOPED, AND SOME OF THE MORE SUCCESSFUL METHODS USED REFERRED TO, TOGETHER WITH THE USE OF GEOTECHNICAL FEATURES IN DEFINING THE RESISTANCE OF SOILS UNDER THE ACTION OF EROSION AGENTS. ASPECTS CONCERNING THE INFLUENCE OF SECONDARY ROADS ON SOCIAL AND ECONOMIC DEVELOPMENT, THE MAINTENANCE COSTS AND THE COST PER TON OF TRANSPORTING MERCHANDISE, ARE ALSO VERY BRIEFLY TREATED.

Santos, MP Ferreira, HN Furtado, V De, MORAIS EL Raposo,
AD Sequeira, FP *Perm Intl Assoc Road Congresses Proc* Vol. 2 1971, 14 pp

2A 233479

LIGHTLY TRAFFICKED ROADS--RHODESIA

IN RHODESIA, A 24 KM SECTION OF A DEVELOPMENT ROAD HAS BEEN SUCCESSFULLY CONSTRUCTED USING A HIGHLY PLASTIC AND VERY COARSE GRAVEL AS THE BASE COURSE. DESPITE THE DIFFICULTIES OF LAYING AND TESTING THE GRAVEL LAYER AN ACCEPTANCE STANDARD BASED ON VISUAL APPEARANCE WAS DEVELOPED. THE STRUCTURAL PERFORMANCE UNDER TRAFFIC WAS SATISFACTORY AND WHERE DISTRESS OCCURRED THIS WAS NOT CAUSED BY THE NATURE OF THE BASE MATERIAL. THE RUNNING SURFACE WAS NOT AS SMOOTH AS MIGHT BE ACHIEVED WITH BETTER GRADED MATERIAL BUT THE SURFACE WAS CONSIDERED ACCEPTABLE FOR THE PURPOSE WHICH IT SERVES. EXPERIMENTAL SECTIONS OF SEVERAL TYPES OF ROAD HAVE BEEN

TREATED WITH A SURFACE DRESSING USING AN AGGREGATE OF QUARTZITIC ORIGIN. IT WAS FOUND ESSENTIAL TO PRECOAT THE STONE WITH A COAL TAR PRIME. THE CALCULATED BINDER RATE IS BETTER ACHIEVED IN TWO APPLICATIONS ONE AS A TACK COAT AND A MIST SPRAY AFTERWARDS. THE STRENGTH AND DURABILITY OF THE AGGREGATE WAS DERIVED FROM THE EFFECTS OF TRAFFIC AND ROAD GRADING AND THE USE OF NATURAL STONE FOR SURFACING SEEMS LIMITED TO UNUSUAL CIRCUMSTANCES. WITH CAREFUL PRELIMINARY PROVING AND TESTING AND DILIGENT SITE CONTROL DURING CONSTRUCTION IT HAS BEEN ESTABLISHED THAT NATURALLY OCCURRING QUARTZ AGGREGATES CAN BE USED QUITE SATISFACTORILY FOR CONCRETE WORK. THE ORIGINAL WORK WAS OF NECESSITY UNDERTAKEN IN EXTREMELY REMOTE AREAS WHERE SITE CONDITIONS WERE DIFFICULT BUT PROVED AN EXTREMELY ECONOMIC PROCESS. AS A RESULT NATURAL AGGREGATES ARE NOW INVESTIGATED FOR ALL WORK EVEN WHERE IGNEOUS ROCK IS AVAILABLE FOR CRUSHING. THIS HAS ACHIEVED SIGNIFICANT ECONOMIES IN THE BRIDGE CONSTRUCTION COSTS. TRAFFIC STATISTICS BOTH IN RESPECT OF NUMBERS AND WEIGHT OF VEHICLES HAVE BEEN COLLECTED FROM PERMANENT AUTOMATIC COUNTING STATIONS SUPPLEMENTED BY VISUAL COUNTS OVER SHORT PERIODS. THE LIFE OF PAVEMENTS HAS BEEN ESTIMATED USING BENKELMAN BEAM AND RADIUS OF CURVATURE TECHNIQUES. RHODESIA IS ENTERING AN ERA OF ROAD RETIREMENT AND AN OVERLAY POLICY IS BEING ADOPTED. TECHNIQUES ARE BEING DEVELOPED WHEREBY ENGINEERING ESTIMATES FOR PRIORITY AND DESIGN ARE MADE, BASED ON DEFLECTION STUDIES, BUT TEMPERED BY LOCAL EXPERIENCE. AT PRESENT DATA IS BEING ACCUMULATED ON THE EFFECT UPON DEFLECTION OF 2% CEMENT STABILIZED BASES, AND ON THE VALIDITY OF THE FIGURES AND GRAPHS USED, AND THEY ARE SUBJECT TO REVISION. IT IS PROBABLE THAT WHERE LESS THAN 150 MM OF GRANULAR OVERLAY IS NECESSARY, OR WHEN THE ADT EXCEEDS 1000 V.P.D. PER LANE, PREMIX WILL BE USED, BUT THAT IN OTHER CASES GRANULAR OVERLAYS WILL BE SATISFACTORY. SO FAR MORE PREMIX THAN GRANULAR OVERLAYS HAVE BEEN USED. A PROGRAM OF BRIDGEWORKS FOR PRIMARY DEVELOPMENT OF RHODESIA IS BEING UNDERTAKEN TO STANDARDS FAR SUPERIOR TO THE ROADS IN THE VICINITY OF THE STRUCTURES. A PRIORITY RATING SYSTEM HAS BEEN DEVELOPED FOR THE DETERMINATION OF A PROGRAM OF WORK BASED ON SOUND ENGINEERING FACTORS. A PROGRESSION OF STANDARDS APPROPRIATE TO THE WIDE VARIATION IN CIRCUMSTANCES OF DEVELOPMENT OF EACH AREA OF THE COUNTRY HAS BEEN ADOPTED. THE ECONOMIC BENEFIT FROM ISOLATED BRIDGEWORKS CAN BE IMMEDIATE AND OUTSTANDING UNDER FAVORABLE CONDITIONS IN THE AREAS DEVELOPED. ACCURATE COSTING OF ROAD MAINTENANCE HAS RECENTLY BEEN COMMENCED. ALTHOUGH IT IS CLEAR THAT FIGURES MUST BE CONTINUOUS OVER 5-10 YEARS FOR REALLY SIGNIFICANT COSTS TO EMERGE, CERTAIN TRENDS HAVE ALREADY EMERGED AND THESE HAVE BEEN ANALYZED.

Mitchell, RL Mathews, A Wootton, PM *Perm Intl Assoc Road Congresses Proc* Vol. 2 1971, 35 pp, 9 Fig, Tabs

2A 233480

USE OF LOCAL MATERIALS NOT NORMALLY ACCEPTED FOR PAVEMENT CONSTRUCTION--SPAIN

VARIOUS SOLUTIONS ARE SET FORTH FOR ECONOMICAL ROADWAYS, USING LOCAL SOIL TREATED WITH LIME AND CEMENT, GRANULAR FOUNDATIONS AND BITUMINOUS PROTECTION FOR THE CARRIAGE BED. SEVERAL EXAMPLES ARE GIVEN WHICH SHOW THE CHARACTERISTICS OF SOILS OF DIFFERENT REGIONS, THEIR MODIFICATION BY THE TREATMENT APPLIED AND THE INTENSITY OF THE TRAFFIC. THE DURABILITY OF ROADWAYS IN THE PREVAILING CONDITIONS IS RECORDED FOR PERIODS OF UP TO FIVE YEARS. THE IMPORTANCE OF A DRAINAGE SYSTEM IS NOTED, BECAUSE

MOISTURE RETAINED IS THE PRINCIPAL CAUSE IN THE DETERIORATION OF THE BODY OF THE ROADWAY. THIS SHOULD BE TAKEN CARE OF BY RAISING THE LEVEL OF THE ROAD SLIGHTLY ABOVE THE LEVEL OF THE GROUND AND BY PROVIDING AS MANY WIDE DITCHES, GUTTERS AND DRAIN PIPES AS MAY BE NECESSARY. THE FUNCTIONS OF ROADS ARE, DEFINED IN RESPECT OF THEIR INFLUENCE ON THE SOCIAL AND ECONOMIC DEVELOPMENT OF THE AREA WHICH THEY SERVE, TO PROVIDE THE BEST MEANS OF ACCESS AND FACILITATE THE EXCHANGE OF PRODUCTS, ETC. VARIOUS KINDS OF BENEFITS ARE EVALUATED: TIME SAVING ON JOURNEYS, REDUCTION OF TRANSPORT COSTS, INCREASED VALUE OF ADJOINING LAND, ETC. IN SPAIN THIS IS CALCULATED BY A FORMULA, WITH FIXED VALUES FOR ITS COMPONENTS. THE SHOW THAT THE PROJECTS ARE JUSTIFIED AND THE NEED FOR THEM, RELEVANT DATA ARE USED TO PROVIDE A BENEFIT/COST RELATIONSHIP.

Delbario, E *Perm Intl Assoc Road Congresses Proc* Vol. 2 1971, 14 pp

2A 233481

LIGHTLY TRAFFICKED ROADS--SWITZERLAND

LIME STABILIZATION IS A PROCESS WHICH ALLOWS THE USE OF CLAYEY AND WET SOILS AS CONSTRUCTION MATERIAL. LIME HAS A FAVORABLE INFLUENCE ON SOIL PROPERTIES FOR HIGHWAY CONSTRUCTION. THE RESULTS AND DEDUCTIONS FROM LABORATORY TESTS ALLOW A DISCERNING AND ECONOMICAL USE OF THIS STABILIZATION PROCESS. THE IMMEDIATE EFFECT FOLLOWING THE ADDITION OF LIME IS A FIRMER CONSISTENCY. THE EXPLANATION OF THE IMMEDIATE EFFECT BY BINDING AND STRUCTURAL CHANGE CAN BE CHECKED BY GEOTECHNICAL TESTS. THE IMMEDIATE EFFECT IS USED AS AN AUXILIARY MEASURE FOR EARTHWORKS TO DRY OUT THE SOIL SO THAT IT CAN BE MORE EASILY WORKED, MADE MORE SUITABLE FOR BEARING TRAFFIC LOAD AND MORE READILY COMPACTED. THE LONG TERM INCREASE IN STRENGTH AND STABILITY IS DUE TO THE INTERACTION OF LIME WITH THE FINELY GRAINED ELEMENTS IN THE SOIL. THIS REACTION LEADS TO THE FORMATION OF A BOND WHICH CEMENTS TOGETHER THE INERT ELEMENTS IN THE SOIL. THE IMMEDIATE AND LONG TERM REACTIONS PRODUCE A SERIES OF FAVORABLE GEOTECHNICAL CHANGES, WHICH CONVERT PREVIOUSLY USELESS MATTER INTO HIGH QUALITY CONSTRUCTION MATERIALS. THE IDENTIFICATION AND CLASSIFICATION OF SOILS IS NOT ENOUGH TO DETERMINE WITH CERTAINTY THEIR REACTIVITY. SPECIFICALLY DESIGNED TESTS MUST BE USED. IT IS THEN POSSIBLE TO CONSTRUCT SATISFACTORY STABILIZED LAYERS AND TO USE THEM ACCORDING TO THEIR LOAD BEARING CAPACITY. IN DETERMINING THE CHOICE OF SUPERSTRUCTURE, IT WAS FOUND THAT THE MOSE ADVANTAGEOUS VERTICAL STRUCTURE CAN BE ARRIVED AT BY COMPARING THE DIFFERENT COSTS. IN THIS CALCULATION NOT ONLY THE EASILY CALCULATED CONSTRUCTION COSTS, BUT ALSO MAINTENANCE COSTS MUST BE CONSIDERED. THANKS TO TRIAL SECTIONS, IT HAS BEEN POSSIBLE TO DETERMINE THE MAINTENANCE COSTS OF THE MORE COMMON STRUCTURES OF LIGHTLY USED ROADS. IT HAS BEEN ESTABLISHED THAT THE MAINTENANCE COSTS OF A PARTICULAR SURFACING ON DIFFERENT BASES DO NOT VARY MUCH. THE KIND AND THE FREQUENCY OF MAINTENANCE WHICH CONTROLS THE AMOUNT OF COST VARIES WITH THE QUALITY AND THICKNESS OF THE LAYER. COMPARISON CAN BEST BE MADE BY EQUATING PERIODIC TOTALS OF MAINTENANCE COSTS. IN THIS WAY THE MOST ADVANTAGEOUS VARIANT CAN BE ARRIVED AT IF THE CRITERION, THAT THE TOTAL COST OF CONSTRUCTION AND MAINTENANCE IS KEPT AT A MINIMUM, BE OBSERVED.

Kuonen, V Hirt, R *Perm Intl Assoc Road Congresses Proc* Vol. 2 1971, 28 pp, Figs, Tabs

2A 233482

LIGHTLY TRAFFICKED ROADS--USSR

LOW COST ROADS CONSTITUTE THE MAJOR PART OF THE COUNTRY'S ROAD NETWORK. THEIR LENGTH EXCEEDS 70 PERCENT OF THE TOTAL LENGTH OF THE ROAD NETWORK IN THE USSR. THE ANNUAL TRAFFIC VOLUME OF LOCAL ROADS IS VERY HIGH. IN THE SOVIET UNION, LOCAL ROADS CONNECTING URBAN CENTERS WITH THE ROAD NETWORK, ONE CENTER WITH ANOTHER CENTER, ACCESS ROADS AND COMMUNICATION ROADS OF DIFFERENT DEPARTMENTS ARE CLASSIFIED AS LIGHTLY TRAFFICKED ROADS. TRAFFIC DENSITY ON LOCAL ROADS VARIES GREATLY ACCORDING TO THE CONDITIONS PECULIAR TO THE LOCALITY AND THE INDUSTRIAL OR AGRICULTURAL NATURE OF THE DISTRICT. SINCE ROAD TRAFFIC IS USUALLY OF A SEASONAL CHARACTER, THE DESIGN TRAFFIC DENSITY IS BASED ON THE DAILY TRAFFIC DENSITY (DURING THE PEAK PERIOD) OF THE SEASON OF THE HEAVIEST TRAFFIC, NOT ANNUAL TRAFFIC DENSITY. IN THE PROCESS OF THE CULTURAL AND ECONOMIC DEVELOPMENT OF A REGION OR DISTRICT, THE CHOICE AND DESIGN OF THE GEOMETRIC AND STRUCTURAL CHARACTERISTICS OF LOCAL ROADS ARE DETERMINED MAINLY BY TECHNICAL AND ECONOMIC EXPEDIENCIES AND TAKING INTO ACCOUNT THAT LATER IMPROVEMENTS AND MODERNIZATION MUST NOT INVOLVE ANY WASTE OF FUNDS ALREADY INVESTED. THE TENDENCY NOW BEING TO USE THE STAGE METHOD FOR MODERNIZING MINOR ROADS, THEIR ECONOMIC IMPORTANCE WITHIN THE NETWORK IS A DECISIVE FACTOR IN THEIR SELECTION FOR FURTHER DEVELOPMENT. IN ORDER TO KEEP DOWN COSTS WHEN CONSTRUCTING LIGHTLY TRAFFICKED ROADS, LOCAL NON-STANDARD MATERIALS AND CERTAIN INDUSTRIAL WASTE PRODUCTS ARE USED IN THE SOVIET UNION TO GOOD EFFECT. IN THIS REPORT, LOCAL NON-STANDARD MATERIALS USED IN PAVEMENT CONSTRUCTION ARE CLASSIFIED, THE MEASURES CONSIDERED TO ENABLE MORE DURABLE PAVEMENT COURSES TO BE CONSTRUCTED ARE DISCUSSED, THE PERFORMANCE CHARACTERISTICS OF GRAVEL AND EARTH ROADS ARE REFERRED TO, AND RECOMMENDATIONS ARE MADE FOR STRENGTHENING PAVEMENTS IN HOT CLIMATES.

Nikholayev, AA Vasylyev, AP Lazebnikov, MG Erastov, AJ Rosov, JN Slavutsky, AK Keilman, BA Malevansky, VV Perm
Intl Assoc Road Congresses Proc Vol. 2 1971, 31 pp, 10 Fig, 15 Tab

2A 233505

MISSISSIPPI'S EXPERIMENTAL WORK ON ACTIVE CLAYS

IN THE YAZOO, PORTER'S CREEK, AND ZILPHA CLAY AREAS THAT COVER LARGE AREAS OF MISSISSIPPI, PAVEMENTS HAVE BEEN BADLY DISTORTED AND DESTROYED BY THE BEHAVIOR OF THE HIGHLY EXPANSIVE SUBGRADES. AN INVESTIGATION WAS CONDUCTED TO PRODUCE A DEFINITIVE STUDY FOR THE PREDICTION OF THE MOVEMENT OF CLAYS, AND TO PRESENT TO THE HIGHWAY ENGINEERS A CONSTRUCTION METHOD THAT WOULD ELIMINATE OR GREATLY REDUCE THE HEAVE OF THE SUBGRADE AFTER THE COMPLETION OF THE ROADWAY. THE DESIGN AND CONSTRUCTION OF THE RESEARCH PROJECT ARE DISCUSSED IN THIS REPORT, AND THE RESULTS AND SUBSEQUENT RECOMMENDATIONS ARE PRESENTED.

Teng, TC Maddox, RM Clisby, MB
Workshop Proceedings Vol. 2 May 1973, pp 1-27, 25 Fig, 2 Ref

2A 233506

USES OF HYDRATED LIME (MOVIE)--AND--LIME

STABILIZATION OF EXPANSIVE CLAYS AT THE DALLAS-FORT WORTH AIRPORT AND MOVIE COMMENTARY THE DESIGN AND CONSTRUCTION OF THE DALLAS-FORT WORTH REGIONAL AIRPORT IS DISCUSSED IN ORDER TO ILLUSTRATE LARGE-SCALE SOIL STABILIZATION AND PAVING PROBLEMS. TESTS HAVE SHOWN THAT UNDESIRABLE SUBGRADE SOILS FOUND IN THE AREA CAN BE TRANS-

FORMED INTO A STABLE, ESSENTIALLY NON-SWELLING FRIABLE MIXTURE IF LIME IS ADDED AND ADEQUATELY MIXED. BESIDES STABILIZING AND IMPROVING THE STRUCTURAL CAPABILITY OF THE TREATED LAYER, THE LIME WILL ALSO MAKE THE TREATED LAYER IMPERVIOUS. VARIOUS METHODS UTILIZED IN THE STABILIZATION PROCESS ARE DISCUSSED.

Kelley, C
Workshop Proceedings Vol. 2 May 1973, pp 28-32

2A 233507

SOIL MODIFICATION HIGHWAY PROJECTS IN COLORADO

THE HIGH INCIDENCE OF ROADWAY FAILURES IN EASTERN COLORADO DUE TO SWELLING SOILS HAS LED TO A MULTITUDE OF ATTEMPTS TO PREVENT REPEAT PERFORMANCES. SOME OF THE IDEAS THAT HAVE BEEN EXPRESSED FOR REDUCING SUBGRADE SWELLINGS ARE THE FOLLOWING: (1) MAKE CUTS WIDE SO WATER IS FAR FROM PAVEMENT AND USE FILL SECTIONS ONLY, IF POSSIBLE; (2) SUBEXCAVATE CUTS AND REPLACE WITH NONSWELLING MATERIAL; (3) SUBEXCAVATE CUTS AND REPLACE WITH THE SAME MATERIAL, BUT TREATED TO BE NONSWELLING; (4) SPREAD SOME MAGIC FLUID OR POWDER OVER THE SUBGRADE THAT WILL MAKE THE SUBGRADE INERT (NONSWELLING); (5) IF THIS FLUID WILL NOT SOAK IN, PUMP IT IN OR DRILL HOLES AND LET IT SOAK IN; (6) PLACE AN IMPERVIOUS BLANKET OVER OR AROUND THE SHOULDERS AND DITCHES TO KEEP THE WATER OUT; (7) USE A THICK IMPERVIOUS PAVEMENT AS A BLANKET TO PREVENT WATER FROM ENTERING THE SUBGRADE (DEEP STRENGTH PAVEMENT); AND (8) CONSTRUCT THE ROADWAY OVER THE SWELLING SOIL AS ECONOMICALLY AS POSSIBLE AND WHEN THE SUBGRADE REACHES MOISTURE EQUILIBRIUM, PLACE A THICK LEVELING COURSE OVER IT TO TAKE OUT THE BUMPS (COMPACTION WITHOUT MOISTURE-DENSITY CONTROL). SINCE 1962, CONSTRUCTION PROJECTS HAVE BEEN SET UP AND CARRIED OUT TO TEST EVERY ONE OF THESE IDEAS AT LEAST ONCE. THIS PAPER DESCRIBES THESE PROJECTS AND PRESENTS AN ANALYSIS OF THE RESULTS IN A BRIEF FORM.

Gerhardt, BB
Workshop Proceedings Vol. 2 May 1973, pp 33-48, 7 Fig

2A 233508

OBSERVATION OF EXPANSIVE CLAYS IN ROADWAYS

EXPANSIVE CLAYS IN TEXAS ARE ESTIMATED TO CAUSE 9 MILLION DOLLARS IN DAMAGES TO STATE HIGHWAYS ANNUALLY. THIS AMOUNT OF MONEY REFLECTS ONLY THE MAINTENANCE COST ATTRIBUTABLE TO EXPANSIVE CLAYS AND NOT THE DEGRADATION OF RIDE QUALITY AND SERVICEABILITY TO THE PUBLIC. ONE PURPOSE OF CURRENT STUDIES IS TO MAKE COMPARISONS OF FIELD OBSERVATIONS WITH PREDICTIVE METHODS IN ATTEMPTING TO REDUCE THIS ANNUAL MAINTENANCE BILL AND THE INCONVENIENCE TO THE MOTORIST. FOUR DIFFERENT METHODS ARE AVAILABLE FOR REDUCING THE DETRIMENTAL EFFECTS OF SWELLING CLAYS: (1) REMOVAL OF THE CLAY; (2) CHEMICAL ALTERNATION; (3) ENCAPSULATION IN WATERPROOF MEMBRANES; AND (4) CHANGE OF THE WATER CONTENT TO THAT EXPECTED AFTER CONSTRUCTION. THE LAST METHOD IS BEING STUDIED MOST CLOSELY AT THIS TIME. OBSERVATIONS ARE MADE IN THIS REPORT OF TWO METHODS PROPOSED BY THE TEXAS HIGHWAY DEPARTMENT FOR CHANGING THE IN-SITU WATER CONTENT PRIOR TO CONSTRUCTION: DRY-LAND FARMING AND PONDING. A NUMERICAL TECHNIQUE FOR PREDICTING MOISTURE MOVEMENT IN UNSATURATED SOILS HAS ALREADY BEEN DEVELOPED. A LONG-TERM FIELD EXPERIMENT IS DESCRIBED IN THIS REPORT WHICH WILL PROVIDE A TEST COMARISON UNDER CONTROLLED CONDITIONS.

Stevens, JB Matlock, H
Aorkshop Proceedings Vol. 2 May 1973, pp 49-65, 10 Fig, 1 Tab, 5 Ref

2A 233509

MEMBRANES AND ENCAPSULATION OF SOILS FOR CONTROL OF SWELLING

THE ADVANTAGES OF PREVENTING THE ENTRANCE OF MOISTURE FROM ABOVE OR BELOW A LAYER OF SOIL ARE OBVIOUS TO DESIGNER AND CONSTRUCTION ENGINEERS ALIKE. ONE PROCEDURE USED IN AN ATTEMPT TO SEAL OUT MOISTURE INVOLVES THE TECHNIQUE OF PLACING IMPERVIOUS MEMBRANES BETWEEN THE SOIL LAYER AND POSSIBLE SOURCES OF MOISTURE. PREVIOUSLY, THE MAJOR DRAWBACK TO EXTENSIVE EMPLOYMENT OF SUCH CONSTRUCTION TECHNIQUES HAS BEEN EITHER THE LACK OF INTEGRITY OF LOW-COST MEMBRANE MATERIALS OR THE RELATIVELY HIGH COST OF MEMBRANE MATERIALS HAVING BETTER DURABILITY TRAITS. HOWEVER, RECENT WORK COMPLETED BY THE U. S. ARMY ENGINEER WATERWAYS EXPERIMENT STATION HAS DEVELOPED A DURABLE, INEXPENSIVE COMBINATION OF MEMBRANES AND PROPER CONSTRUCTION TECHNIQUES, WHICH TOGETHER OVERCOME THE PAST RESTRICTIONS FOR USE OF MEMBRANE WATERPROOFING. THIS REPORT DESCRIBES A MEMBRANE- ENVELOPED SOIL LAYER (MESL) SYSTEM. IT CONSISTS OF A SUBGRADE UPON WHICH A FOUNDATION LAYER OF COMPACTED SOIL (CONSTRUCTED FROM NATURAL SUBGRADE OR LOCALLY AVAILABLE SOIL) LIES BETWEEN A LOWER AND UPPER WATERPROOF MEMBRANE. THE MEMBRANES ARE JOINTED AND SEALED ALONG THE EDGES, FORMING A WATERPROOF ENCAPSULATED SOIL SYSTEM. FOLLOWING A BRIEF DISCUSSION OF MATERIALS DEVELOPMENT, THE CONSTRUCTION TECHNIQUE FOR SUCCESSFUL INSTALLATION OF A MESL SYSTEM IS PRESENTED. RESULTS OF STRUCTURAL AND COST ANALYSIS STUDIES ARE GIVEN AND THE LIMITATIONS OF THE SYSTEM ARE POINTED OUT. BRIEF MENTION IS MADE OF AN ALTERNATE CONSTRUCTION PROCEDURE WHICH IS CURRENTLY BEING INVESTIGATED.

Hammitt, GM Ahlvin, RG
Workshop Proceedings Vol. 2 May 1973, pp 80-95, 3 Fig, 12 Ref

2A 233510

EXPANSIVE CLAY ROUGHNESS IN THE HIGHWAY DESIGN SYSTEM

FROM AN ANALYSIS OF SYSTEMS CHARACTERIZATION OF EXPANSIVE CLAY ROUGHNESS IT APPEARS THAT A PROPER CHARACTERIZATION OF SUCH ROUGHNESS REQUIRES A MIXTURE OF ENGINEERING (E.G., HEAVE) AND GEOMORPHOLOGICAL (E.G., SURFACE PATTERNS) PROPERTIES. AN EQUATION IS PRESENTED WHICH MAKES IT POSSIBLE TO DETERMINE THE EFFECTS, ON THE SERVICEABILITY INDEX, OF REDUCING THE AMPLITUDE AND RATE OF HEAVING OF A GIVEN CLAY SUBGRADE BY APPLYING SOME PRE-CONSTRUCTION TECHNIQUE. THE ECONOMIC IMPLICATIONS PER LANE MILE PER YEAR OF REDUCING THE SURFACE ACTIVITY INDEX CAN BE READ DIRECTLY FROM A CHART PRESENTED IN THIS REPORT FOR THAT SPECIFIC PAVEMENT DESIGN. OBVIOUSLY, THERE IS SOME OPTIMUM MIXTURE OF PRE-AND POST- CONSTRUCTION TREATMENT BUT THERE IS NO SINGLE STRATEGY THAT WILL WORK IN ALL CASES. FOR EXAMPLE, THE OPTIMUM MIXTURE OF OVERLAYING, LIME-TREATMENT, AND POINDING WILL DEPEND UPON THE THICKNESSES, MATERIALS, AND TRAFFIC IN THIS OR ANY OTHER SPECIFIC DESIGN AND CAN BEST BE DETERMINED WITH AN OVERALL SYSTEMS COMPUTER PROGRAM. THE PRACTICAL INDICATIONS TO DATE ARE THAT GENERAL PAVEMENT ROUGHNESS DUE TO EXPANSIVE CLAY, RATHER THAN ANY ASSOCIATED CRACKING OR RUTTING, IS ONE OF THE MOST COSTLY SINGLE ELEMENTS IN ANY PAVEMENT DESIGN. IT IS ALSO SHOWN BY THESE SYSTEMS STUDIES THAT A UNIT PERCENT REDUCTION IN THE SURFACE ACTIVITY INDEX IS MORE EFFECTIVE THAN NEARLY ANY OTHER DESIGN FACTOR IN REDUCING THE OVERALL COST OF BUILDING AND MAINTAINING PAVEMENTS.

Lytton, RL Vol. 2 pp 123-49, 7 Fig, 1 Tab, 47 Ref

2A 233511

MOISTURE STABILIZATION BY MEMBRANES, ENCAPSULATION AND FULL DEPTH PAVING

FROM A REVIEW OF SEVERAL EXPERIMENTAL PROJECTS (AT CLIFTON, ORDWAY, ELK SPRINGS, AND OTHER SITES) CONSTRUCTED ON EXPANSIVE SOILS IN VARIOUS REGIONS OF COLORADO THE FOLLOWING CONCLUSIONS WERE DRAWN: (1) CATALYTICALLY BLOWN ASPHALT MEMBRANES CAN BE PLACED FOR ABOUT 50 CENTS PER SQUARE YARD AND ARE EFFECTIVE IN MAINTAINING AS-CONSTRUCTED MOISTURE IN SUBGRADE SOILS. (2) FULL DEPTH ASPHALT BASES ARE EFFECTIVE IN REDUCING MOISTURE BUILDUP IN SUBGRADE SOILS. SPECIAL PRECAUTIONS ARE NEEDED, HOWEVER, TO PREVENT MOISTURE CHANGE CYCLES AT THE SHOULDERS IN ORDER TO PREVENT LONGITUDINAL CRACKING IN THE PAVEMENT A FEW FEET IN FROM THE SHOULDER. (3) GRANULAR UNTREATED BASES, EITHER DIRECTLY OR INDIRECTLY, ARE RESPONSIBLE FOR THE HIGHER MOISTURES FOUND UNDER SUCH BASES IN COMPARISON TO FULL DEPTH ASPHALT BASES. (4) ENCAPSULATED OR ENVELOPED SUBGRADE SOILS REMAIN AT A LOWER MOISTURE CONTENT. THIS DOES NOT APPEAR TO BE ECONOMICALLY PRACTICAL, HOWEVER, SINCE ON THE ELK SPRINGS PROJECT, ENOUGH ADDITIONAL SOIL SUPPORT WAS NOT GAINED OVER THAT UNDER ASPHALT BASE TO OFFSET THE EXTRA COST OF PLACING THE MEMBRANE. (5) SOIL SUPPORT VALUES UNDER ASPHALT MEMBRANES AND FULL DEPTH ASPHALT BASES ARE CONSIDERABLY HIGHER THAN UNDER GRANULAR UNTREATED BASES WHEN COMPARED FOR SIMILAR CONDITIONS. A NEW CORRELATION OF LABORATORY STABILOMETER R VALUES AND FIELD SOIL SUPPORT VALUES FOR THE DRIER CONDITIONS IS SUGGESTED. UNDER CONDITIONS SIMILAR TO ORDWAY AND ELK SPRINGS, THIS WOULD RESULT IN A DECREASED THICKNESS OF THE PAVEMENT STRUCTURE OF ABOUT 0.45 STRUCTURAL NUMBER BELOW THAT CALLED FOR BY THE CURRENT COLORADO FLEXIBLE PAVEMENT DESIGN PROCEDURE. (6) THE CURRENT COLORADO DESIGN PROCEDURE FOR FLEXIBLE PAVEMENTS IS REASONABLY ACCURATE FOR UNTREATED GRANULAR BASES AND SHOWS NO NEED FOR ADJUSTMENT. (7) IT IS NOT PRACTICAL TO REPRODUCE FIELD MOISTURE CONDITIONS WHEN MOLDING STABILOMETER SPECIMENS IN THE LABORATORY TO PREDICT ACTUAL FIELD SOIL SUPPORT VALUES.

Brakey, BA
Workshop Proceedings Vol. 2 May 1973, pp 155-89, 14 Fig, 7 Ref

2A 233512

CONTROL OF VOLUME CHANGES IN EXPANSIVE EARTH MATERIALS

METHODS FOR THE CONTROL OF VOLUME CHANGES IN EXPANSIVE SOILS HAVE BEEN DIVIDED INTO (1) TECHNIQUES THAT DO NOT REQUIRE ADDITIVES: COMPACTION CONTROL, PREWETTING, HEATING; AND (2) TECHNIQUES USING ADDITIVES: LIME, CEMENT, CHEMICALS. MUCH CAN BE DONE THROUGH CONTROL OF COMPACTION. A MODERATE DENSITY WET OF OPTIMUM WATER CONTENT USING A SHEEPS-FOOT ROLLER SHOULD MINIMIZE SWELL, AND CURRENT KNOWLEDGE OF THE PROPERTIES OF COMPACTED CLAY SHOULD ENABLE DESIGNS ACCOUNTING FOR STRENGTH, VOLUME CHANGE, AND PERMEABILITY CRITERIA. PREWETTING IS AN EFFECTIVE MEANS OF VOLUME CHANGE CONTROL WHEN TIME IS NOT CRITICAL. LIME TREATMENT OF THE UPPER 6 TO 12 INCHES OF THE WETTED SOIL CAN BE USED TO INCREASE STRENGTH AND FACILITATE CONSTRUCTION. LIME CONTINUES TO BE THE MOST EFFECTIVE ADDITIVE FOR STABILIZATION, AND THE DEEP-PLOW METHOD PROVIDES MEANS FOR TREATMENT TO DEPTHS UP TO 36 INCHES. ON THE OTHER HAND STABILIZATION USING LIME SLURRIES AND LIME PILES IS OF DOUBTFUL VALUE, EXCEPT IN DRIED, FISSURED MATERIALS. NO CHEMICALS HAVE BEEN FOUND THAT ARE COMPETITIVE WITH LIME FOR TREATMENT OF EXPANSIVE CLAYS. PROPRIETARY CHEMICAL STABILIZERS AND COMPACTION AIDS HAVE NOT YET BEEN SHOWN EFFECTIVE FOR CONTROL OF VOLUME CHANGE.

Mitchell, TK Raad, L
Workshop Proceedings Vol. 2 May 1973, pp 200-19, 4 Fig, 2 Tab, Refs

2A 233513

UTAH'S PROBLEMS WITH SWELLING SOILS

THE MAJORITY OF UTAH'S PROBLEMS WITH SWELLING SOILS OCCURS IN THE MANCOS SHALE AREAS. TO DATE A PAVEMENT STRUCTURE WHICH WILL ADEQUATELY PREVENT OR SUPPRESS HEAVING TO A TOLERABLE LEVEL HAS NOT BEEN DESIGNED. PRESENTLY THERE ARE APPROXIMATELY 130 MILES OF STATE HIGHWAY AND 90 LANE MILES OF INTERSTATE THROUGH THE MACOS SHALE AREAS, AND IT IS EXPECTED THAT THERE WILL BE 80 MORE LANE MILES OF INTERSTATE CONSTRUCTED IN THE MANCOS SHALE. UTAH'S PROBLEM, THEREFORE, STEMS FROM THE FACT THAT A CONSIDERABLE MAINTENANCE BURDEN WILL RESULT IF THE SWELLING OF THE MANCOS SHALE CANNOT BE CONTROLLED BY ADEQUATE PAVEMENT STRUCTURES AND ROADWAY CONSTRUCTION PRACTICES. BRIEFLY, THIS REPORT (1) REVIEWS THE PROPERTIES OF CHARACTERISTICS OF THE MANCOS SHALE, (2) REVIEWS THE VARIOUS DESIGNS WHICH HAVE BEEN USED IN AN ATTEMPT TO PREVENT SWELLING, (3) INDICATES THE RELATIVE EFFECTS OF THESE DESIGN METHODS, AND (4) ATTEMPTS TO EXPLAIN WHY THESE DESIGNS WERE NOT SUCCESSFUL.

Price, DT
Workshop Proceedings Vol. 2 May 1973, pp 220-9, 7 Fig

2A 233514

REVIEW OF HIGHWAY DESIGN AND CONSTRUCTION THROUGH EXPANSIVE SOILS IN SOUTH DAKOTA ON I-95-MISSOURI RIVER WEST-135 MILES

IN THIS REPORT A REVIEW IS PRESENTED OF RESEARCH STUDIES CONDUCTED ON EXPANSIVE SOILS IN SOUTH DAKOTA. CONCLUSIONS ON THE BASIS OF THIS REVIEW ARE AS FOLLOWS: (1) IT IS POSSIBLE TO ACHIEVE RELATIVELY GOOD MOISTURE AND DENSITY CONTROL BY DESIGNATING ROLLER PASSES AND MAKING FREQUENT MOISTURE TESTS. (2) CONTROL OF SPECIAL UNDERCUTTING AND SOIL SELECTION CAN BE ASSURED BY USE OF SPECIALLY TRAINED CREWS FROM THE CENTRAL MATERIALS SECTION, ASSIGNED TO CONTROL THE WORK. (3) EXTREME WARPING AND HEAVING OF THE SUBGRADE, OVER NARROW FAULT LINES, APPEARS TO BE REDUCED BY DEEP UNDERCUTTING OF EXPANSIVE SHALE AND REPLACEMENT WITH LOWER LIQUID LIMIT SOIL. (4) DEFINITE CONCLUSIONS ON IMPROVEMENT OF RIDEABILITY OF THE FULL LENGTH OF THE INTERSTATE ROUTE, WHERE THE SPECIAL UNDERCUT AND BACKFILL DESIGN WERE EMPLOYED, WILL NOT BE POSSIBLE UNTIL AT LEAST FIVE MORE YEARS HAVE ELAPSED. AT THIS POINT IN TIME, THE RIDEABILITY OF THE SURFACING IS EXTREMELY GOOD AND APPEARS TO BE BETTER THAN ON OTHER SIMILAR HIGHWAYS CONSTRUCTED THROUGH PIERRE SHALE WHERE SPECIFICATIONS DID NOT REQUIRE DEEP UNDERCUTTING AND MORE RIGID CONTROL OF COMPACTION EFFORTS AND MOISTURE APPLICATION. (5) LONG RANGE COST COMPARISONS ARE NECESSARILY DEPENDENT ON TIME AND AT THIS POINT IT IS NOT POSSIBLE TO KNOW DEFINITELY HOW THE TWO SURFACING TYPES WILL COMPARE.

McDonald, EB Potter, AW
Workshop Proceedings Vol. 2 May 1973, pp 230-44, 4 Fig, 8 Ref

2A 233515

CALIFORNIA'S GENERAL EXPERIENCES

A VERY BRIEF REVIEW IS PRESENTED OF CALIFORNIA'S EXPERIENCES IN CONSTRUCTING HIGHWAYS IN AREAS HAVING EXPANSIVE SOILS.

Smith, RE
Shop Proceedings Vol. 2 May 1973, pp 295-9

2A 233516

EXPANSIVE SOILS IN WYOMING HIGHWAYS

THIS PAPER BRIEFLY SUMMARIZES THE PROBLEMS ENCOUNTERED IN CONSTRUCTING HIGHWAYS IN WYOMING IN AREAS WITH EXPANSIVE SOILS, AND MENTIONS THE METHODS WHICH WERE USED TO SOLVE THEM.

Diller, DG
Workshop Proceedings Vol. 2 May 1973, pp 250-5

2A 233517

PROBLEMS OF HIGH-VOLUME CHANGE SOILS IN NORTH DAKOTA

FOLLOWING A BRIEF REVIEW OF PROBLEMS ENCOUNTERED IN NORTH DAKOTA IN AREAS WITH EXPANSIVE SOILS, IT IS CONCLUDED THAT THE EXPANSIVE SOILS ARE NO LONGER THE PROBLEM THAT THEY WERE IN 1967 OR PRIOR TO THAT TIME. THIS IS DUE TO THE FACT THAT THE CONTINUOUSLY REINFORCED PAVING CONCEPT HAS BEEN EMPLOYED AND NEW COMPACTION STANDARDS, WHEREBY SOILS ARE COMPACTED TO A LOWER DENSITY AND A HIGHER MOISTURE CONTENT, HAVE BEEN FOLLOWED. THERE MAY BE OTHER PROBLEMS WITH THE CONTINUOUSLY REINFORCED CONCRETE PAVEMENT IN THE FUTURE BUT FOR THE PRESENT, IT APPEARS TO BE THE ANSWER TO PAVEMENT ROUGHNESS FOR CONSTRUCTING ROADWAYS IN THE AREAS HAVING EXPANSIVE SOILS.

Leer, DK
Workshop Proceedings Vol. 2 May 1973, pp 256-8

2A 233518

SWELLING SOILS IN NORTH DAKOTA

A FEW BRIEF COMMENTS WERE MADE ON NORTH DAKOTA'S EXPERIENCES WITH SWELLING CLAYS AND SHALES. IT WAS POINTED OUT THAT BETTER FIELD TESTS FOR IDENTIFYING SWELLING SOILS ARE NEEDED, AND THAT ALSO THE NEED EXISTS TO MAKE THE INFORMATION THAT IS PRESENTLY AVAILABLE ON SUCH SOILS MORE USABLE FOR THE OPERATING OR FIELD ENGINEERS.

Plummer, DD
Workshop Proceedings Vol. 2 May 1973, pp 259-61

2A 233519

DESIGN OF MONTANA HIGHWAYS IN AREAS OF EXPANSIVE SOILS

A BRIEF DISCUSSION IS GIVEN OF EXPERIENCE WITH EXPANSIVE CLAYS BY THE MONTANA DEPARTMENT OF HIGHWAYS UNDER THE FOLLOWING SUBTITLES: DISTRIBUTION OF SWELLING SOILS; METHODS OF SAMPLING AND TESTING; APPLICATION OF TESTING DATA; AND EVALUATION OF THE EXPANSION INDEX TEST.

Hogan, JM
Work Shop Proceedings Vol. 2 May 1973, pp 262-73, 8 Fig

2A 233520

KANSAS PROCEDURES FOR HIGHWAY CONSTRUCTION IN SWELLING CLAYS AND SHALES

THE KANSAS APPROACH TO PROBLEMS ASSOCIATED WITH EXPANDING CLAYS AND CLAY SHALES HAS EVOLVED OVER A PERIOD OF MORE THAN FORTY YEARS. TEMPERED BY EXPERIENCE, IT NOW INCLUDES A COMBINATION OF LIME MODIFICATION TO REDUCE SWELL POTENTIAL AND DESIGN FEATURES AND CONSTRUCTION CONTROLS TO MINIMIZE THE DEGREE TO WHICH SWELL POTENTIAL WILL ADVERSELY AFFECT THE PERFORMANCE OF THE PAVEMENT STRUCTURE. THESE MEASURES WOULD PROBABLY NOT BE CLASSIFIED AS DRASTIC IN COMPARISON WITH MEASURES USED IN OTHER AREAS. THEY HAVE IN GENERAL, GIVEN SATISFACTORY RESULTS IN KANSAS. A SIGNIFICANT POINT IS THAT THE HIGHER SWELLING SOILS ARE CONCENTRATED IN AREAS OF HEAVIER RAINFALL ALLOWING MEASURES CONFINED TO THE UPPER PORTION OF THE SUBGRADE TO SUFFICE. THE

SAME APPROACH IN A MORE SEVERE ENVIRONMENT WOULD LIKELY NOT GIVE THE SAME RESULTS.

Clark, GN
Workshop Proceedings Vol. 2 May 1973, pp 274-82, 9 Ref

2A 233521
ARIZONA'S EXPERIENCE WITH SWELLING CLAYS AND SHALES

IN ARIZONA MOST OF THE SWELLING CLAY LIES IN A VERY ARID REGION. MEMBRANE CONSTRUCTION, FULL DEPTH ASPHALT, WIDENED CUT DITCHES, AND MOISTURE CONTROL IN EMBANKMENTS ARE BEING UTILIZED. TWO THINGS PRESENTLY BEING INVESTIGATED IN ARIZONA ARE CHEMICAL STABILIZATION AND THE POSSIBLE PLACING OF MEMBRANES OVER THE ENTIRE PAVEMENT SURFACE.

Morris, GR
Workshop Proceedings Vol. 2 May 1973, pp 283-5

2A 233533
USE OF WET SAND PROCESS FOR FARM ROAD CONSTRUCTION IN EAST GERMANY

WET SAND IS A MIXTURE OF MOIST, NON-HEATED AGGREGATE MATERIAL (MAXIMUM PARTICLE SIZE 15 MM, PROPORTION OF PARTICLES UP TO 2 MM-70%) AND HEATED CUT-BACK BITUMEN. IT IS ADDED TO A MIXTURE OF SURFACE-ACTIVE AGENTS AND LIME HYDRATE WITH THE RESULT THAT THE HEATED CUT-BACK BITUMEN DISPLACES THE WATER ON TOP OF THE COLD AND MOIST AGGREGATE SURFACE AND THEN SETS FIRM. THE METHOD IS USED FOR LOW-COST ROAD CONSTRUCTION IN EAST GERMANY BECAUSE IT ENABLES LOCALLY AVAILABLE CONSTRUCTION MATERIALS TO BE USED, LEADS TO SUFFICIENTLY DENSE AND WEAR-RESISTANT SURFACINGS FOR LIGHTLY-TRAFFICKED ROADS, IS RESISTANT TO WEATHERING, AND IS MORE ECONOMICAL THAN ANY OTHER BITUMINOUS METHOD. THE POSSIBILITY OF THE METHOD BEING USED FOR ROADS IN RESIDENTIAL AREAS IS MENTIONED. /TRRL/

Freudenberg, G *Strasse, Berlin /Germany/* Vol. 11 No. 5, 1971, pp 243-7, 12 Fig, 1 Tab

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

2A 233585
SHAFT SINKING BY GROUND FREEZING: ELY OUSE-ESSEX SCHEME

FOR THE SINKING OF SIX SHAFTS IN THE EAST ANGLIAN FENLANDS, GROUND FREEZING WAS ADOPTED AS THE SINGLE EXPEDIENT FOR TREATING A VARIED COMBINATION OF UNATTRACTIVE GROUND CONDITIONS. THE DECISION TO DO SO ON THE PERMANENT SHAFTS WAS TAKEN AT THE DESIGN STAGE AND THE METHOD WAS CHOSEN ALSO AT THE ALTERNATIVE WORKING SITES BY THE TENDERERS FOR THE SUBSEQUENT TUNNELLING CONTRACT. NOTWITHSTANDING SOME DIFFICULTIES, IT LED TO THE SATISFACTORY COMPLETION OF ALL THE SHAFTS. THEY WERE AN IMPORTANT FIRST STEP IN A SCHEME FOR THE BULK TRANSFER OF WATER, RIVER TO RIVER, FROM NORFOLK TO ESSEX. THAT SECTION OF THE TRANSMISSION LINK WHICH TRAVERSES THE FENS, BEING IN DIFFICULT COUNTRY FOR MAJOR PIPELINE WORK, LIES LESS EXPENSIVELY IN TUNNEL IN THE GAULT CLAY. THIS BED RUNS FROM ONE TO THREE HUNDRED FEET DEEP BELOW THE LOWER CHALKS AND UPPER GREENSAND WHICH ARE GENEROUS TO THE WATER SUPPLY UNDERTAKINGS OF THE REGION. THE CHALKS THEMSELVES ARE MASKED FOR THE MOST PART BY SUPERFICIAL DEPOSITS UP TO 50 FT THICK, CONSISTING OF PEAT, WHICH IS FARMED USING WIDE-TREAD TRACTORS, OR SANDS AND GRAVELS NORMALLY WORKED IN FLOODED PITS BY DRAGLINE EXCAVATORS. THE PAPER INDICATES SOME FACETS OF THE RELATION BETWEEN DESIGN REQUIREMENTS AND THE SPECIAL METHOD FOR CONSTRUCTION. THE EXECUTION OF THE WORKS IS DESCRIBED, TOGETHER WITH THE PROGRESS, AND

CONSTRUCTION TECHNIQUES UNDER FREEZING CONDITIONS, INCLUDING THE SLIP-FORMING OF A NUMBER OF THE SHAFTS. THERE WERE A FEW GROUND FAILURES, NEVER IN A FROZEN SECTION, BUT WHICH COULD HAVE BEEN RELATED. THESE ARE CONSIDERED, TOGETHER WITH THEIR REMEDY AND THE STEPS TAKEN TO PREVENT THEIR RECURRENCE. INFORMATION CONCERNING GROUND HEAVE DUE TO FREEZING, A QUANTITATIVE ANALYSIS OF THE WORKS AND THEIR COST, AND A COMPREHENSIVE LIST OF SOME OF THE RELATED LITERATURE BY OTHERS CONCLUDES THE PAPER. /AUTHOR/

Collins, SP Deacon, WG *Inst Civil Engineers Proc, London /UK/* No. 7506, 1972, pp 129-56, 15 Fig, 4 Phot, 24 Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

2A 233619
THE DESIGN AND CONSTRUCTION OF RAILWAY EMBANKMENTS IN BULL-DUST SOILS

THIS REPORT DEALS WITH THE DETERMINATION OF THE MOST SUITABLE METHODS OF UTILIZING THE BULL-DUST SOILS IN ORDER TO CONSTRUCT A NEW RAILWAY LINE FROM KOOLYANOBING THROUGH VIRGIN BUSH TO KALGOORLIE. THE AREA LIES BETWEEN ELEVATIONS OF 1100 FT AND 1700 FT AND IS COVERED WITH MALLEE SCRUB AND SALMON GUMS. DETAILS ARE GIVEN OF PRELIMINARY SOIL SURVEY AND INVESTIGATIONS INCLUDING: AN INSPECTION OF EMBANKMENTS CONSTRUCTED FROM SIMILAR SOILS; FIELD TRIALS TO DETERMINE THE POSSIBILITIES OF COMPACTION; THE TYPE OF PLANT REQUIRED AND THE MOISTURE CONTENT NECESSARY; INVESTIGATIONS TO DETERMINE WATER RESOURCES IN THE REGION OF THE RAILWAY; AND LABORATORY EXPERIMENTS TO DETERMINE THE BEST SECTION OF EMBANKMENT TO ADOPT IN RELATION TO MATERIALS AND WEATHERING. /TRRL/

Meager, RG Sands, PG
Proc Symp Soils & Earth St /Aust/ Conf Paper 1971, pp 10-5, 6 Fig, 1 Tab, 4 Phot, 3 Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

2A 233628
SAND-CEMENT STABILIZATION IN THICK LAYERS

A NEW TYPE OF PAVEMENT STRUCTURE WAS USED IN THE NETHERLANDS FOR THE FIRST TIME IN 1969 ON A MOTORWAY. IT CONSISTS OF A 0.40M-THICK SAND-CEMENT LAYER UNDER A 0.26 M-THICK BITUMINOUS SURFACING COMPOSED OF 0.18 M GRAVEL ASHALTIC CONCRETE AND TWO LAYERS, EACH OF 0.04 M ASPHALTIC CONCRETE, AS BASECOURSE AND WEARING COURSE. THE AMOUNT OF CEMENT REQUIRED FOR THE BASE AND THE CONSTRUCTION EQUIPMENT AND METHOD ARE DISCUSSED. /TRRL/

Grevelt, ER *Polytechnisch Tijdschrift /Neth/* Vol. 26 No. 16, Aug. 1971, pp 639-42, 3 Tab, 5 Phot

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

2A 233706
THE DETERMINATION OF THE MAXIMUM DENSITY WITH NUCLEAR GAUGES

A STUDY TO DETERMINE THE FEASIBILITY OF USING NUCLEAR GAGES TO OBTAIN TEST MAXIMUM DENSITY OF SOILS USED IN HIGHWAY CONSTRUCTION IS REPORTED. AN EXPERIMENTAL COMPACTION MOLD, LARGE ENOUGH TO ALLOW USE OF A NUCLEAR GAGE ON THE COMPACTED SPECIMEN, WAS USED IN CONJUNCTION WITH NUCLEAR GAGES TO OBTAIN THE MOISTURE-DENSITY RELATIONSHIP OF SOILS. TEST MAXIMUM DENSITY WAS REPORTED IN TERMS OF COUNT RATIO. SINCE THE SAME SOIL WOULD BE MEASURED IN THE FIELD, ALSO IN TERMS OF COUNT RATIO, GAGE CALIBRATION WOULD BE UNNECESSARY. BOTH BACKSCATTER AND DIRECT TRANSMISSION MEASUREMENTS WERE MADE WITH THE LATTER SHOWING A LESSER VARIABILITY.

RESULTS OF THE STUDY INDICATE THAT THE BASIC IDEA IS FEASIBLE BUT LARGELY IMPRACTICAL. THERE ARE TECHNICAL PROBLEMS WHICH MUST BE RESOLVED BEFORE THE CONCEPT COULD BE IMPLEMENTED AS A PRACTICAL COMPACTION TESTING PROCEDURE. /BPR/

Weber, WG Howe, DR
California Division Highways, Bureau of Public Roads /US/

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4723137 68)PB 178 223, 3C63021279

2A 233707

EQUILIBRIUM MOISTURE AND DENSITY CONDITIONS IN COLORADO SUBGRADE SOILS-SECOND INTERIM REPORT
AN ANALYSIS WAS CONDUCTED OF MOISTURE-DENSITY INFORMATION FROM COLORADO AND OTHER AREAS OF THE NATION AND WORLD. THE OBJECTIVE OF THE STUDY WAS TO DEVELOP A BASIS FOR PREDICTING EQUILIBRIUM MOISTURE AND DENSITY VALUES OF SUBSURFACE SOILS IN HIGHWAY CUTS AND FILLS. SOIL DENSITY WAS FOUND TO DEPEND ON SO MANY VARIABLES THAT A STRAIGHT-FORWARD APPROACH TO THE ANALYSIS WAS IMPOSSIBLE. IT WAS POSSIBLE, HOWEVER, TO DEVELOP A VALID RELATIONSHIP BETWEEN SOIL MOISTURE AND PLASTICITY. IT WAS FURTHER DETERMINED THAT IN COLORADO SUBSURFACE SOIL MOISTURE USUALLY REACHES A STATE OF EQUILIBRIUM IN FIVE YEARS OR LESS AFTER THE CONSTRUCTION OF A HIGHWAY. DRAINAGE CONDITIONS APPEAR TO BE A MAJOR FACTOR INFLUENCING SOIL MOISTURE. /AUTHOR/

Colorado Department Highways, Bureau of Public Roads /US/ Apr. 1968

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4654464 68)PB 178 858, 1C63021336

2A 233745

FINITE ELEMENT PROGRAM FEECON FOR UNDRAINED DEFORMATION ANALYSES OF GRANULAR EMBANKMENTS ON SOFT CLAY FOUNDATIONS

A FINITE ELEMENT ANALYSIS OF EMBANKMENT CONSTRUCTION (FEECON) WAS DEVELOPED TO ENABLE THE ENGINEER TO RATIONALLY ANALYZE THE STRESSES, PORE PRESSURES, AND UNDRAINED SHEAR DEFORMATIONS CAUSED BY RAPID CONSTRUCTION OF GRANULAR EMBANKMENTS IN A SERIES OF LIFTS PLACED ON SOFT CLAY FOUNDATION SOIL. ADDITIONAL LOADING COMMANDS ARE AVAILABLE IN FEECON TO ENABLE THE ANALYSIS OF OTHER TYPES OF ENGINEERING PROBLEMS, SUCH AS EXCAVATION. THIS TECHNIQUE DOES NOT CONSIDER DEFORMATIONS CAUSED BY CONSOLIDATION OF THE FOUNDATION OR BY CREEP. A CHOICE OF NONLINEAR, ISOTROPIC, ELASTIC STRESS-STRAIN DEFORMATION MODELS OF THE SOIL MATERIALS IS AVAILABLE TO REPRESENT THE UNDRAINED OR DRAINED SHEAR BEHAVIOR OF SOILS. TO DEMONSTRATE THE APPLICABILITY OF THE FEECON PROGRAM, THE SECOND STAGE CONSTRUCTION OF THE FORE RIVER TEST SECTION IN SOUTH PORTLAND, MAINE WAS ANALYZED. A GOOD AGREEMENT WAS OBTAINED WITH THE MOVEMENTS AND EXCESS PORE PRESSURES MEASURED IN THE FIELD. THE EXAMPLE ANALYSIS ALSO SHOWED THAT THE COMPUTED DEFORMATIONS CAN BE VERY SENSITIVE TO CHANGES IN SOME OF THE SOIL PARAMETERS, SUCH AS UNDRAINED SHEAR STRENGTH OF A SINGLE CLAY LAYER, BUT MAY BE INSENSITIVE TO OTHER MATERIAL PROPERTIES, SUCH AS THE INITIAL MODULUS OF THE FILL. /FHWA/

Simon, RM Ladd, CC Christian, JT
Massachusetts Institute Technology, Federal Highway Administration /US/ No. 294, Feb. 1972, 100 pp

ACKNOWLEDGMENT: Federal Highway Administration NTIS PB 208 407, 3C63022951

2A 233746

EROSION PREVENTION DURING HIGHWAY CONSTRUCTION BY THE USE OF SPRAYED ON CHEMICALS

NINE COMMERCIAL SPRAY ON PLASTIC CHEMICALS WERE EVALUATED AS EROSION INHIBITORS. ALL THE CHEMICALS WERE COMPARED WITH STRAW TACKED WITH ASPHALT EMULSION AND WITH UNTREATED SOIL. THE COST OF EACH CHEMICAL WAS ALSO OBTAINED TO DETERMINE IF THE MOST EFFECTIVE CHEMICALS WERE ECONOMICALLY FEASIBLE. THERE ARE THREE PRINCIPAL PHYSIOGRAPHIC PROVINCES IN VIRGINIA, EACH HAVING SOILS SIGNIFICANTLY DIFFERENT IN COMPOSITION AND ERODIBILITY. TWO HIGHWAY SLOPES WITH A VERTICAL HEIGHT OF 15 TO 20 FEET AND A SLOPE OF APPROXIMATELY 2:1 WERE SELECTED TO BE TESTED IN EACH PROVINCE. IT WAS FOUND THAT THE SAME CHEMICALS WERE NOT THE MOST EFFECTIVE IN THE DIFFERENT AREAS. ALSO, NO CHEMICAL PERFORMED BETTER OR COST LESS THAN THE STRAW TACKED WITH ASPHALT EMULSION IN ANY OF THE THREE AREAS. HOWEVER, SOME CHEMICALS DID SHOW SIGNIFICANT EROSION PROTECTION AND ARE RECOMMENDED IN CASES WHERE THE CONVENTIONAL STRAW AND ASPHALT ARE UNDESIRABLE OR UNAVAILABLE. /FHWA/

Wyant, DC Sherwood, WC Walker, HN
Virginia Highway Research Council July 1972

ACKNOWLEDGMENT: Federal Highway Administration NTIS PB 213 207, 4C63023054

2A 233776

ROADMAKING MATERIALS IN THE CARIBBEAN. /5/ THE VOLCANIC ANTILLES

GEOLOGICAL FEATURES, ROCKS AND SOILS ARE CONSIDERED, AND NATURAL MATERIALS ARE CLASSIFIED ACCORDING TO USEFULNESS FOR ROAD ENGINEERING. TYPICAL LANDSCAPES ARE ILLUSTRATED AND BRIEF NOTES GIVEN ON SOIL EROSION, ROAD LOCATION AND ASSOCIATED DEVELOPMENT. TABLES ARE INCLUDED ON VOLCANIC SOIL CLASSIFICATION AND MORPHOLOGICAL AND ENGINEERING CHARACTERISTICS. /RRL/

Caroll, DM Beaven, PJ
Road Research Laboratory /UK/ JAN65

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 233803

THE STABILITY OF A SLURRY TRENCH IN COHESIONLESS SOILS

HYDROSTATIC PRESSURE, ARCHING OF THE SOIL AND ELECTRO-OSMOTIC FORCES HAVE EACH BEEN SUGGESTED AS THE DOMINANT FACTOR TO ACCOUNT FOR STABILITY OF TRENCH EXCAVATIONS IN COHESIONLESS SOILS SUPPORTED BY CLAY SLURRIES. THE AUTHORS SUGGEST THAT THE MOST IMPORTANT MECHANISM IS THE HYDROSTATIC PRESSURE OF THE SLURRY. HOWEVER, THE INCREASE IN DENSITY OF THE SLURRY DUE TO THE SUSPENSION OF CUTTINGS MUST BE CONSIDERED IN COMPUTING THIS HYDROSTATIC PRESSURE. WHILE A CONCRETE DIAPHRAGM CUT-OFF WAS UNDER CONSTRUCTION AT PIERRE-BENITE, FRANCE, AN UNEXPECTED FLOOD OCCURRED, CAUSING SEVERAL SLIPS IN THE TRENCH EXCAVATION. THE ANALYSIS OF THESE SLIPS IS PRESENTED AND IT CONFIRMS THAT THE STABILITY OF A SLURRY TRENCH IN COHESIONLESS SOIL CAN BE ACCOUNTED FOR PROVIDED THAT THE CORRECT DENSITY IS USED IN COMPUTING THE HYDROSTATIC PRESSURE OF THE SLURRY. /RRL/A/

Morgenstern, N Amir-tahmasseb, I *Geotechnique* /UK/ Dec. 1965

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 233841

TESTING THE ELASTIC PROPERTIES OF NATURAL STONE THE COMPRESSION TEST FOR STONES IS NOT THE ONLY FACTOR DETERMINING THEIR QUALITY AND SUITABILITY IN ROAD CONSTRUCTION, THE DEFORMATION /ELASTICITY/ OF THE STONE MUST ALSO BE MEASURED. /FG/RRL/

Temme, T *Bitumen, Teere, Asphalte, Peche /Ger/ 1965*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 233937

STRUCTURAL FAILURE OF WESTERN HIGHWAYS CAUSED BY PIPING

HIGHWAY FILLS, EMBANKMENTS, BRIDGES, AND DRAINAGE STRUCTURES CONSTRUCTED FROM AND BUILT UPON LOCAL GEOLOGIC MATERIALS, PARTICULARLY VALLEY-FILL ALLUVIUM IN THE DRYLANDS WEST, ARE PIPED TO AN ALARMING DEGREE IN MANY PLACES. PIPING AND RELATED COLLAPSE STRUCTURE WERE OBSERVED AT NUMEROUS SITES. VALLEY ALLUVIUM AND MUCH OF THE BEDROCK IN THE MORE ARID PARTS OF THE WEST GENERALLY ARE HIGHLY MONTMORILLONITIC AND HAVE A HIGH CONTENT OF EXCHANGEABLE NA. ALSO, MUCH OF THE VALLEY FILL ALLUVIUM HAS A VERY LOW FIELD-MOISTURE CONTENT WITH LOOSELY COMPACTED COMPONENTS, CHIEFLY IN THE CLAY-SILT-SAND SIZE RANGE. COMMONLY THE SILT AND SAND-SIZE GRAINS ARE OF HARDER MATERIALS SUCH AS CRYSTALLINE-ROCK FRAGMENTS. WEAK CLAY OR SILT CEMENT BINDS, WHEN DRY, THE LOOSELY PACKED AGGREGATES INTO FIRM, STABLE MATERIALS. BUT WHEN THESE BECOME SATURATED WHERE WATER IS CONCENTRATED AND SEEP DOWNWARD THROUGH THE SOIL, THE CLAY AND SILT CEMENT MELT AWAY, COLLAPSE FOLLOWS, PRODUCING A VERTICAL HOLE OR DEPRESSION. THESE SINKS FURTHER CONCENTRATE DRAINAGE, AND IF A NEARBY GULLY OR DITCH OFFERS A SHORT, STEEP-GRADIENT PATH FOR THE INFILTRATING WATER TO ESCAPE TO, THE WATER WILL FLOW UNDERGROUND TO SUCH DISCHARGE POINTS AND IN DOING SO PRODUCE LATERAL DRAINAGE TUBES, THE PIPES. MOST PIPING AND RELATED COLLAPSE AFFECTING HIGHWAYS APPEAR TO BE INITIATED BY DRAINABLE DESSICATION CRACK SYSTEMS. STORM OR SNOW-MELT WATER FLOWING TO DISCHARGE POINTS THROUGH THE CRACKS RAPIDLY ENLARGES THEM BOTH BY PHYSICAL MEANS AND CHEMICAL DISAGGREGATION. THE POROUS, MONTMORILLONITIC ALLUVIAL CRUMBS SORB WATER RAPIDLY AS IT FLOWS THROUGH THE DESSICATION CRACKS. PIPING AND ASSOCIATED COLLAPSE ALSO IS COMMONLY INITIATED IN SITUATIONS WHERE INFILTRATING WATER PENETRATES AND SATURATES A LAYER HAVING HIGHER PERMEABILITY THAN OTHER LAYERS IN THE ALLUVIUM. BRIDGE ABUTMENTS, WING WALLS, PIERS AND CULVERTS ARE MOST COMMONLY IMPERILED BY PIPING. TO MINIMIZE MAINTENANCE COSTS AND POSSIBLE LOSSES OF LIFE RELATED TO HIGHWAYS OR BRIDGE FAILURES DUE TO PIPING AND COLLAPSE STRUCTURE, PRE-CONSTRUCTION SURVEYS SHOULD ASCERTAIN IF LOCAL ROAD-BUILDING MATERIALS AND ROUTE LOCATIONS ARE SUBJECT TO PIPING. CATCHMENT BLEED-OFF DRAINS UNDER BRIDGE DECK-ROADWAY JUNCTION LINES WOULD BE MOST USEFUL IN PREVENTING PIPING BENEATH ABUTMENTS AND ADJACENT BRIDGE APPROACHES. CULVERT DISCHARGE SHOULD NEVER BE CONCENTRATED NEAR THE HIGHWAY BUT SHOULD BE CARRIED OVERLAND TO DISCHARGE INTO THE MAIN FULLY. THE MAIN RULES TO FOLLOW ARE; /1/ AVOID PIPING SITES AND MATERIALS WHENEVER POSSIBLE AND /2/ AVOID ALLOWING CONCENTRATION OF WATER WHERE PIPING MAY UNDERMINE ROADWAYS, BRIDGES, OR DRAINAGE STRUCTURES.

Parker, GG Jenne, EA *Highway Research Record, Hwy Res Board 1967*

2A 234119

INVESTIGATION OF EMBANKMENT PERFORMANCE

THE PERFORMANCE OF AN EMBANKMENT AND ITS FOUNDATION MUST BE INVESTIGATED AND EVALUATED BOTH DUR-

ING CONSTRUCTION AND FOR AN INDEFINITE PERIOD OF TIME FOLLOWING COMPLETION. INSTRUMENTS PRESENTLY AVAILABLE FOR THIS PURPOSE ARE DESCRIBED AND EVALUATED. REFERENCE IS MADE TO ACTUAL EMBANKMENTS WHICH HAVE INCORPORATED SUCCESSFUL INSTALLATIONS. INSTRUMENTATION PROBLEMS AND LIMITATIONS ARE REVIEWED WITH RESPECT TO THE TYPES OF MEASUREMENTS DESIRED IN EMBANKMENT CONSTRUCTION. IT IS EMPHASIZED THAT BECAUSE OF SEVERE ENVIRONMENT AND NEED FOR LONG-TIME RELIABILITY, INSTRUMENTATION MUST BE SIMPLE, RUGGED, AND EASILY MAINTAINED AND REPAIRED. TYPES OF INSTRUMENTATIONS DESCRIBED INCLUDE PIEZOMETERS, INCLINOMETERS, SETTLEMENT DEVICES, HORIZONTAL STRAIN AND MOVEMENT DEVICES, SURFACE MEASUREMENTS INCLUDING CREEP OF NATURAL SLOPES, AND STRONG-MOTION EARTHQUAKE RECORDERS. /ASCE/

Wilson, SD *Am Soc Civil Engr J Soil Mech Div July 1967*

2A 234183

PURE DEVIATORIC LOADING DEVICE FOR SOILS. IMPROVED PNEUMATIC CONTROL

THE THEORY OF PURE DEVIATORIC LOADING FOR SHEAR TESTING OF SOILS IS BRIEFLY DESCRIBED. A DETAILED DESCRIPTION IS GIVEN OF THE DESIGN, CONSTRUCTION AND PERFORMANCE OF A TESTING CONSOLE THAT CONTROLS THE PURE DEVIATORIC LOAD. SOME OF THE TECHNICAL AND SCIENTIFIC FEATURES OF THE UNIT ARE ALSO DISCUSSED. /AUTHOR/

Klausner, Y

Negev Inst Arid Zone Research /Israel/ Apr. 1967

2A 234419

GEOLOGIC ASPECTS OF SOFT-GROUND TUNNELING

SOIL MECHANIC FACTORS THAT DETERMINE TUNNELING CONDITIONS FOR A PROPOSED EARTH TUNNEL ARE DISCUSSED. IN CONNECTION WITH SOFT-GROUND TUNNELING, THE DIFFICULTIES IN COST OF CONSTRUCTION OF THE TUNNEL WITH GIVEN DIMENSIONS DEPEND ALMOST EXCLUSIVELY ON THE STAND-UP TIME OF THE GROUND. THE STAND-UP TIME INDICATES THE TIME THAT ELAPSES BETWEEN THE EXPOSURE OF AN AREA AT THE ROOF OF THE TUNNEL AND THE BEGINNING OF NOTICEABLE MOVEMENTS OF THE GROUND ABOVE THIS AREA. THE FACTORS THAT DETERMINE THE STAND-UP TIME OF AN UNSUPPORTED ROOF AREA WITH GIVEN DIMENSIONS DEPEND TO A LARGE EXTENT ON THE POSITION OF THE WATER TABLE. ABOVE THE WATER TABLE, THE STAND-UP TIME DEPENDS ESSENTIALLY ON THE TENSILE AND SHEARING STRENGTH OF THE GROUND. SIX PRINCIPLE CATEGORIES OF GROUND MUST BE DISTINGUISHED: FIRM, RAVELING, RUNNING, FLOWING, SQUEEZING, AND SWELLING. THESE CATEGORIES ARE DISCUSSED AND DEFINED. SERIOUS DIFFICULTIES THAT MAY BE ENCOUNTERED DURING THE CONSTRUCTION OF AN EARTH TUNNEL ARE DIRECTLY OR INDIRECTLY DUE TO THE PERCOLATION OF WATER TOWARDS THE TUNNEL. METHODS OF IMPROVING THE PROPERTIES OF SOFT GROUND ARE DESCRIBED. RELIABLE INFORMATION ON SUBSOIL CONDITIONS ARE OBTAINED BY MEANS OF TEST BORINGS. IT IS CONCLUDED THAT MORE KNOWLEDGE IS NEEDED IN THE FIELD OF SOFT-GROUND TUNNELING ON THE DETAILS OF THE STRUCTURE OF SEDIMENTARY DEPOSITS, THE BEHAVIOR OF DIFFERENT SEDIMENTS AT TUNNEL HEADINGS, AND THE LOADS ON TEMPORARY AND PERMANENT TUNNEL SUPPORTS.

Terzaghi, K

Wiley, John & Sons, Inc 1950

2A 234440

SUB-SURFACE DRAINAGE

THESE REFERENCES ON SUB-SURFACE DRAINAGE INCLUDE SELECTIONS ON SUBDRAINAGE OF AIRPORTS AND HIGHWAYS, PORE PRESSURES IN BASE COURSES, PERMEABILITY OF

SOIL AND ITS MEASUREMENT, ANALYSIS OF FLOW-PROBLEMS FOR HIGHWAY SUB-DRAINAGE, FLOW PATTERN NEAR A GRAVITY WELL, HIGHWAY CONSTRUCTION ACROSS MARSH DEPOSITS, STABILIZATION OF MUCK-PEAT SOILS, VERTICAL SAND DRAINS, FILTER WELLS, DESIGN CRITERIA FOR PROTECTIVE FILTERS AND FOR DRAINAGE WELLS, CONSOLIDATION OF FINE-GRAINED SOILS BY DRAIN WELLS, USE OF ELECTRO-OSMOSIS IN SOIL STABILIZATION, AND CONTROL OF LANDSLIDES BY UNDERDRAINAGE.

Highway Research Information Service July 1970

2A 234485

A STUDY OF THE PROTECTION OF HIGHWAYS EMBANKMENTS

THE EROSION OF EMBANKMENTS PRODUCED BY RAIN AND THE METHOD OF PROTECTING THEM BY A PROCESS WHICH CAN AFFECT THE WORK DONE IN THE CONSTRUCTION AND MAINTENANCE OF HIGHWAYS ARE STUDIED. THE FOLLOWING FACTORS ARE STUDIED WITH REGARD TO THEIR INFLUENCE ON THE MOVEMENT OF WATER AS THE PRINCIPAL CAUSE OF EROSION: GRADIENT OF THE TERRAIN, PRESENCE OR ABSENCE OF DITCHES FOR SURFACE DRAINAGE, EXTENT AND FORM OF THE WATERSHED, VEGETATION WHICH PROTECTS THE TERRAIN, AND PERMEABILITY OF THE TERRAIN. /LTE/LCPC/

Proyectos /Cuba/ 1966

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 234556

VEHICLE TUNNEL CONSTRUCTION-VOL 1-PLANNING, DESIGN AND CONSTRUCTION

DISCUSSIONS COVER: THE RELATIONSHIP BETWEEN TUNNEL STRUCTURE AND MOUNTAIN (FOUNDATION AND STRUCTURE), GEOLOGY, PETROGRAPHY, ROCK AND SOIL TYPES, HYDROLOGY AND ROCK MECHANICS, STATICS, BASIC METHODS OF TUNNEL CONSTRUCTION, INCLUDING OPEN CONSTRUCTION ON LAND AND UNDER WATER AND CLOSED CONSTRUCTION METHODS, AND SPECIAL AND AUXILIARY METHODS USED IN VEHICLE TUNNEL CONSTRUCTION, PARTICULARLY IN MOUNTAINOUS AREAS. /RRL/

Wagner, H
Ernst Und Sohn, Berlin /Germany/ 1968

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 234689

SOIL MECHANICS FOR ROAD CONSTRUCTION /GERMAN/
SOIL MECHANICAL PROBLEMS OF ROAD CONSTRUCTION AND TEST METHODS FOR ROAD CONSTRUCTION MATERIALS ARE DISCUSSED. STABILIZATION OF SOILS AND PRACTICAL DESIGN TAKING ACCOUNT OF TRAFFIC LOADING AND SOIL BEARING CAPACITY ARE ALSO DISCUSSED. /FG/RRL/

Balduzzi, F
Druck Svenska Cementforeningen /Swed/ 126 pp, 1967

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 234730

BIBLIOGRAPHY ON SOIL MECHANICS. VOL 5, 1965-1966 /IN GERMAN/

THE BIBLIOGRAPHY IS ARRANGED UNDER THE FOLLOWING HEADINGS: (1) BIBLIOGRAPHIES; (2) GENERAL; (3) SOIL; (4) PROPERTIES OF SOIL; (5) STATICS AND DYNAMICS OF SOIL; (6) GROUNDWATER, PORE WATER, SURFACE WATER; (7) FOUNDATION ENGINEERING, HYDRAULIC ENGINEERING, TUNNEL CONSTRUCTION, MINING; (8) ROAD CONSTRUCTION, EARTHWORKS, RAILWAY CONSTRUCTION, AGRICULTURAL CONSTRUCTION ENGINEERING. /FG/RRL/

Petermann, H Kuhn, H
Road Research Society /Germany/, Forschungsarbeit Aus Str Wesen /Ger/ 1969

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 234772

GEOTECHNICAL PROBLEMS WITH SOFT BANGKOK CLAY ON THE NAKHON SAWAN HIGHWAY PROJECT

FROM THE START AT KM. 51,8 UP TO APPROXIMATELY KM. 72 NEAR AYUTHAYA THE NAKHON SAWAN HIGHWAY WILL BE BUILT ON SOFT BANGKOK CLAY. IN THIS AREA THERE IS A CONTINUOUS LAYER OF SOFT CLAY HAVING A THICKNESS OF 4-5 METERS, AND IN PLACES IT EXTENDS DOWN TO 16-18 METERS. THESE DEEP GULLIES IN THE UNDERLYING STIFF CLAY ARE OLD RIVERBEDS, AND THE ROAD LINE CROSSES THEM AT SEVEN PLACES. BESIDES THE SOIL INVESTIGATIONS CARRIED OUT ALONG THE ROAD LINE, SPECIAL ATTENTION HAS BEEN PAID TO THE OLD RAILWAY EMBANKMENT WHICH RUNS ALMOST PARALLEL TO THE ROAD AT A DISTANCE OF 1-3 KM. TO THE WEST. THIS EMBANKMENT, 60 YEARS OLD, IS OF APPROXIMATELY THE SAME HEIGHT AS THE PLANNED HIGHWAY. CONSIDERABLE DIFFICULTIES HAVE ALREADY BEEN ENCOUNTERED IN MAINTAINING THIS STRETCH, AND SOIL INVESTIGATIONS HAVE BEEN CARRIED OUT ON VARIOUS TROUBLE SPOTS IN ORDER TO ANALYSE BOTH THE STABILITY AND THE SETTLEMENT CONDITIONS. IT SHOULD ALSO BE MENTIONED THAT EXPERIENCE FROM TWO TEST SECTIONS ON THE BANGKOK-SIRACHA HIGHWAY, WHICH HAVE NOW BEEN UNDER OBSERVATION FOR MORE THAN ONE YEAR, HAS BEEN UTILIZED IN ANALYSING THE PROBLEMS FOR THE NAKHON SAWAN HIGHWAY. IN MANY RESPECTS THE BANGKOK CLAY CANNOT BE DEALT WITH USING CONVENTIONAL TEXTBOOK METHODS. UNTIL ADDITIONAL RESEARCH WORK HAS FURTHER REVEALED ITS GEOTECHNICAL PROPERTIES THE GREATEST SIGNIFICANCE HAS TO BE ATTACHED TO THE FIELD OBSERVATIONS. /RRL/

Eide, O Norwegian Geotechnical Institute Publ 1968

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 234864

LOESSIAL COLLAPSIBLE SOILS AS FOUNDATION BASE IN ROMANIA

THE PROPERTIES ARE DESCRIBED OF LOESS SOIL DEPOSITS, INCLUDING MOISTURE CONTENT, GRADING, PLASTICITY AND SHEAR STRENGTH, AND THE PROBLEMS ENCOUNTERED DURING THE EXECUTION OF CONSTRUCTION WORK IN LOESS SOIL. METHODS OF IMPROVING CONSTRUCTIONAL PROPERTIES OF THE SOIL, PARTICULARLY BY CONTROLLING THE MOISTURE CONTENT AND WETTING OF STRUCTURES FOUNDED IN IT, ARE DISCUSSED. /RRL/

Botea, E Stanculescu, I Bally, RJ Antonescu, IP
Soil Mech & Fdn Engineering /Rom/, Natl Cncl Engineers & Technicians /Rom/ 1969

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 234882

XIIITH CONGRESS TOKYO 1967. QUESTION II: PLANNING OF PROJECTS-EARTHWORKS

THE FOLLOWING TOPICS WERE DISCUSSED: (1) PRELIMINARY SURVEYS FOR THE STUDY OF PROJECTS, (2) GEOMETRIC STUDIES FOR THE PROJECTS-COMPUTER PROCESSES-PLAN SURVEY-ALIGNMENT, VOLUME OF EXCAVATION, SETTING OUT, (3) SOIL SAMPLING (4) EARTHWORKS IN CONTACT WITH THE PAVEMENT, (5) CONSTRUCTION OF EARTHWORKS, AND (6) SPECIAL CASES (ROADS ON SUBSOILS OF LOW BEARING CAPACITY, ROADS ON SOILS LIABLE TO LANDSLIP, SUBSIDENCE AND SUBJECT TO BE COVERED WITH SAND, AND ROADS ON SALTY SOILS). A GENERAL REPORT BY THIEBAULT, A., IS APPENDED. /RRL/

Thiebault, A
Perm Intl Assoc Road Congress

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 235015

**MANUAL ON ENGINEERING GEOLOGY /IN RUSSIAN/
WORKING TECHNIQUES FOR ENGINEERS AND METHODS OF
INTERPRETING RESULTS OF GEOLOGICAL AND GEOTECHNICAL
INVESTIGATIONS ARE OUTLINED. HEADINGS OF CHAPTERS
ARE AS FOLLOWS: BASIC PRINCIPLES DERIVED FROM
ASSOCIATED SCIENCES AND APPLIED TO GEOTECHNICAL
STUDIES, SOIL SCIENCES, SOIL MECHANICS, GEOLOGICAL
AND GEOTECHNICAL PHENOMENA, GEOTECHNICAL STUDIES,
SPECIAL METHODS, PARTICULAR ASPECTS OF GEOTECHNICAL
STUDIES FOR VARIOUS TYPES OF CONSTRUCTION, GEOLOGY,
SOIL IMPROVEMENT, AND EQUIPMENT USED IN GEOTECHNICAL
STUDIES. /LCPC/RRL/**

Nedra, Moscow /Ussr/ 1968

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 235031

**EMBANKMENTS ON COMPRESSIBLE SOILS /IN FRENCH/
THIS BIBLIOGRAPHY LISTS PUBLICATIONS CONCERNED WITH
THE CONSTRUCTION OF EMBANKMENT ROADS BUILT ON
VARIOUS TYPES OF COMPRESSIBLE SOIL (PEAT, SWAMP, MUD,
CLAY, ETC). IT DEALS WITH (1) CONSTRUCTION, (2) STUDY OF
SOIL IN-SITU AND IN THE LABORATORY (FULL-SCALE TESTS,
PORE PRESSURE MEASUREMENTS, ODOMETER SHEAR TESTS,
ETC) FROM THE POINT OF VIEW OF ITS COMPOSITION, MECHANICAL
CHARACTERISTICS, BEHAVIOR (SETTLEMENT, CONSOLIDATION,
ETC.) AND (3) CONSTRUCTION METHODS FOR THIS TYPE OF ROAD. /TRRL/**

Lab Cent Ponts Chauss, Paris /France/ 1969, 2 pp, 183 Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

2A 235041

**STABILITY OF SLOPES /IN FRENCH/
THIS ARTICLE REVIEWS PROBLEMS OF SLOPE STABILITY: (1)
INVESTIGATIONS INTO TYPES OF FAILURE, (2) STABILITY
STUDIES, AND (3) SLOPE CONSTRUCTION METHODS. THE
STABILITY OF VARIOUS TYPES OF STRUCTURES IS ANALYZED:
EMBANKMENTS ON COMPRESSIBLE SOIL, CUTTING TRENCHES,
NATURAL SLOPES, AND EMBANKMENTS ON SLOPES. SHORT-TERM
AND LONG-TERM STABILITY CONDITIONS ARE OUTLINED FOR
EACH CASE. THE VARIOUS STAGES OF SLOPE STABILITY
CALCULATIONS ARE DESCRIBED: SOIL STUDIES, HYDRAULIC
STUDIES AND CALCULATION METHODS (PLANE, CIRCULAR
CALCULATION) AND THE MOST IMPORTANT NOMOGRAPHS.
CONSTRUCTION METHODS ARE EXAMINED, AND EMPHASIS IS
LAID ON THE NEED FOR ADAPTING THE DESIGN TO THE SITE
IN ORDER TO LIMIT THE PROBLEMS. DIRECTIVES ARE GIVEN
FOR EACH TYPE OF STRUCTURE: EMBANKMENTS ON COMPRESSIBLE
SOIL (SLOPES, LATERAL STABILITY SHOULDERS), CUTTING
TRENCHES (SLOPES, DRAINAGE SYSTEMS), AND EMBANKMENTS
ON SLOPES (GEOMETRY OF THE STRUCTURE, DRAINAGE,
ETC.). /TRRL/**

Pilot, G *Construction, Paris /France/ Vol. 25 No. 10, Oct. 1970, pp 338-42, 5 Fig, 3 Phot*

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

2A 235147

**GROUND VIBRATIONS FROM TUNNEL BLASTING
THIS ARTICLE DEALS WITH THE MEASUREMENT AND CHARACTER
OF GROUND VIBRATIONS CAUSED BY BLASTING A 12FT
DIAMETER PILOT TUNNEL THROUGH SANDSTONE AS A
PRELIMINARY OPERATION IN THE CONSTRUCTION OF THE
SECOND MERSEY ROAD TUNNEL. THE BASIC PROPERTIES OF
A GROUND WAVE ARE SHOWN TO BE THE FREQUENCY AND
AMPLITUDE. THE FREQUENCY IS DEPENDENT ON THE TYPE
OF GROUND WHILE THE AMPLITUDE DEPENDS ON THE WEIGHT
OF EXPLOSIVE CHARGE, THE GROUND TYPE, AND THE
DISTANCE FROM THE BLAST. A FORMULA FOR PREDICTING
THE AMPLITUDE OF VIBRATION, FIRST DEVELOPED BY**

MORRIS, IS SHOWN TO BE INACCURATE AT SHORT DISTANCES
AND A MODIFICATION IS DEVELOPED. A COMPARISON IS
MADE OF VIBRATIONS IN THE BEDROCK AND IN THE CLAY
OVERBURDEN, AND THE EFFECT OF USING SHORT DELAY
DETONATIONS INSTEAD OF HALF-SECOND DETONATORS IS
OBSERVED. THE EFFECT OF GROUND VIBRATIONS ON BUILDINGS
IS DESCRIBED AND A CRITERION OF DAMAGE IS GIVEN,
I.E. THE LEVEL OF VIBRATION ABOVE WHICH DAMAGE TO A
STRUCTURE WILL RESULT. APART FROM A LIMIT ON THE
WEIGHT OF EXPLOSIVE FIRED TO PREVENT DAMAGE TO A
STRUCTURE, IT IS SHOWN THAT THE WEIGHT MUST ALSO BE
LIMITED WITH CONSIDERATION FOR HUMAN REACTION TO
THE BLASTING IF DOMESTIC RESIDENCES ARE NEARBY. IT IS
SHOWN THAT A LOWER CRITERION MUST BE ADOPTED IN
SUCH CASES TO PREVENT SEVERE NUISANCE. /RRL (A)/

Davies, TV *Tunnels & Tunnelling /UK/ May 1970*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 235173

**THE CLAREMONT TO DANVILLE ROAD TUNNEL
A DESCRIPTION IS GIVEN OF THE DESIGN AND CONSTRUCTION
TO THE STAGE REACHED IN FEBRUARY 1970 OF THE
1,880-FT LONG ROAD TUNNEL FROM CLAREMONT TO DANVILLE
IN PRETORIA. THE TUNNEL RUNS NORTH TO SOUTH THROUGH
THE DASPOORT SYSTEM OF THE PRETORIA SERIES. THE
TUNNEL CENTER LINE WAS INVESTIGATED BY PRELIMINARY
DRILLING, AND ADDITIONAL SOIL TESTS WERE CONDUCTED
AFTER THE APPROACH CUTTINGS HAD BEEN COMPLETED.
SOIL TEST RESULTS ARE GIVEN. THE DESIGN ALLOWS FOR
TWO TRAFFIC LANES AND TWO FOOT-WALKS, GIVING A
TUNNEL WIDTH AT ROAD LEVEL OF 38 FEET. CANOPIES
ARE PROVIDED AT EACH TUNNEL ENTRANCE AND A
VENTILATION SHAFT IS PROVIDED AT MID-LENGTH OF
THE TUNNEL. LIGHT IS TRANSITIONED INTO AND ALONG
THE TUNNEL. TUNNEL LIGHT VALUES ARE GIVEN. A
DESCRIPTION IS GIVEN OF THE METHOD OF CONSTRUCTION
OF THE APPROACH CUTTINGS AND OF DRIVING THE
TUNNEL FROM NORTH TO SOUTH. CONSTRUCTION HAS NOT
YET COMMENCED ON THE SOUTHERN END OF THE TUNNEL.
/RRL(A)/**

Edwards, JH Graham, DR *Technology and Potential of Tunnelling June 1970*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 235316

**SOIL AND FOUNDATION INVESTIGATIONS OF THE
PATAPSCO TUNNEL PROJECT
PROCEDURES FOLLOWED IN THE SOIL AND FOUNDATION
STUDIES FOR THE CONSTRUCTION OF THE PATAPSCO
TUNNEL PROJECT ARE DESCRIBED. AVAILABLE SOURCES
OF DATA ON LOCAL SOILS AND GEOLOGY WERE
INVESTIGATED. A FIELD STUDY WAS MADE, DURING
WHICH TIME THE ENTIRE PROPOSED ALIGNMENT WAS
COVERED ON FOOT, OBSERVATIONS MADE, AND
SAMPLES RECOVERED FOR LABORATORY TESTING.
THE PREDOMINANT SOIL TYPES ARE ERODED
SEDIMENTS OF AN UNCONSOLIDATED NATURE.
SURFACE SOIL SEDIMENTS ARE OF THE POTOMAC
GROUP OF THE LOWER CRETACEOUS. THESE
SEDIMENTS REST UPON CRYSTALLINE ROCK.
GRAVEL AND CLAY DEPOSITS WHICH WERE
STREAM TRANSPORTED FROM THE NORTHWEST
DURING THE PERIODS OF GLACIAL ACTION ARE
ENCOUNTERED. A MASTER SOIL PLAN AND
PROFILE WERE PREPARED FOR EACH
CONSTRUCTION SECTION BY THE DESIGN
ENGINEER FOR THAT SECTION. THE
IMPORTANCE OF REVISIONS IN
CONSTRUCTION PLANS DUE TO FIELD
OBSERVATIONS IS EMPHASIZED. THIS
ASSURED A CONTINUOUS REEVALUATION
OF THE SOIL AND FOUNDATION
CONDITIONS AS WORK PROCEEDED.
MAINTENANCE AND OPERATIONS ARE
BRIEFLY DISCUSSED.**

Balter, RB Miller, SM *Highway Research Board Bulletin 1960*

2A 235367

CONTROL OF SLIDE BY VERTICAL SAND DRAINS

THE VIRGINIA HIGHWAY DEPARTMENT WAS RELOCATING AND WIDENING A HIGHWAY LOCATED IN ROUGH AND MOUNTAINOUS TERRAIN, WITH THE MOUNTAINS BEING CUT BY NUMEROUS STREAMS FORMING A NUMBER OF WATER GAPS. EXCAVATION SHOWS THAT THE ROAD PASSED THROUGH A THICK MANTLE OF TALUS, MOSTLY SANDY SOIL, AND BOULDERS. SLIDES SHOWED EVIDENCE OF DEVELOPING IN THE TALUS MATERIAL. STUDY DISCLOSED THE PRESENCE OF A HORIZONTAL BED OF PLASTIC VARVED IMPERVIOUS CLAY ABOUT 35 FEET ABOVE GRADE. IT WAS FEARED THAT WATER DRAINING THROUGH THE LOOSE SAND WOULD REACH THIS BED OF CLAY, THEN FOLLOW IT AND BREAK OUT ON THE SLOPE. SAND DRAINS WERE INSTALLED IN HOPES THAT THE WATER WOULD BE CARRIED DOWN AND DISCHARGED IN THE POROUS MATERIAL AT THE BOTTOM. A WELL-DRILLING COMPANY CONTRACTED TO DRILL THE HOLES. THESE DRAINS WERE CONSTRUCTED AT LOW COST AND HAVE PERFORMED WELL FOR SEVEN YEARS. IT IS CONCLUDED THAT THESE DRAINS ARE OPERATING EFFICIENTLY AND CONTROLLING DRAINAGE PROBLEMS.

Parrott, WT *Highway Research Board Bulletin* 1955

2A 235371

SUBSURFACE DRAINAGE OF HIGHWAYS AND AIRPORTS

SUBSURFACE DRAINAGE IS A METHOD OF CONTROLLING THE MOISTURE CONTENT OF SUBGRADE SOILS AND BASE COURSES FOR PAVEMENTS BY RESTRICTING THE ENTRANCE OF WATER OR PROVIDING MEANS FOR ITS ESCAPE, OR IN SPECIAL CASES, PREVENTING EXCESSIVE LOSS OF WATER. FACTORS TO BE CONSIDERED ARE CLIMATE, SOIL, GROUND-WATER, CAPILLARITY AND PERMEABILITY, ROAD LOCATION, SURFACE DRAINAGE, SUBSURFACE DRAINS, INTERCEPTION DRAINS, WATER TABLE DRAINS, DRAINAGE OF GRANULAR BASES, ECONOMICS, UNDERDRAIN CONSTRUCTION, AND UNDERDRAIN FAILURES. BASIC PRINCIPLES OF LOCATION, DESIGN, AND CONSTRUCTION ARE PRESENTED AND THEIR APPLICATIONS ARE ILLUSTRATED.

Highway Research Board Bulletin 1959

2A 235447

ON THE FRICTION BETWEEN SANDS AND CONSTRUCTION MATERIALS

THE MOBILIZATION OF SKIN FRICTION BETWEEN SAND AND CONCRETE HAS BEEN STUDIED BY RUNNING A SERIES OF DIRECT-SHEAR TESTS WITH DOUBLE SURFACE OF SHEAR IN A GLASS-SIDED SHEAR BOX 44 CM LONG AND 10 CM WIDE. TWO DIFFERENT SANDS AND THREE CONCRETE-SURFACE RUGOSITIES HAVE BEEN TESTED. THE RESULTS CONFIRM THE WELL-KNOWN PHENOMENON THAT MOBILIZED FRICTION INCREASES WITH SHEAR DISPLACEMENT. THE AUTHOR SUGGESTS AN EMPIRICAL RELATIONSHIP BETWEEN THE ANGLE OF SKIN FRICTION AND THE SHEAR DISPLACEMENT. THE EXPRESSION, BECAUSE OF ITS SIMPLE FORM, COULD FIND APPLICATION IN THE TREATMENT OF SEVERAL SOIL-MECHANICS PROBLEMS INVOLVING SKIN-FRICTION DEVELOPMENT. /AMR/

Berardi, G

Atti Dell Istituto Di Delle Costr 1966

ACKNOWLEDGMENT: *Applied Mechanics Review*

2A 235454

THE SOUTH COVE TUNNEL PROJECT, BOSTON, MASSACHUSETTS

THE DESIGN ASPECTS ARE OUTLINED OF A NEW SUBWAY STRUCTURE IN DOWNTOWN BOSTON, WHICH FORMS PART OF THE MASSACHUSETTS BAY TRANSPORTATION AUTHORITY'S (MBTA) SOUTHWEST CORRIDOR EXTENSION. IT WILL REPLACE AND EXTEND SERVICE BETWEEN THE WASHINGTON STREET TUNNEL AND FOREST HILLS WITH AN IMPROVED,

HIGH PERFORMANCE TRANSIT FACILITY AND WILL PROVIDE PATRONS WITH A SPEEDIER, MORE COMFORTABLE, AND SAFER JOURNEY. SOIL BORINGS ALONG THE TUNNEL ROUTE ESTABLISHED THE FACT THAT A LAYER OF MISCELLANEOUS FILL COVERS A LARGE PORTION OF THE SITE UNDER WHICH OCCUR THE SILTS, OCCASIONALLY WITH PEAT. BENEATH THE SILTS ARE THE CHARACTERISTICALLY BOSTON CLAYS- SOFT BLUE AT THE BOTTOM, STIFFER YELLOW AT THE TOP. THE PROPERTIES OF COHESIVE SOIL STRATA WERE EXAMINED IN DETAIL BY MEANS OF LABORATORY TESTS ON UNDISTURBED SAMPLES. LOADS WERE CALCULATED ON THE SUBWAY STRUCTURE. SUPPORT OF EXISTING BUILDINGS WILL BE PROVIDED BY A TREMIE CONCRETE WALL. CONSTRUCTION TECHNIQUES USED WILL BE CUT-AND-COVER TUNNELLING, TUNNEL BORING, AND INSTALLATION OF A CONCRETE CUT-OFF WALL BY SLURRY TRENCH PROCESS. VENTILATION PROVISIONS AND RAIL SUPPORTS ARE DESCRIBED. THE MBTA'S TRAINS WILL BE IN DAILY OPERATION DURING THE PERFORMANCE OF THE WORK IN THE EXISTING TUNNEL.

Stacho, ZA *Boston Society Civil Engineers Journal* Oct. 1968

2A 235473

CERTAIN FEATURES OF LATERAL PRESSURES OF SOILS

A BRIEF REVIEW IS PRESENTED OF EXPERIMENTAL INVESTIGATIONS OF TWO TYPES OF RETAINING STRUCTURES IN THE UNITED STATES AND IN ENGLAND. SPECIAL FEATURES ARE DESCRIBED OF LATERAL PRESSURES ON INCLINED STRUTS OF WIDE OPEN BRACED CUTS. PRACTICAL EXPERIENCES DURING THE CONSTRUCTION OF THE FIRST NEW YORK SUBWAYS SHOWED THAT THE LATERAL PRESSURES OF SOILS AGAINST THE UPPER ROWS OF STRUTS EXCEEDED APPRECIABLY THE VALUES OBTAINED FROM DESIGN DIAGRAMS OF THE CUSTOMARY TRIANGULAR SHAPE. THE PREVENTIVE MEASURES IN SUCH CASES WERE FOUND TO BE: (1) THE GROUND WATER LOWERING SHOULD BE PERFORMED NOT ONLY BY STEPPED ROWS OF WELL POINTS INSIDE OF THE CUT BUT ALSO WITH THE HELP OF INDIVIDUAL DEEP WELLS WITH PRESSURE PUMPS AT THEIR BOTTOMS PLACED OUTSIDE OF THE SHEET WALL, (2) ADDITIONAL ROWS OF STRUTS SHOULD BE INSTALLED HAVING THE PURPOSE TO DECREASE THE SPAN 'L' AND TO RELIEVE THE UPPER ROW OF INCLINED STRUTS, AND (3) CONSIDERATION SHOULD BE GIVEN IN DESIGN EVEN IF ONLY APPROXIMATELY TO ALL THESE SPECIAL FACTORS WHEN COMPUTING AND DETAILING THE STRUCTURE. SOME ASPECTS ARE OUTLINED OF THE DESIGN OF ANCHORED SHEET PILE BULKHEADS. THE SIMPLIFIED METHOD OF THE EQUIVALENT BEAM WITH REPORTED MODIFICATIONS IS SUGGESTED AS REPRESENTING A PRACTICAL, FEASIBLE APPROACH TO A FINAL SOLUTION OF THE DESIGN PROBLEMS FOR THIS TYPE OF STRUCTURE.

Tschebotarioff, GP *Highway Research Board Special Reports* 1960

2A 235476

THE DESIGN, CONSTRUCTION AND PERFORMANCE OF VIBRATING-WIRE EARTH PRESSURE CELL

THERE IS A NEED IN GEOTECHNICAL RESEARCH FOR A RELIABLE INSTRUMENT FOR LONGTERM MEASUREMENTS OF THE STATES OF STRESS INDUCED IN SOIL BY CIVIL ENGINEERING CONSTRUCTION. SUCH MEASUREMENTS MAY BE USED TO CHECK DESIGN METHODS AND TO ASSES THE VALIDITY OF THE ASSUMPTIONS EMPLOYED. THE DESIGN AND CONSTRUCTION OF A ROBUST YET ACCURATE TOTOL EARTH PRESSURE CELL DEVELOPED FOR THIS PURPOSE IS DESCRIBED. RESULTS FROM A GROUP OF CELLS BURIED IN THE CLAY CORE OF AN EARTHFILL DAM ARE GIVEN, WHICH DEMONSTRATE A CONSISTENT PERFORMANCE AND RELIABILITY OF THE CELLS OVER A PERIOD OF FIVE YEARS. /AUTHOR/

Thomas, HS Ward, WH *Geotechnique /UK/* Mar. 1969

2A 235644

TUNNEL SURVEY, PART II

WHEN DRIVING A TUNNEL IT IS SOMETIMES NECESSARY TO DRIVE A PILOT TUNNEL FOR REASONS OF SOIL INVESTIGATION, SOIL TREATMENT, ETC. THE SURVEY CAN BE ADJUSTED ON HOLING THROUGH AND SURVEY STATIONS ESTABLISHED ALONG THE LENGTH OF THE PILOT TUNNEL TO FACILITATE GUIDING OF THE MAIN SHIELD. CONTROL OF THE TUNNEL FACE WHILE DRIVING ENTAILS KEEPING A TIGHT CHECK ON SIX THINGS: (1) THE LINE-TO INSURE THE TUNNEL IS IN THE CORRECT POSITION IN THE HORIZONTAL PLANE, (2) THE LEVEL-TO ENSURE THE TUNNEL IS IN THE CORRECT POSITION IN THE VERTICAL PLANE, (3) THE SQUARE-TO ENSURE THAT THE SHIELD IS POINTING IN THE CORRECT DIRECTION HORIZONTALLY, (4) THE PLUMB-TO ENSURE THE SHIELD IS POINTING IN THE CORRECT DIRECTION VERTICALLY, (5) THE ROLL-TO ENSURE THE KEY IS IN THE CORRECT POSITION, AND (6) THE SHAPE-TO ENSURE THE TRAMMEL IS CORRECT, I.E. THE TUNNEL IS CIRCULAR. WITH THE DEVELOPMENT OF ADVANCED MECHANICAL HANDLING IN TUNNELLING TECHNIQUES, THE ADVANCE OF THE TUNNEL FACE HAS BEEN SUCH THAT MORE SPEEDY TECHNIQUES WERE REQUIRED TO KEEP PACE. SCALES FIXED TO THE REAR END OF THE SHIELD ARE USED SUCCESSFULLY TO SURVEY THE POSITION OF THE SHIELD FROM A KNOWN SURVEY STATION. A THEODOLITE AND A LEVEL ARE USED TO KEEP A CHECK ON LEVEL. CONTROL OF PLUMB AND ROLL IS KEPT USING A PLUMB BOB ON THE SHIELD. A VISUAL DISPLAY SYSTEM GIVING A PREDICTED POSITION OF THE SHIELD 8FT IN FRONT OF THE FACE WAS DEVELOPED. THIS PREDICTOR SYSTEM CONSISTS OF A SERIES OF MIRRORS SO LOCATED ON THE FACE THAT A BEAM OF LIGHT PROJECTED FROM A LIGHT BOX IS REFLECTED ON TO A SCREEN BY THE SHIELD DRIVER'S CONTROLS. THE LASER HAS BEEN USED AS A LIGHT SOURCE IN THE UNITED STATES ON ONE OR TWO TUNNELS. SPECIAL PROBLEMS ARE DISCUSSED RELATING TO THE SETTING OUT OF SUBMERGED TUBE TUNNELS. GREAT ADVANCES HAVE BEEN MADE IN THE FIELD OF DISTANCE MEASUREMENT BY ELECTRONIC MEASURING INSTRUMENTS, GEODOMETER AND TELLUROMETER. THESE INSTRUMENTS ARE BASED ON THE MEASUREMENT OF DISTANCE BY MEANS OF MODULATED MICROWAVES. THE FIRST USES LIGHT AS ITS MEDIA, AND THE SECOND RADIO WAVES. THE MEKOMETER WAS DEVELOPED BY THE NATIONAL PHYSICAL LABORATORY USING ELLIPTICALLY POLARIZED LIGHT MODULATION AT MICROWAVE FREQUENCY, AND THE REFLECTED LIGHT IS COMPARED IN PHASE WITH THE EMITTED LIGHT. THIS INSTRUMENT IS PORTABLE AND AUTOMATICALLY CORRECTS ITSELF FOR SMALL CHANGES IN ATMOSPHERIC PRESSURE, AND THE OPERATION IS INDEPENDENT OF HUMIDITY. THE PRECISION INDICATOR OF THE MERIDIAN (PIM) IS DESCRIBED AND ITS USE UNDERGROUND DISCUSSED. COMPUTERIZATION OF MANY OF THE RUN OF THE MILL SURVEY CALCULATIONS SPEEDS THE WORK AND LEADS TO THE PREDICTION THAT AN AUTOMATED SYSTEM OF TUNNEL CONTROL MAY SOON BE DEVELOPED.

Mcbeth, DG *Tunnels & Tunnelling /UK/ Jan. 1970*

2A 235663

ACUTE PROBLEMS OF GEOMECHANICS AND THEIR THEORETICAL APPLICATIONS

CONTENTS: THEORY OF PLASTICITY AND THE TRUE BEHAVIOR OF ROCK MASS, V. MENCL STABILIZATION OF SOIL BY ELIMINATION OF THE PHENOMENA ON BOUNDARY OF LAYERS, CH. VEDER ON CLASSIFICATION OF SOFT ROCKETS, K. MAGAR THOUGHTS ON THE PROBLEM OF GLACIAL EROSION, R. HAEFELI MODEL TESTS ON FLOW THROUGH FISSURED ROCK, W. WITTKÉ, C. LOUIS EXTENT OF PENETRATION OF GROUT IN FISSURED ROCK, W. WITTKÉ ON THE CORRELATION OF SEISMICALLY AND STATICALLY DETERMINED MODULI OF ELASTICITY OF ROCK MASSES, H. LINK NEW EXPERIMENTS ON TUNNEL CONSTRUCTION, THEIR RESULTS AND IMPLICATIONS, K. SATTLER MODEL EXPERIMENTS ON

TUNNEL CONSTRUCTION SIMULATED AS SEMIRIGID SHELLS, L. RABCEWICZ, F. PACHER LAWS OF MODELS FOR TUBICAL TUNNELS, G. SONNTAG ROCK PRESSURE IN FELBETAUERN HIGHWAY-TUNNEL, F. KÄHLER, J. WANDERER ROCKFALLS IN PRESSURE GALLERIES, H. DETZLHOFER COCONTROL OF THE ORIGIN OF CRACKS IN ROCK, R. KVAPIL CONSIDERATIONS ON THE OVERBURDEN OF PRESSURE TUNNELS, F. HAUTUM ON THE INTERACTION OF TWO ADJOINING PRESSURE TUNNELS AND THE NECESSARY OVERBURDEN, W. FORSTER, T. DORING THE PERMISSIBLE STRESS IN ROCK AROUND PRESSURE TUNNELS, F. PACHER GROUTING METHODS FOR PRESTRESSING THE PRESSURE TUNNELS, H. LAUFFER MECHANIZED TUNNEL HEADING IN HARD ROCK, G. NABER ROCK REINFORCEMENT OF THE CAVERN AT VEYTAUX, O. RESCHER PHOTOELASTIC STUDIES ON FOUNDATION OF HONGRIN SOUTH DAM, O. RESCHER ROCK FOUNDATIONS OF DAMS, E. GRUNER.

Muller, L

Geomechanical Society Symp /Austria/ 283 pp, 1968

ACKNOWLEDGMENT: Applied Mechanics Review

2A 235774

PRINCIPLES OF SOIL MECHANICS INVOLVED IN FILL CONSTRUCTION

THE STABILITY OF THE FILL AND THE SUPPORTING POWER OF THE UNDERSOIL CAUSED BY THE WEIGHT OF THE FILL ARE INDEPENDENT OF ELASTIC CONSTANTS SINCE THE PROBLEM IS ONE OF PLANE DEFORMATION. THE GREATEST SHEARING STRESS AT ANY POINT IN THE UNDERSOIL IS P/π WHERE P IS THE UNIT LOAD, AND IF THIS DOES NOT EXCEED THE COHESION CORRESPONDING TO THE MAXIMUM ALLOWABLE DEFORMATION, THE SUPPORTING POWER OF THE UNDERSOIL IS AMPLE. IF THE COHESION OF THE UNDERSOIL IS LESS THAN P/π , IT DOES NOT FOLLOW THAT FAILURE WILL RESULT. FURTHER STUDY OF THE SUPPORTING POWER OF THE UNDERSOIL IS NECESSARY IN THIS CASE AND FOR THIS PURPOSE PRANDTL'S METHOD OF PLASTIC EQUILIBRIUM MAY BE USED. THE PHI CIRCLE METHOD IS APPLIED TO THE PROBLEM OF THE STABILITY OF THE FILL ITSELF. /AUTHOR/

Palmer, LA Barber, ES Krynine, DP DISCUSSER *Highway Research Board Proceedings 1937*

2A 235895

DESIGN AND CONSTRUCTION OF TIED-BACK SHEET PILE WALL

THE PROBLEM OF SIDEHILL INSTABILITY IN THE WIDENING AND RECONSTRUCTION OF NEW YORK AVENUE, N. E., WASHINGTON, D. C. BEING SOLVED BY A TIED-BACK SHEET PILE WALL DESIGN IS DESCRIBED. THE CONSTRUCTION PROCEDURE IS GIVEN. SOIL INVESTIGATION AND ANALYSES ARE INCLUDED. AN EFFECTIVE SOLUTION WOULD BE TO INSTALL A PERMANENT STEEL SHEET PILE WALL ALONG THE OUTSIDE EDGE OF THE SHOULDER WITH A PARTED UNLOADING OF THE INPLACE FILL DOWNHILL OF THE BULKHEAD. LATERAL STRESSES WOULD THEN BE RESISTED BY A WATER AND TIE-BACK SYSTEM ANCHORED SUFFICIENTLY DEEP INTO THE UNDISTURBED CLAY UNDER THE ROADWAY SO AS TO BE BEYOND ANY POTENTIAL FAILURE PLANE.

O, COLMAN E Ramirez, JJ *Highway Focus Dec. 1970*

2A 236004

PILE TESTS-ARKANSAS RIVER PROJECT

FIELD DRIVING AND LOADING TESTS WERE MADE ON A VARIETY OF PILES DRIVEN WITH DIFFERENT HAMMERS TO DEVELOP CRITERIA FOR THE DESIGN AND CONSTRUCTION OF PILE FOUNDATIONS IN SAND FOR LOCKS AND DAMS ON THE LOWER ARKANSAS RIVER. THE EFFECT OF JETTING ON THE CAPACITY OF A PILE WAS DETERMINED. STEEL PIPE AND H-PILES WERE INSTRUMENTED TO MEASURE STRAINS PRODUCED BY COMPRESSION AND TENSION LOADINGS TO DETERMINE THE DISTRIBUTION OF STRESS IN THE PILES. LOAD

TESTS WERE ALSO MADE ON PILES DRIVEN DURING CONSTRUCTION OF SOME OF THE LOCKS IN THE LOWER VALLEY. THE PILE TESTS SHOWED THAT 12-IN. TO 16-IN. 50-FT. LONG DISPLACEMENT PILES DRIVEN INTO THE ALLUVIAL SANDS IN THE ARKANSAS RIVER VALLEY HAVE CAPACITIES IN EXCESS OF 100 TONS IN COMPRESSION, AND 50 TONS IN TENSION. THE PILE CAPACITY WAS THE SAME REGARDLESS OF HAMMER USED TO DRIVE THE PILE. COMPRESSION TEST FAILURE LOADS CHECKED CAPACITIES CALCULATED FROM THE PACIFIC COAST UNIFORM BUILDING CODE AND JANBU EQUATION EXCEPT FOR H-PILES. /ASCE/

Mansur, CI Hunter, AH *Am Soc Civil Engr J Soil Mech Div* Sept. 1970

2A 236006

LATERAL LOAD TESTS ON PILES-ARKANSAS RIVER PROJECT

FIELD LATERAL LOAD TESTS WERE MADE ON A VARIETY OF PILES DRIVEN WITH DIFFERENT HAMMERS TO DEVELOP CRITERIA FOR THE DESIGN AND CONSTRUCTION OF PILE FOUNDATIONS IN SAND FOR LOCKS AND DAMS OF THE LOWER ARKANSAS RIVER. THE INVESTIGATION INCLUDED DETERMINATION OF THE EFFECTS OF PILE BATTER, REPETITIVE LOAD, JETTING AND PREJETTING, AND DENSIFICATION OF THE FOUNDATION SOILS ON THE FLEXURAL AND LATERAL LOAD-DEFORMATION BEHAVIOR OF INDIVIDUAL PILES. THE PILE TESTS SHOWED THAT: (1) TRIANGULAR DISTRIBUTION OF MODULUS OF HORIZONTAL SUBGRADE REACTION NH WITH RESPECT TO DEPTH IS A GOOD APPROXIMATION; (2) COEFFICIENT NH IS DEPENDENT ON THE PILE DEFLECTION; (3) REPETITIVE LOADING INCREASES TOTAL DEFLECTION AT A GIVEN LOAD LEVEL BY ABOUT 100%; (4) FOR A GIVEN LATERAL LOAD, FULLY JETTED PILES DEFLECT 20% TO 50% MORE THAN UNJETTED PILES; (5) DENSIFICATION OF THE FOUNDATION SANDS INCREASES NH VALUE BY ABOUT 100%; AND (6) THE LATERAL LOAD CAPACITY OF A PILE IS ESSENTIALLY INDEPENDENT OF THE HAMMER USED TO DRIVE THE PILE. /ASCE/

Alizadeh, M Davisson, MT *Am Soc Civil Engr J Soil Mech Div* Sept. 1970

2A 236058

ANCHORED DIAPHRAGM WALLS IN SAND-SOME DESIGN AND CONSTRUCTION CONSIDERATIONS

A METHOD OF ESTIMATING THE ANCHOR LOADS REQUIRED TO SUPPORT A MULTI-TIED CONTINUOUS WALL IS INTRODUCED. IT INVOLVES A PROCEDURE WHICH CALCULATES THE POSITION AND MAGNITUDE OF A RESULTANT TIE AT ANY STAGE OF EXCAVATION BY TREATING THE WALL AS A SINGLE TIED STRUCTURE. COMPARISON OF DESIGNS CARRIED OUT BY THE CEMENTATION METHOD AND EXPERIMENTAL WORK INDICATE THAT THE RESULTS OBTAINED PROVIDE A GOOD ESTIMATE OF THE HORIZONTAL FORCES. THE RESULTS OBTAINED BY THE GENERALLY USED METHODS ARE ALSO SHOWN. THE MAIN DESIGN AND STABILITY CONSIDERATIONS ASSOCIATED WITH TRENCH EXCAVATION UNDER BENTONITE ARE DESCRIBED. RECOMMENDATIONS COVERING THE MAIN REQUIREMENTS FOR TREMIE CONCRETE FOR LOAD BEARING DIAPHRAGM WALLS ARE GIVEN. METHODS OF ESTIMATING ANCHOR LOCATION, OVERALL STABILITY AND LOAD CARRYING CAPACITY WITH RELEVANT SAFETY FACTORS ARE ILLUSTRATED. ANCHOR CONSTRUCTION STAGES ARE DESCRIBED TOGETHER WITH THE POSTTENSIONING PROCEDURES AND CORROSION PROTECTION NORMALLY RECOMMENDED FOR SAND ANCHORS. FINALLY, THE INFLUENCE OF PRESTRESSED TIE-BACKS ON THE LATERAL MOVEMENTS AND SETTLEMENT OF THE RETAINED SOIL MASS IS DISCUSSED. /AUTHOR/

Littlejohn, GS Jack, BJ Sliwinski, ZJ *Inst Hwy Engineers Journal, London /UK/* Apr. 1971

2A 236492

THE SEISMICITY OF INDIANA AND ITS RELATION TO CIVIL ENGINEERING STRUCTURES

PREVIOUS RECORDS OF EARTHQUAKES ARE EXAMINED, THEIR LOCATION AND YEAR NOTED AND DISCUSSED IN RELATION TO GEOLOGIC FAULTING. A DESCRIPTION OF THE SEISMIC GEOLOGY OF THE INDIANA AREA INCLUDES CONSIDERATION OF THE STRUCTURAL FRAMEWORK, FAULT SYSTEMS, AND THE RELATIONSHIP BETWEEN EARTHQUAKES AND FAULTS. THE SEISMIC HISTORY OF THE REGION SINCE 1638 IS DESCRIBED AND PLOTTED ON A MAP. THE POSSIBILITY OF REOCCURRENCE OF EARTHQUAKES IS PREDICTED AND POTENTIAL DAMAGE OF HIGHWAY STRUCTURE IS DETAILED. CONSTRUCTION PLANS OF HIGHWAY BRIDGE STRUCTURES WERE REVIEWED, AND THE FOUNDATION PROVISIONS AND LOCATION, SOIL TYPE AND RELATIVE STRENGTH, AND THE LOCATION OF THE GROUND WATER TABLE WERE STUDIED. SOIL CONDITIONS AT 12 BRIDGE SITES WERE STUDIED AND AREAS WITH THE LARGEST POTENTIAL EARTHQUAKE DAMAGE WERE IDENTIFIED. GROUND ACCELERATIONS WERE PREDICTED FOR EARTH OF THE TWELVE SITES USING ACCEPTABLE SEISMOLOGICAL TECHNIQUES AND THE VALUES ARE TABULATED. THE NEED IS INDICATED FOR FURTHER STUDIES TO EVALUATE DAMAGE BY SHAKING AS WELL AS LIQUEFACTION AT THE BRIDGE AREAS. SEISMIC BUILDING CODES ARE DISCUSSED AS ARE EXISTING SEISMIC DESIGN STANDARDS IN INDIANA. LESSONS DRAWN FROM THE SAN FERNANDO EARTHQUAKE ARE LISTED. CONCLUSIONS DRAWN FROM INFORMATION PRESENTED IN THE REPORT DRAW ATTENTION TO EARTHQUAKES THAT MAY BE EXPECTED IN THE FUTURE. RECOMMENDATIONS ARE MADE WITH REGARD TO THE DEVELOPMENT OF A SEISMIC DESIGN CODE FOR INDIANA.

Kovacs, WD

Purdue & Ind State Hwy Comm Jhrp No. 44, Dec. 1972, 42 pp, 10 Fig, 3 Tab, Refs

2A 236541

GROUNDWATER CONTROL IN TUNNEL CONSTRUCTION

TUNNEL DEWATERING INVOLVES GROUNDWATER HYDROLOGY AND SOIL MECHANICS: HYDROLOGY TO UNDERSTAND THE CONTROL OF WATER OUTSIDE THE TUNNEL; SOIL MECHANICS TO PREDICT THE EFFECT OF WATER ENTERING THE TUNNEL. AFTER COMPLETING A GEOLOGICAL STUDY, THE NEXT STEP IS TO ANALYZE WHAT KIND OF AQUIFER TO USE FOR A GIVEN TUNNEL DEPENDING ON THE PERMEABILITY THICKNESS, STORAGE OF WATER, AND RECHARGE SOURCES THAT ARE AVAILABLE. IF GROUND WATER PROBLEMS ARE PREDICTED, THEN RECOMMENDATIONS SHOULD INCLUDE SIEVE ANALYSES FOR PERVIOUS SOILS, ATTERBERG LIMITS FOR LESS PERVIOUS SOILS, AND PUMPING TESTS. THE METHODS OF PREDRAINAGE ARE WELL POINT SYSTEMS, DEEP WELLS, AND EJECTOR SYSTEMS: THE COSTS OF PREDRAINAGE DEPEND ON DRILLING COSTS, WELL COMPLETION, SUBMERSIBLE ELECTRIC PUMPS, ELECTRICAL POWER, DISCHARGE SYSTEM, OPERATING COSTS, AND MAINTENANCE COSTS. SOMETIMES COMPRESSED AIR IS USED ALONG WITH PREDRAINAGE METHODS TO DISPLACE WATER, ALTHOUGH SOME FORM OF GROUTING MUST BE UTILIZED ON THE CASINGS. THE SERVICES OF A SKILLED HYDROLOGIST, GEOLOGIST, OR SOILS ENGINEER ARE RECOMMENDED FOR ANY UNUSUAL CONDITIONS-SETTLEMENTS, EXISTING WATER SUPPLIES, SHAFT PREDRAINAGE, ETC.

Powers, JP *N Am Rapid Excav & Tunneling Conf Proc* Vol. 1 June 1972, pp 331-69, 7 Fig, 14 Ref

2A 236542

PERFORMANCE OF A SOFT GROUND TUNNEL ON THE WASHINGTON METRO

THE OBJECTIVES WERE TO DETERMINE THE RELATIONSHIP OF CONSTRUCTION METHODS TO SETTLEMENTS AND TO OBSERVE THE PATTERN OF SOIL MOVEMENT AROUND THE

TUNNEL AS AN AID IN EVALUATING UNDERPINNING CRITERIA FOR NEARBY STRUCTURES. THREE LINES OF SOIL DISPLACEMENT INSTRUMENTS (INCLINOMETERS, EXTENSOMETERS, AND PIEZOMETERS) WERE PLACED THROUGH A TEST SECTION IN THE LAFAYETTE PARK TUNNEL, WASHINGTON, D. C.; INSTRUMENT MEASUREMENTS WERE COORDINATED WITH SHIELD MOVEMENTS. SOIL DISPLACEMENTS AROUND THE SHIELD, CAUSED BY SETTLEMENTS, ARE THE RESULT OF: (1) THE POLING PLATES ON THE SHIELD, (2) PLOWING AND YAWING OF THE SHIELD, (3) GROUTING THROUGH THE SHIELD, (4) RIP EXPANSION, AND (5) RIB DEFLECTION.

Hansmire, WH Cording, EJ *N Am Rapid Excav & Tunneling Conf Proc* Vol. 1 June 1972, pp 371-89, 13 Fig, 3 Ref

2A 236569

TUNNELING EXPERIENCES, CITY OF EDMONTON, ALBERTA CANADA

TUNNEL REQUIREMENTS ARE BROKEN INTO THREE CATEGORIES AND THE SIX MAJOR STEPS WHICH MAKE UP THE CONSTRUCTION OF INTERCEPTOR SEWERS BY THE TUNNELING METHOD ARE DESCRIBED. MAJOR TUNNEL OPERATIONS ARE DONE BY MINING MACHINES ALONG WITH A SKIP HOIST FOR MUCK DISPOSAL, MATERIALS HANDLING AND LOWERING AND RAISING OF PERSONNEL. FOR SMALLER TUNNEL OPERATIONS, A STATIONARY WALKING GANTRY WITH A CAR DUMPING STAND AND A SEPARATE MAN CAGE FOR LOWERING PERSONNEL INTO THE SHAFT IS USED. STILL SMALLER TUNNELS REQUIRE A MOBILE GANTRY CRANE. IN A DISCUSSION OF THE SURFACE AND UNDERGROUND PLANT SETUP, THE FENCING OF THE SITE AND THE EQUIPMENT USED ARE REVIEWED. THE HOISTS OF VARYING SIZE THAT WERE USED ARE DESCRIBED IN A TABLE, AS ARE ALSO THE COMPRESSORS. THE SINKING OF THE SHAFT WHICH IS CIRCULAR AND VARIES IN SIZE DEPENDING ON THE SIZE OF THE JOB IS DETAILED. FOR SHAFTS UP TO 10 FT DIAMETER, SQUARE, 3-GAGE, FOUR FLANGED LINER PLATES WERE USED. THE GROUND IS EXCAVATED BY HAND WITH THE USE OF 37 LB. JACKHAMMERS. MINE UNDERVENT AND TUNNEL EXCAVATION PROCEDURES ARE ALSO REVIEWED. INVERT POUR, ARCH POUR, MONOLITHIC POUR-FILL CIRCLE, AND PRECAST PIPE COMPLETE WITH GROUTING (THE FOUR OPERATIONS IN THE PLACING OF THE CONCRETE LINER) ARE REVIEWED. TRAINING AND SAFETY PROGRAMS, THE DOMINANT FEATURES OF THE BEDROCK TOPOGRAPHY OF EDMONTON, THE REASONS WHY THE CITY CHOSE TO CONSTRUCT ITS OWN STORM AND SANITARY TUNNELS, AND THE FINANCIAL FEATURES OF THE OPERATION ARE OTHER ASPECTS DISCUSSED.

Beaulieu, AC *N Am Rapid Excav & Tunneling Conf Proc* Vol. 2 June 1972, pp 933-63, 6 Fig, 8 Tab

2A 236570

STILLWATER TUNNEL PROJECT

THE BASIC PURPOSE OF THE PROJECT IS THE DEVELOPMENT OF COMPLETE SYSTEMS FOR RAPID TUNNEL CONSTRUCTION. CONTRACTS AND SPECIFICATIONS WILL BE WRITTEN TO ENCOURAGE INNOVATION BY THE BIDDERS. TUNNEL BORING MACHINES WILL BE USED TO EXCAVATE ALL OF THE TUNNEL EXCEPT THE 4500 FT OF QUARTZITIC ROCK AT THE UPSTREAM END WHICH WILL BE EXCAVATED BY DRILL AND BLAST TECHNIQUES. RESEARCH WILL INCLUDE GEOLOGIC, GEOPHYSICAL, ROCK MECHANICS, AND SOIL MECHANICS INVESTIGATIONS AS WELL AS THE RESEARCH AND DEVELOPMENT OF THE EXCAVATION PROCESS, MATERIALS HANDLING, LINING SYSTEMS, AND ENVIRONMENTAL CONTROLS. THE OBJECTIVES SOUGHT IN THE BORING MACHINE DEVELOPMENT AND OPERATION ARE ENUMERATED. TRAIN, SLURRY, PNEUMATIC, CONVEYOR, AND UNITIZED SYSTEMS ARE SOME OF THE MATERIALS HANDLING SYSTEMS CONSIDERED. EVALUATION OF THE SIZING OF SYSTEM COMPONENTS SUCH AS PUMPS AND PIPING WILL ALSO BE DONE. CEMENT

AND CHEMICAL GROUTING, THREE TYPES OF PRECAST SEGMENT LINERS SHOTCRETE, CAST-IN-PLACE CONCRETE, EXPANDED METAL SHEETS WITH CONCRETE BACKFILL AND SHOTCRETE FINAL LINING AND OTHER YET UNDEVELOPED SYSTEMS WILL BE EVALUATED. THE PROGRAM INCLUDES DETAILED SURFACE GEOLOGIC MAPPING OF THE TUNNEL ALIGNMENT ON ORTHOPHOTOGRAPHS MODIFICATION AND TRIAL OF SEVERAL SURFACE GEOPHYSICAL TECHNIQUES, AND THE TESTING OF SEVERAL BOREHOLE LOGGING SYSTEMS. LABORATORY AND FIELD TESTING IS DISCUSSED AS ARE ALSO CERTAIN ASPECTS OF OCCUPATIONAL HEALTH AND SAFETY, AND CONSTRUCTION CONTRACT ADMINISTRATION.

Arthur, HG *N Am Rapid Excav & Tunneling Conf Proc* Vol. 2 June 1972, pp 965 81, 6 Fig, 4 Ref

2A 236572

CONSTRUCTION DIFFICULTY INDEX FOR TUNNEL CONSTRUCTION

THE PAPER REPORTS PROGRESS ON A CONTINUING STUDY BEING MADE FOR PURPOSES OF DEVELOPING RELIABLE DATA FOR PREDICTING COSTS AND PROGRESS ON FUTURE TUNNEL CONTRACTS. BASIC DATA ON THE PROGRESS PER SHIFT, HOURS MINED PER SHIFT, HOURS OF DOWNTIME PER SHIFT, CAUSE OF DOWNTIME, AND TYPE OF SOIL MINED IS REPORTED, AND AN EXAMPLE OF A WEEKLY MINING REPORT IS PRESENTED. DATA REGARDING MANPOWER AND EQUIPMENT USED DURING TUNNELING OPERATIONS IS SUPPLIED. THE SOIL TYPE BEING MINED WAS VERIFIED BY VISUAL OBSERVATION AND COMPARED WITH DATA LISTED ON A PREVIOUSLY PREPARED SOIL PROFILE. MACHINE MINING DATA FOR FIVE CONTRACTS ARE TABULATED. INFORMATION CULLED FROM A REVIEW OF THE DATA IS PRESENTED AND INCLUDES SUCH ASPECTS AS PROGRESS RATES, RATES OF TUNNEL PROGRESS WHICH COULD BE USED FOR ESTIMATING PURPOSES, THE REMOVAL OF LARGE BOULDERS, MINING MACHINES, CONTROL OF GROUNDWATER, SOIL PROFILES, AND PRECONSTRUCTION PLANNING. THE NEED IS INDICATED FOR A STANDARDIZED DATA GATHERING PROCEDURE APPLIED TO ALL TUNNEL CONSTRUCTION ON A NATIONAL BASIS AND COORDINATED BY A NATIONAL AGENCY.

Sulinski, SJ *N Am Rapid Excav & Tunneling Conf Proc* Vol. 2 June 1972, pp 997 101, 12 Fig

2A 236580

THE ROMEO TUNNELS-DETROIT, MICHIGAN-A CURRENT REPORT ON RAPID EXCAVATION IN DIFFICULT GROUND RAPID EXCAVATION IN HIGHLY VARIABLE SOIL CONDITIONS WHICH INCLUDE CLAYS RANGING FROM VERY PLASTIC TO VERY HARD, GRAVELS, SANDS, SILTS AND BOULDERS, AND IN PERMEABLE SOILS WHICH CONTAIN HIGH CONCENTRATIONS OF METHANE GAS COMPRESSED BY GROUNDWATER LEVELS SOME 40 FT. ABOVE TUNNEL INVERT IS DESCRIBED. THE PAPER DEMONSTRATES THAT CONTINUOUS RAPID EXCAVATION IN DIFFICULT GROUNDS IS LIMITED BY FACTORS OTHER THAN THE EXCAVATION PROCESS ITSELF. IN THIS PROJECT, THE ENTIRE TUNNEL WAS EXCAVATED UNDER COMPRESSED AIR AND AN EXTENSIVE DEWATERING PROGRAM WAS UNDERTAKEN TO REDUCE GROUNDWATER PRESSURES TO A LEVEL WHICH COULD BE CONTROLLED BY LOW TUNNEL AIR PRESSURE. SOLUTIONS TO THE PROBLEM OF COMPRESSED AIR LOSS AT THE HEADING ARE SUGGESTED. CONVENTIONAL 4 IN. CIRCULAR STEEL RIBS AT 4 FEET INTERVALS WITH SOLID 3 IN. THICK TIMBER LAGGING WAS USED AS TUNNEL LINING. THREE ALTERNATIVE TYPES OF MECHANICAL EXCAVATORS (CLOSED FACED ROTARY BORING MACHINE; OSCILLATING ARM OR WINDSHIELD WIPER EXCAVATOR; AND THE EXCAVATOR SHIELD) THAT COULD BE SUCCESSFULLY USED FOR THIS PROJECT ARE DESCRIBED. DETAILS ARE GIVEN OF THE EQUIPMENT ITSELF AND THE OPERATION OF THE ROBBINS EXCAVATOR SHIELD.

THE MACHINE CONSISTS OF A SHIELD ASSEMBLY FITTED WITH AN EXCAVATOR, BREASTING SYSTEM, MUCK APRON, MUCK CONVEYOR AND THRUSTING SYSTEM TUNNELING EQUIPMENT FOR WORKING IN MOST EVERY KIND OF SOIL CONDITION IMAGINABLE. TUNNELING PLANT PRODUCTION DATA ARE PRESENTED.

Traylor, TW *N Am Rapid Excav & Tunnelling Conf Proc* Vol. 2 June 1972, pp 1113-24, 3 Fig

2A 236602

GROUTING COHESIONLESS WATER-BEARING SOILS IN CITY TUNNELS

EXAMPLES ARE PRESENTED OF THE USE OF GROUTING PROCESSES FOR TREATMENT OF WATER-BEARING GRANULAR SOILS AND ITS APPLICATION IN THE FIELD OF UNDERGROUND WORKS PARTICULARLY IN URBAN AREAS. THE SELECTION OF THE GROUTING METHOD AND THE EXTENT OF TREATMENT REQUIRED DEPENDS ON THE NATURE AND BEHAVIOR OF THE SUBSOIL, AND WHETHER THE TREATMENT IS TO BE OF A PERMANENT OR TEMPORARY NATURE. GENERAL PRINCIPLES OF GROUTING ARE REVIEWED AND ECONOMIC DATA ARE DISCUSSED. THE USE OF A CEMENT-BASED, AERATED, EXPANSIVE MIX WITH SPECIAL CHARACTERISTICS USED TO TREAT CALCAREOUS BOULDER-MUD-STONE AND LIMESTONE IN A PARIS CONSTRUCTION PROJECT IS DESCRIBED. TREATMENT WAS PARTICULARLY DELICATE IN THE HAMBURG SUBWAY CONSTRUCTION PROJECT WHERE THE SOILS WERE SANDY AND WITH FINE AND HOMOGENEOUS GRADINGS, AND CONSTRUCTION TOOK PLACE AT A SHALLOW DEPTH. GROUTING WAS ESPECIALLY DIFFICULT IN UNDERGROUND CONSTRUCTION IN MUNICH WHERE THERE WAS THE NECESSITY TO AVOID HEAVING. DETAILS ARE GIVEN OF OTHER PROJECTS IN MUNICH, FRANKFURT, VIENNA, MILAN, AND IN SERGRERA, SPAIN. IN SOME OF THESE EXAMPLES, THE GROUTING PROCESS IS AUXILIARY TO TRADITIONAL METHODS AND IN OTHERS THEY ARE PRIMARY. IT IS STRESSED THAT THE USE OF THE TECHNIQUE REQUIRES THE UTMOST CARE AND THE SKILL OF AN EXPERIENCED SPECIALIST CONTRACTOR.

Haffen, M Janin, J *N Am Rapid Excav & Tunnelling Conf Proc* Vol. 2 June 1972, pp 1539-68, 12 Fig, 36 Ref

2A 236637

EROSION CONTROL STRUCTURES

EROSION AND EXCESS RUNOFF ARE PRODUCTS OF MANY FACTORS: SOIL TYPE, PLANT COVER, CROPPING PRACTICES CLIMATIC ZONES, RAINFALL AMOUNTS AND INTENSITIES, AND DEGREE AND LENGTH OF SLOPE TO NAME A FEW. WATER EROSION USUALLY OCCURS AS SHEET EROSION, WHICH IS THE PERIODIC REMOVAL OF THIN SHEETS OF SOIL OVER AN AREA, OR AS GULLY EROSION THAT FORMS INCISED CHANNELS. THE END PRODUCT IS SEDIMENT. IT IS IN THE CONSTRUCTION STAGE THAT NATURAL CONDITION SUCH AS TOPOGRAPHY, NATURAL COVER, SOIL CONDITIONS, AND DRAINAGE PATTERNS ARE BEING DISRUPTED DUE TO MANIPULATIONS BY MAN AND MACHINES. IT SHOULD BE THE GOAL OF EACH DESIGN AND CONSTRUCTION ENGINEER TO CONTROL THESE RESULTS WITHIN REASONABLE LIMITS DURING THE CONSTRUCTION STAGE AND FINALLY TO PERMANENTLY STABILIZE THE AREA FOR CONTROL OF EROSION AND RUNOFF UPON COMPLETION OF THE JOB. THERE ARE A NUMBER OF BASIC PRINCIPLES FOR CONTROLLING RUNOFF AND EROSION THAT HAVE PROVED SOUND OVER THE YEARS FOR OTHER LAND USES AND THAT CAN PROVE TO BE JUST AS USEFUL FOR HIGHWAY CONSTRUCTION. THESE INCLUDE SUCH THINGS AS PROPER ATTENTION TO SOIL, FOUNDATION, AND TOPOGRAPHY IN SITE SELECTION; MINIMUM EXPOSURE OF BARE AREAS BY CONTROL OF CLEARING AND GRADING OPERATIONS; DIVERSION OF WATER AWAY FROM CRITICAL AREAS; FLATTENING SLOPES; REDUCING SLOPE LENGTHS; USE OF TEMPORARY COVER; AND CONTROL OF EQUIPMENT ACCESS AND TRAVEL WAYS. A NUMBER OF STRUCTURAL

MEASURES ARE DISCUSSED THAT MAY BE USED AS EITHER TEMPORARY OR PERMANENT INSTALLATIONS. THESE INCLUDE SUCH THINGS AS GRASSES OR PAVED WATERWAYS, BURIED PIPE OUTLETS, DIVERSION TERRACES, BENCHES, VARIOUS TYPES OF GRADE CONTROL STRUCTURES, CHUTES, INLETS, AND DEBRIS BASINS. /AUTHOR/

Barnes, RC *Highway Research Board Special Reports* No. 135, 1973, pp 94-8, 1 Ref

2A 236639

PENNDOT'S RESPONSE TO EROSION CONTROL

PENNSYLVANIA DEPARTMENT OF TRANSPORTATION (PENNDOT) HAS BEEN ENGAGED IN POST-CONSTRUCTION EROSION CONTROL ACTIVITIES FOR MANY YEARS THROUGH THE USE OF SEEDING, MULCHING AND PLANTINGS, PROPER LANDSCAPE MANAGEMENT, AND DITCH PAVING. MENTION WAS MADE OF EROSION CONTROL DURING ACTUAL EARTH-MOVING ACTIVITIES IN THE PENNDOT CONSTRUCTION SPECIFICATIONS; HOWEVER, THIS WAS NOT ENFORCED, EXCEPT POSSIBLY WHEN THE PROJECT WAS IN CLOSE PROXIMITY TO A PUBLIC WATER SUPPLY. IN EARLY 1970 THE FEDERAL HIGHWAY ADMINISTRATION ISSUED A MEMORANDUM REQUIRING THAT ALL FEDERAL AND FEDERAL-AID CONTRACTS BE STRENGTHENED TO INCLUDE SPECIFIC TEMPORARY POLLUTION CONTROL PROVISIONS IN CONTRACT DOCUMENTS AND TO PROVIDE FOR DIRECT PAYMENT FOR THIS WORK. FROM THIS MEMORANDUM, PENNSYLVANIA ADOPTED A PROVISION FOR TEMPORARY PROJECT WATER POLLUTION CONTROL (SOIL EROSION) FOR PROJECTS LET SINCE OCTOBER 1, 1970. THE PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL RESOURCES PREPARED A DRAFT OF PROPOSED EROSION CONTROL REGULATIONS PRINTED ON FEBRUARY 26, 1972, AND PUBLIC HEARINGS WERE SCHEDULED IN MAY 1972. THE PENNSYLVANIA ENVIRONMENTAL QUALITY BOARD ADOPTED THE REGULATIONS IN SEPTEMBER 1972. THIS REGULATION REQUIRES THAT A PERMIT BE SECURED FROM THE PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL RESOURCES FOR ANY EARTHMOVING ACTIVITY IN EXCESS OF 25 ACRES WITH THE EXCLUSION OF FARMING ACTIVITIES. IN CUMBERLAND COUNTY, A RESEARCH PROJECT ON EROSION CONTROL IS BEING CONDUCTED JOINTLY BY PENNDOT, THE PENNSYLVANIA DEPARTMENT OF AGRICULTURE, AND THE U. S. GEOLOGICAL SURVEY BEFORE, DURING, AND AFTER THE CONSTRUCTION OF INTERSTATE 81. THE EROSION CONTROL METHODS USED ON HIGHWAY CONSTRUCTION PROJECTS IN PENNSYLVANIA ARE OUTLINED. OTHER RESEARCH PROJECTS AND STUDIES CURRENTLY UNDER WAY ARE ALSO DISCUSSED. ASIDE FROM WATER POLLUTION, THE PENNDOT POLLUTION CONTROL PROGRAM INVOLVES OTHER FORMS OF POLLUTION, E.G., AIR, LAND, AESTHETIC, AND SOCIAL. /AUTHOR/

Huber, HH *Highway Research Board Special Reports* No. 135, 1973, pp 123-8, 3 Fig, 1 Tab, 2 Ref

2A 236643

SOIL AS AN ENGINEERING CONSTRUCTION MATERIAL /IN JAPANESE/

BECAUSE OF THE GREAT DISTANCES AND VARIED CLIMATIC CONDITIONS, MANY SOIL TYPES OCCUR IN AUSTRALIA, AND THEIR PROPER USAGE AS CONSTRUCTION MATERIALS REQUIRES A KNOWLEDGE OF HOW TO DEAL WITH SOIL VARIABILITY. TERRAIN EVALUATION AND SOIL RECOGNITION METHODS HAVE BEEN HIGHLY DEVELOPED FOR THESE PURPOSES, AS WELL AS THE VARIOUS METHODS OF SOIL STABILIZATION. RECENTLY, NEW METHODS OF STATICAL ANALYSIS (BAYESIAN PROBABILITY) HAVE BEEN STUDIED AS A MEANS OF IMPROVING CONSTRUCTION CONTROL AND ASSISTING RECOGNITION OF THE CRITICAL FACTORS INVOLVED IN ANY PARTICULAR SOIL CONSTRUCTION WORK. NEWLY DEVELOPED TECHNIQUES FOR THE TESTING AND EVALUATION OF SOIL AND STABILIZED SOIL FOR USE AS PAVEMENT MATERIAL, AND IN EARTHEN EMBANKMENT CONSTRUCTION, ARE

DESCRIBED WITH PARTICULAR REFERENCE TO CURRENT AUSTRALIAN RESEARCH, BOTH IN THE LABORATORY AND AS CONTROLLED LONG-TERM FIELD TRIALS. THE RESULTS OF THIS EXPERIENCE ARE NOW BEING INCORPORATED IN PRACTICAL CONSTRUCTION MANUALS. /CSIRO/

Ingles, OG
Public Works Res Inst, Cm /Japan/ Vol. 13 No. 7, 1971, pp 359-61

ACKNOWLEDGMENT: Commonw Scient Indus Res Org /Austral/

2A 236706

OSCILLATION OF PILES-SOME MARINE EXPERIENCE
AN INNOVATION IN THE CONSTRUCTION OF CUT-OFF WALLS IS DESCRIBED. THE NEW TYPE OF CONTINUING DIAPHRAGM WALL IS CALLED "PAROI MOULEE PLASTIQUE." IT'S ECONOMY IS DUE TO THE RE-USE OF ALL THE BENTONITE STABILIZING FLUID FROM THE TRENCH, WHICH IS TRANSFORMED INTO A CONSTRUCTION MATERIAL OF ADEQUATE STRUCTURAL STRENGTH BY ADDING TO EVERY CUBIC METER OF SLURRY ABOUT 150 KG OF CEMENT TYPE CLK 325, AND SOME RETARDER OF THE LIGNOSULFITE TYPE. THE INVENTORS CLAIM THAT THIS NEW TYPE OF IMPERMEABLE CUT-OFF WALL WOULD RESPOND WITH ELASTIC DEFORMATION TO EXCESSIVE STRESSES AND WOULD NOT DEVELOP CRACKS. A COMPARISON WITH HYDRATION PRODUCTS OF VARIOUS CEMENTS AND PLASTER OF PARIS INDICATED SIMILARITIES OF MICROSTRUCTURE. IT SEEMED THAT THE BENTONITE/CEMENT SLURRY PROVIDED THE PERFECT MEDIUM FOR THE GROWTH OF STABLE CLUSTERS OF CALCIUM SILICATE HYDRATE, WHICH APPARENTLY PREVENT THE STACKS OF FLAT, PLATE-LIKE CLAY PARTICLES WITH WET SURFACES FROM SLIDING APART. PERHAPS THE MOST REMARKABLE FACT IS THAT THE IN SITU STRENGTH OF THE CUT-OFF WALL MATERIAL WAS UP TO 30 KG/SQ CM AT 28 DAYS.

Sainsbury, RN Mowlem, J
Ground Engineering /UK/ Vol. 6 N3 May 1973, pp 44-51, 2 Fig, 3 Phot

2A 236852

DESIGN CONSIDERATIONS FOR DEEP RETAINED EXCAVATIONS IN OVER-CONSOLIDATED SEATTLE CLAYS
THE HARD CLAYS FOUND IN MANY PARTS OF THE SEATTLE AREA HAVE PRESENTED MAJOR PROBLEMS TO HIGHWAY ENGINEERS IN THE PAST 10 YEARS. DURING THIS PERIOD INTERSTATE FREEWAYS, STATE HIGHWAYS AND OTHER LOCAL CONSTRUCTION PROJECTS HAVE REQUIRED DEEP EXCAVATIONS AND STRUCTURES LOCATED WITHIN THE CLAY STRATA. IT WAS THE CONSTRUCTION OF INTERSTATE 5 THROUGH DOWNTOWN SEATTLE THAT CREATED THE MOST SERIOUS PROBLEMS AND RESULTED IN A UNIQUE RETAINING WALL SYSTEM. THE UNSTABLE SLOPES ON THIS PROJECT ALERTED DESIGN ENGINEERS TO THE POTENTIAL HAZARDS OF DEEP EXCAVATIONS IN THE HARD CLAYS. THIS PAPER DISCUSSES THE ORIGIN AND PHYSICAL CHARACTERISTICS OF THE CLAYS AND ILLUSTRATES HOW THESE CHARACTERISTICS ARE CONSIDERED IN THE DESIGN OF DEEP RETAINED EXCAVATIONS.

Strazer, RJ Wilson, SD Bestwick, LK
Workshop Proceedings Vol. 2 May 1973, pp 96-122, 12 Fig, 14 Ref

2A 236861

FOUNDATION OF A TUNNEL BY THE SAND-FLOW SYSTEM
THE ARTICLE DESCRIBES MODEL TESTS TO DEMONSTRATE THE SAND-FLOW SYSTEM, A TECHNIQUE DEVELOPED FOR FORMING THE FOUNDATION OF A SUNKEN TUNNEL FOR THE PROPOSED CROSSING OF THE RIVER WESTERSCHIEDT IN THE NETHERLANDS. IN THIS SYSTEM, ORIFICES IN THE BOTTOM OF PREFORMED TUNNEL ELEMENTS ARE MIXTURE OF SAND-WATER IS THEN FORCED UNDER THE TEMPORARILY SUPPORTED TUNNEL ELEMENTS WHICH LIE IN A DREDGED TRENCH. THE SEDIMENTATIONS GRADUALLY BUILD UP AND COMPLETELY FILL THE SPACE BETWEEN THE TUNNEL SECTION AND THE SIDES OF THE TRENCH. /TRRL/

Griffioen, A Vanffioen, AL *Tunnels & Tunnelling /UK/* Vol. 5 N No. 4, 1973, pp 354-63, 12 Fig, 11 Phot

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/IRRD 206 696, 2C63236286

2A 237006

PATENTED METHOD OF EXCAVATING SOFT GROUND TUNNELS BY DRIVING IN A SET OF ANTI-CRUMBLING NEEDLES

THE ARTICLE DESCRIBES A METHOD FOR EXCAVATING TUNNELS IN SOFT GROUND. IT USES A SYSTEM OF TUBULAR STEEL 'NEEDLES' ABOUT 2.50 M LONG DRIVEN INTO THE GROUND FOR STRENGTHENING PURPOSES. THE 'NEEDLES' ARE POSITIONED USING A CENTERING MEMBER. FURTHER STRENGTHENING MAY BE OBTAINED BY INJECTING THROUGH THE NEEDLES LIQUID CEMENT OR BENTONITE, WHICH WILL BE ABSORBED BY THE SURROUNDING SOIL. /TRRL/

Giacobino, GP *Tunnels & Tunnelling /UK/* No. 4, 3 pp, 6 Fig

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

2A 237037

TUNNELS FOR ROADS AND MOTORWAYS
THE PAPER USES THREE EXAMPLES OF ROAD TUNNEL CONSTRUCTION IN BRITAIN TO SHOW HOW WIDE VARIATIONS IN TUNNELING COST DEPEND UPON GROUND CONDITIONS. THE EXAMPLES USED ARE THE GREAT CHARLES STREET TUNNEL, BIRMINGHAM, THE HEATHROW AIRPORT CARGO TUNNEL AND THE CLYDE TUNNEL. THE PRINCIPLES TO BE CONSIDERED IN TUNNEL PLANNING AND CONSTRUCTION ARE OUTLINED IN ORDER TO OBTAIN THE MOST SATISFACTORY SOLUTION FOR THE LEAST COST. THE RELATIVE COSTS OF BORED TUNNELS COMPARED WITH THOSE OF CUT-AND-COVER METHODS OF CONSTRUCTION ARE BRIEFLY MENTIONED.

Wood, AM
Quarterly J of Engineering /UK/ Vol. 5 No. 1, 1972, pp 111-26, 4 Fig, 3 Tab, 20 Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

2A 237097

CONSIDERATIONS ON AN EXPERIMENTAL EMBANKMENT CONSTRUCTED ON COMPRESSIBLE SOIL
A PROPOSED NAPLES MOTORWAY BYPASS WOULD INVOLVE ROAD CONSTRUCTION ON THE RIVER SARNO PLAINS, AN INTENSELY CULTIVATED AND IRRIGATED AREA WITH A LARGELY ORGANIC AND THEREFORE COMPRESSIBLE SUB-SOIL. THIS ARTICLE DESCRIBES THE CONSTRUCTION OF A FULL SCALE EXPERIMENTAL ROAD EMBANKMENT ON THIS TERRAIN AND THE FIELD TESTS CARRIED OUT TO MEASURE ITS COMPRESSIBILITY AND FORECAST SETTLEMENT. THE RESULTS OF THE EXPERIMENT FAVOR A VIADUCT SOLUTION FOR THIS BYPASS. /TRRL/

Manacorda, A Oliva, N *Autostrade /Italy/* Vol. 14 No. 8, Aug. 1972, pp 4-15, 8 Fig, 2 Tab, 3 Phot

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

2A 237186

PREVENTIVE MEASURES TO REDUCE FROST ACTION ON HIGHWAYS IN FINLAND-AND DISCUSSION
THE REPORT DESCRIBES THE METHODS USED TO DIMINISH OR PREVENT THE DETRIMENTAL EFFECTS OF FROST IN FINLAND. THE LEVELING OF THE NON-UNIFORM FROST HEAVING CAME ABOUT BY USING WEDGES ON THE BORDER OF ROCK CUTS, WHERE EMBANKMENTS AND CUTS MEET, WHERE SOIL CHANGES, AND BETWEEN BOTH SIDES OF CULVERTS. PREVENTION OR REDUCTION OF FROST HEAVING WAS BROUGHT ABOUT BY REPLACING THE FROST-SUSCEPTIBLE SOIL WITH NON-FROST-SUSCEPTIBLE SOIL OR INCREAS-

ING THE EMBANKMENT ON FRIST-SUSCEPTIBLE SOIL. ABSORPTION OF THE GROUNDWATER TABLE INTO THE BASE COURSE WAS PREVENTED BY USING AN INSULATING COURSE, LOWERING THE GROUNDWATER TABLE DEEP DRAINAGE, DITCHING OF THE ROAD OR BY CHEMICAL STABILIZATION. VERTICAL DRAIN WITH GRAVEL FILL HAS ALSO BEEN USED TO REDUCE THE SUCTION OF WATER INTO THE BORDER ZONE OF FREEZING AND TO EVAPORATE WATER FROM THE BASE AND SUBBASE COURSE. THIS REPORT ALSO DESCRIBES SOME ASPECTS TO BE CONSIDERED IN THE CONSTRUCTION OF FROST-RESISTANT ROADS. /AUTHOR/

Taivainen, OA Jumikis, AR Gray, H *Highway Research Record, Hwy Res Board* 1963

2A 237255

LITERATURE ON THE PHYSIC-CHEMICAL PROPERTIES, THE FLOW BEHAVIOR AND FROST SENSITIVITY OF CLAY-WATER-MIXTURES

IN THIS LITERATURE SURVEY, THE RELEVANT PAPERS ARE DIVIDED INTO THE FOLLOWING SECTIONS: /1/ GENERAL PAPERS ON CLAY AND ITS RHEOLOGICAL BEHAVIOUR, THEORIES, DIRECTIONS, BIBLIOGRAPHIES, /2/ MIXTURES OF CLAY MINERALS AND THEIR PROPERTIES, /3/ INVESTIGATIONS OF CLAYS /RADIOGRAPHICAL AND MINERALOGICAL, AS WELL AS PHYSICO-CHEMICAL TESTS/, /4/ PAPERS DEALING WITH THE FLOW LAWS /VISCOSITY, HEAT TREATMENT, THIXOTROPY/, /5/ CLAY AS A BUILDING MATERIAL /THICK RINSING, INJECTION, STABILISATION OF THE SOIL/, AND /6/ FROST IN THE SOIL. /FG/RRL/

Jessberger, HL
Berichte 1965

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 237278

PRINCIPLES OF GEOCRYOLOGY (PERMAFROST STUDIES) PART II, ENGINEERING GEOCRYOLOGY, CHAPTER 10, USE OF ICE, SNOW AND FROZEN SOIL IN ENGINEERING STRUCTURES

THIS TRANSLATION IS THE ELEVENTH FROM THE SOVIET PERMAFROST PUBLICATION PRINCIPLES OF GEOCRYOLOGY, PART II. THIS TRANSLATION OF CHAPTER 10 REVIEWS THE USE OF ICE, SNOW AND FROZEN SOIL AS CONSTRUCTION MATERIALS IN PERMAFROST REGIONS. THE DESIGN AND CONSTRUCTION OF ENGINEERING STRUCTURES OF SNOW, ICE AND FROZEN SOIL ARE DESCRIBED. THE CHAPTER CONCLUDES WITH A DISCUSSION OF THE CONSTRUCTION AND OPERATION OF ICE-WALLED STOREHOUSES. /CGRA/

Voitkovskii, KF Krylov, MM *Nrc Div Bldg Res Tech Transl /Can/* Sept. 1967

ACKNOWLEDGMENT: Canadian Good Roads Association AD 652 774, 3C64051330

2A 237351

INFLUENCE OF THE FROST ACTION OF THE HIGHWAY PAVEMENTS RESISTANCE

OBSERVATIONS AND INVESTIGATIONS ON THE INFLUENCE OF FROST ACTION ON HIGHWAY PAVEMENT RESISTANCE ARE PRESENTED. TYPICAL FROST FAILURES OCCUR ON PAVEMENTS ALREADY IMPAIRED BY FATIGUE AND ARE THEREFORE A SECONDARY PHENOMENA. THE CRACKS ARE DUE TO FATIGUE IN THE ASPHALT SURFACE. DEEPER COMPACTED, MULTI-LAYER ROAD SYSTEMS ARE RECOMMENDED FOR FROST RESISTANCE.

Turnsek, V Balduzzi, F *Gradbenie Vestnik /Yugoslavia/* Mar. 1966

2A 237460

FREEZING AND THAWING TESTS OF MASONRY AND EXPOSED AGGREGATE CONCRETE PANELS
KNOWLEDGE CONCERNING DURABILITY OF BRICK MASONRY AND EXPOSED AGGREGATE CONCRETE WAS RE-

QUIRED TO DETERMINE SUITABILITY OF MATERIALS FOR TUNNEL PORTAL STRUCTURES LOCATED HIGH IN THE MOUNTAINS AND, THEREFORE, SUBJECT TO SEVERE WEATHERING. FREEZING AND THAWING TESTS WERE PERFORMED ON PANELS PREPARED FOR THE COLORADO DEPARTMENT OF HIGHWAYS BY COMMERCIAL MANUFACTURERS. FREEZING WAS BY REFRIGERATED AIR AT 0 DEG F AND THAWING WAS IN WATER AT 50 DEG F. RESULTS DETERMINED AFTER 500 CYCLES SHOW ALL EXPOSED AGGREGATE PANELS AND 2 OF 3 BRICK PANELS REMAINED IN EXCELLENT CONDITION. ONE BRICK MASONRY PANEL DEVELOPED RANDOM CRACKS AT 380 CYCLES, APPARENTLY CAUSED BY ABSORPTION CHARACTERISTICS OF THE BRICK. /AUTHOR/

Porter, LC
Bureau of Reclamation /US/ Nov. 1967

2A 237471

HIGHWAY DESIGN AND CONSTRUCTION PROBLEMS ASSOCIATED WITH THE LOESSIAL SOILS OF WEST TENNESSEE

THE INTERSTATE HIGHWAY PROGRAM CAUSED TENNESSEE TO BECOME CONCERNED ABOUT THE DESIGN AND CONSTRUCTION OF ROADWAYS IN THE LOESS BELT. THE MOISTURE ACCUMULATION IN THE SUBGRADE IS A PRIMARY FACTOR AFFECTING THE STABILITY OF ROADWAYS CONSTRUCTED IN THE LOESS BELT. SUBGRADE TREATMENT WAS 6 OR 7 PERCENT (BY WEIGHT) PORTLAND CEMENT, AS WELL AS THE PORTLAND CEMENT STABILIZED BASE RECOMMENDED FOR FLEXIBLE PAVEMENTS IN THIS AREA. IF RIGID PAVEMENTS ARE DESIRED, A SOIL-CEMENT BASE IS RECOMMENDED. RIGID PAVEMENTS GENERALLY ARE MUCH MORE SATISFACTORY THAN FLEXIBLE PAVEMENTS WHERE THE DESIGN IS BASED ON COMPARABLE LOAD REQUIREMENTS. THE IMPORTANCE IS RECOGNIZED OF A APPROPRIATE BASE AND PAVEMENT THICKNESSES AND PROPER DRAINAGE. RIGID CONTROLS MUST BE EXERCISED IN THE CONSTRUCTION OF LOESS EMBANKMENTS. PERMEABILITY AND CBR TESTS HAVE PROVEN THAT LOESS, WHEN COMPACTED TO ITS MAXIMUM DENSITY AT OPTIMUM MOISTURE CONTENT, IS ESSENTIALLY IMPERVIOUS. SIDE SLOPES FOR FILLS ARE PRESENTLY CONSTRUCTED ON A 2:1 RATIO. WHATEVER THE SLOPE DESIGN CHOSEN, SURFACE DRAINAGE MUST BE CONTROLLED AT ALL TIMES. SIDE DITCHES SHOULD BE FLAT-BOTTOMED AND, DEPENDING ON THE GRADIENT, SHOULD BE PAVED, SODDED OR SEEDDED.

Royster, DL Rowan, WH *Highway Research Record, Hwy Res Board* 1968

2A 237476

EFFECT OF INORGANIC CHEMICALS ON THE CONSISTENCY PROPERTIES OF AN EXPANSIVE SOIL SAMPLE

CONSISTENCY PROPERTIES OF A SOIL TO A CERTAIN EXTENT INDICATE THE BEHAVIOR OF THE SOIL FOR ENGINEERING CONSTRUCTION. THE RESULTS ARE REPORTED OF THE EFFECT OF 20 INORGANIC CHEMICALS IN VARYING AMOUNTS ON THE CONSISTENCY PROPERTIES OF AN EXPANSIVE SOIL SAMPLE FROM POONA. CERTAIN SOLUBLE AND INSOLUBLE HYDROXIDES MAKE THE SOIL FRIABLE. POTASSIUM CHLORIDE AND SODIUM CHLORIDE ARE ALSO FOUND EFFECTIVE IN IMPROVING THE SHRINKAGE CHARACTERISTIC OF THE SOIL. FERROUS CHLORIDE AND AMMONIUM HYPOPHOSPHATE MAKE THE SOIL MASS POROUS. /AUTHOR/

Katti, RK Barve, AG *Highway Research Board Bulletin* Jan. 1962

2A 237515

ENVIRONMENTAL FACTORS EXCEPT FROST
THESE REFERENCES ON ENVIRONMENTAL FACTORS, EXCEPT FROST, INCLUDE SELECTIONS ON SOIL MOISTURE AND EVAPORATION, SOIL-MOISTURE THEORY, MOISTURE MOVEMENT IN SOIL DUE TO A TEMPERATURE GRADIENT, EFFECT OF SURFACE COVER ON SOIL MOISTURE LOSSES BY EVAPORATION, DISTRIBUTION OF MOISTURE IN SOILS, SOIL TEMPERA-

TURES AND FACTORS INFLUENCING IT, THERMAL CONDUCTIVITIES IN SOILS, TESTS FOR THERMAL DIFFUSIVITY, EXPERIENCES WITH EXPANSIVE CLAYS, OSMOTIC INTERPRETATION OF SWELLING OF SOILS, MEASUREMENT OF PF IN SOIL BY FREEZING-POINT, MOISTURE BARRIERS FOR HIGHWAY SUBGRADE PROTECTION, USES OF IMPERMEABLE SUBBASES IN HIGHWAY CONSTRUCTION, SOME EFFECTS OF SOIL, WATER AND CLIMATE UPON THE CONSTRUCTION, LIFE AND MAINTENANCE OF HIGHWAYS, INTERRELATIONSHIPS OF LOAD, VOLUME CHANGE AND LAYER THICKNESS OF SOIL TO THE BEHAVIOR OF ENGINEERING STRUCTURES, STRENGTH OF SOILS IN RELATION TO PRESSURE DEFICIENCY IN PORE WATER, MEASUREMENT OF PORE WATER PRESSURE, AND EFFECT OF SEASONAL VARIATIONS IN SOIL MOISTURE CONTENT.

Highway Research Information Service M00721

2A 237524

EFFECT OF CLIMATIC FACTORS ON SUBGRADE MOISTURE CONDITIONS

RESEARCH WAS CONDUCTED UPON SUBGRADE MOISTURE CONDITIONS TO EXTEND EXISTING KNOWLEDGE TO A WIDER RANGE OF CLIMATES. MEASUREMENTS MADE UNDER SEVERAL ROAD AND AIRFIELD PAVEMENTS IN BOTH TROPICAL AND SEMI-TROPICAL COUNTRIES ARE CONSIDERED. THE MAIN FACTOR IN DETERMINING THE MOISTURE CONDITION OF THE SUBGRADE, IRRESPECTIVE OF CLIMATE, IS THE CLOSENESS OF THE WATER-TABLE TO THE SURFACE. WHERE THE WATER-TABLE IS DEEPER, OR NON-EXISTENT, THE RELATION BETWEEN THE SUBGRADE MOISTURE CONDITION AND THE CLIMATIC WATER BALANCE IS EXAMINED, AND EVIDENCE IS PRESENTED FOR A RELATION BETWEEN THE SECTION OF SOIL MOISTURE IN THE SUBGRADE AND THE THORNTWHAITE MOISTURE INDEX. THE MAIN FACTORS DETERMINING MOISTURE CONDITIONS IN SOIL ARE RAINFALL AND EVAPOTRANSPIRATION, AND IT IS SUGGESTED THAT A CLIMATIC CLASSIFICATION, BASED ON THE MOISTURE BALANCE, MAY BE USEFUL IN CONNECTION WITH ESTIMATING THE PROBABLE MOISTURE CONDITIONS IN ROAD SUBGRADES AND IN THE ASSESSMENT OF THE PERFORMANCE OF ROAD- MAKING MATERIALS IN AREAS WITH DIFFERING CLIMATES.

Russam, K. Coleman, JD *Geotechnique /UK/* Mar. 1961

2A 237526

FROST ACTION

THESE REFERENCES ON FROST ACTION INCLUDE SELECTIONS ON LOSS OF PAVEMENT SUPPORTING CAPACITY DUE TO FROST, FROST ACTION IN SOILS, FREEZING AND THAWING OF SOILS AS FACTORS IN THE DESTRUCTION OF HIGHWAY PAVEMENTS, SOIL-MOISTURE CONDITIONS AND PHENOMENA IN FROZEN SOILS, MECHANICS OF FROST RESEARCH, THERMAL PROPERTIES OF SOILS, SOIL TEMPERATURES AND FACTORS INFLUENCING IT, CALCULATION OF DEPTH OF FREEZING AND THAWING UNDER PAVEMENTS, STRENGTH OF PERENNIALY FROZEN SOILS, PERMAFROST AND RELATED ENGINEERING PROBLEMS, DAM CONSTRUCTION IN PERMAFROST AREAS, AND USE OF AERIAL PHOTOGRAPHS IN NORTHERN AREAS.

Highway Research Information Service July 1970

2A 237540

FROST DESIGN CRITERIA FOR PAVEMENTS

THE INCREASES IN TRAFFIC AND WHEEL LOADINGS ON AIRFIELD AND HIGHWAY PAVEMENTS IN THE PAST 10 TO 15 YEARS, THE RISING COSTS OF PAVEMENT CONSTRUCTION, MAINTENANCE, AND REPAIR, THE GREATER NEED FOR MAINTAINING PAVEMENTS IN FULLY SERVICEABLE CONDITION AT ALL TIMES, AND THE INCREASING OF OPERATING SPEEDS HAVE MADE IT NECESSARY TO CONSIDER FROST ACTION IN GREATER DETAIL IN PAVEMENT DESIGN. THIS PAPER DESCRIBES CRITERIA FORMULATED BY THE CORPS OF

ENGINEERS TO MEET THE NEEDS OF ITS CONSTRUCTION IN AREAS OF SEASONAL FROST. THE VARIATION OF SUBGRADE STRENGTH THROUGH THE SEASONS IS ILLUSTRATED, AND IT IS INDICATED THAT THE FROST-MELTING PERIOD IS CRITICAL WHEN CONDITIONS ARE CONDUCIVE TO ACTIVE FROST ACTION. METHODS FOR RECOGNITION OF CONDITIONS OF SOIL, TEMPERATURE, AND MOISTURE WHICH RESULT IN DETRIMENTAL FROST ACTION ARE DESCRIBED. BASE COMPOSITION REQUIREMENTS ARE GIVEN. LOAD DESIGN CHARTS FOR AIRFIELD AND HIGHWAY FLEXIBLE PAVEMENTS FOR VARIOUS TYPES OF LOADINGS ARE PRESENTED. LOAD- DESIGN CRITERIA FOR RIGID PAVEMENTS ARE ALSO GIVEN. THE APPLICATION OF THESE METHODS IS ILLUSTRATED BY MEANS OF DESIGN EXAMPLES. NEEDED STUDIES TO FURTHER IMPROVE THE PRESENT DESIGN CRITERIA ARE DISCUSSED. /AUTHOR/

Linell, KA *Highway Research Board Bulletin* 1953

2A 237548

PLASTIC SOIL CEMENT

RESULTS OF FREEZING AND THAWING, WETTING AND DRYING, AND SHRINKAGE TESTS, ARE SHOWN ON THE SOIL CEMENT MIXTURE USED IN ROAD CONSTRUCTION.

Nagano, R. Wada, H. Nakano, K. *Chemical Abstracts*
Semento Givutsu Nempo /Japan/ 1962

ACKNOWLEDGMENT: Portland Cement Association

2A 237550

EXPANDED POLYSTYRENE AND THE IMPROVEMENT OF ROADS (FRENCH)

TO REDUCE THE COST OF ROAD CONSTRUCTION AND AVOID USING GRAVEL TO REPLACE FROST-SUSCEPTIBLE MATERIALS SUCH AS LOAM, CLAY OR MARL, RESEARCH WORKERS AT B.A.S.F. HAVE DEVELOPED ELASTIFIED STYROPOR PLATES. THESE PLATES MADE FROM PRE-FOAMED OR ELASTIFIED STYROPOR ARE LAID ON THE SUBGRADE ON LAYERS OF STONE AND ARE COVERED FIRST WITH SAND, THEN WITH SETTS, BITUMEN OR CONCRETE SURFACING. NEW TYPES OF SURFACING WITH A HEAT-RESISTANT ACRYLIC POLYETHYLENE- BITUMEN BASE WILL NOT SOFTEN EVEN IN EXTREME HEAT. /LCPC(A)/RRL/

Modern Plastics, Paris /Fr/ May 1967

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 237555

OBSERVATIONS ON FREEZING AND THAWING OF SOIL CLEARED OF SNOW IN FINLAND IN 1958-1964

COMPUTER PROCESSING OF RESULTS OBTAINED FROM 110 FROST PENETRATION METERS LOCATED THROUGHOUT FINLAND HAS YIELDED INFORMATION ON THE FOLLOWING QUESTIONS' /1/ THE RELATIONSHIP BETWEEN FREEZING INDEX AND FROST PENETRATION, AND BETWEEN FREEZING INDEX AND THAWING, /2/ FREEZING OF THE SOIL AND THAWING IN VARIOUS PARTS OF THE COUNTRY AND FOR WINTERS AND VARYING INTENSITY, /3/ THE RELATIONSHIP BETWEEN FREEZING INDEX AND FROST PENETRATION IN DIFFERENT SOILS, AND /4/ THE LENGTH OF THE FREEZING AND THAWING PERIODS IN VARIOUS PARTS OF THE COUNTRY, WITH PARTICULAR CONSIDERATION OF PROBLEMS ENCOUNTERED IN ROAD CONSTRUCTION. /RRL/

Soveri, U. Johansson, S.
State Inst Technical Research /Finland/ 1966

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 237562

INSULATED HIGHWAY CROSSES FINNISH SWAMPS

CRUSHED ROCK AND THICK GLASS WOOL PLATES WILL CARRY A SUPERHIGHWAY ACROSS THE WEAK SOIL AND SWAMPS ALONG THE SOUTHERN COASTLINE OF FINLAND.

THE NEW ROAD WILL BE AN EXTENSION OF THE FOUR-LANE HIGHWAY LEADING SOUTH FROM HELSINKI. DETAILS OF THE SOIL CONDITIONS, FOUNDATION LAYER, AND ROAD DECK ARE GIVEN. /RRL/

Engineering Construction World /Neth/ Aug. 1967

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 237574

FROST AND FOUNDATIONS (IN GERMAN)

ROCKS, LOOSE SOIL AND VOLCANIC ASH ARE DISCUSSED AS FOUNDATION CONSTRUCTION MATERIALS AND THE EFFECT OF TEMPERATURE CHANGES, WIND AND FROST ON FOUNDATIONS AND STRUCTURES. THE ROCKS ARE CHARACTERIZED ACCORDING TO THEIR BEHAVIOUR UNDER THE ACTION OF FROST. PARTICULAR MENTION IS MADE OF THE ADVERSE EFFECT OF FROST AND THAWING ON ROAD FOUNDATIONS AND THE BEARING CAPACITY OF ROADS. FINALLY, METHODS OF TESTING THE FROST RESISTANCE OF MATERIALS AND FIGHTING FROST EFFECTS IN FOUNDATIONS ARE DESCRIBED. /FG/RRL

Klengel, J

Vebl Verlag Fur Bauwesen /Ger/ 1968

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 237586

SUCTION OF SOILS AND ROAD MATERIALS /IN FRENCH/
THE CAPILLARY RISE OF WATER IN VARIOUS TYPES OF SOIL SUBJECTED TO DIFFERENT KINDS OF TREATMENT IS ANALYZED AND CALCULATED, AND METHODS OF PREVENTING IT IN PAVEMENT LAYERS ARE PRESENTED. /LCPC/RRL/

Fenzy, E *Revue Gen Des Routes & Aerodr /France/ Mar. 1968*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 237605

ELECTRIC ANALOGUE TEST ON HEAT INSULATION COURSES IN ROADS /IN GERMAN/

ELECTRIC ANALOGUE TESTS TO CLARIFY THE THERMODYNAMIC BEHAVIOR OF ROADS HAVING HEAT INSULATION COURSES TO AVOID FROST DAMAGE ARE DESCRIBED. THE INSULATING COURSE IN THE TEST ROAD LAY DIRECTLY BENEATH THE BITUMINOUS PAVEMENT. FIRST RESULTS OF THESE TESTS SHOW THAT THE FUNCTIONAL RELATION BETWEEN THE DESIGN AND EFFECTIVENESS UNDER VARIOUS OUTSIDE CONDITIONS CAN BE DETERMINED WITHOUT DIFFICULTY IF THE TEMPERATURE AND HEAT CONDUCTION VALUES OF THE CONSTRUCTION MATERIALS AND SOILS ARE KNOWN. FURTHER WORK IS TO BE CENTERED ON THE DETERMINATION OF CONSTANT VALUES. /FG/RRL/

Behr, H *Strasse Und Autobahn /Germany/ 1969*

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

2A 237635

BARK AS FILLER-AND LIGHT FILL MATERIAL IN ROAD EMBANKMENTS /IN NORWEGIAN/

BARK WAS USED AS CONSTRUCTION MATERIAL ON A NEW MOTORWAY AT VINTERBRU NEAR OSLO. THE PROBLEM OF OBTAINING BARK IN SUFFICIENT QUANTITIES DURING THE CONSTRUCTION PERIOD IS DISCUSSED. THE EFFICIENCY OF DIFFERENT TYPES OF CONSTRUCTION MACHINERY IN HANDLING THE BARK BOTH REGARDING VOLUME CAPACITIES AND TRACTION CONDITIONS DURING THE LOADING, HAULING AND UNLOADING STAGES IS THEN MENTIONED. METHODS EMPLOYED IN PLACING AND COMPACTING THE BARK ARE DESCRIBED. IMPROVED LOAD SPREADING EFFECT IS OBTAINED BY A 20-40 CM LAYER OF BARK ON SOFT MATERIALS WITH LOW BEARING CAPACITY. FURTHER RESEARCH IS NEEDED ON THE USE OF BARK IN ROAD CONSTRUCTION, BUT EXPERIENCE INDICATES THAT IT CAN BE EASILY HANDLED

EVEN IN WET CONDITIONS DURING RAINY PERIODS BY ORDINARY CONSTRUCTION MACHINERY. /SVV/RRL/

Klem, I H Klem, G S *Teknisk Ukeblad, Oslo /Norway/ Feb. 1970*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

2A 237721

ORGANIC CATIONIC CHEMICALS AS STABILIZING AGENTS FOR IOWA LOESS

THIS PAPER PRESENTS THE RESULTS OF PRELIMINARY EVALUATION STUDIES OF A NUMBER OF ORGANIC CATIONIC CHEMICALS AS STABILIZING AGENTS FOR IOWA LOESS. THE LOESS RANGES TEXTURALLY FROM SILTY LOAM TO SILTY CLAY. AN UNCONFINED COMPRESSION TEST IS USED FOR RATING THE CHEMICALS. IN THIS TEST, THE PRINCIPAL CRITERIA OF STABILITY ARE COMPRESSIVE STRENGTH, MOISTURE ABSORPTION, AND SWELLING AFTER 24 HOURS IMMERSION IN WATER. THE EFFECTS OF THE CHEMICALS ON AIR-DRY STRENGTH AND SHRINKAGE DURING AIR DRYING ARE ALSO CONSIDERED IN EVALUATING THE BENEFITS TO STABILITY. THOUGH OF A PRELIMINARY NATURE, THE INVESTIGATION DEMONSTRATES THE SUPERIORITY OF SEVERAL OF THE NINETEEN CATIONIC CHEMICALS USED. CHEMICALS DESIGNATED BY THE TRADE NAMES ARQUAD 2HT, ARQUAD 2S, ARMEEN RESIDUE, ARMAC T, CRUDE AMINE, AND ARMEEN RESIDUE ARQUAD, ARE CONSIDERED PARTICULARLY WORTHY OF FURTHER STUDY. THESE CHEMICALS IN AMOUNTS RANGING FROM 0.08 TO LESS THAN 1.0 PERCENT BY DRY WEIGHT OF THE SOIL SUBSTANTIALLY IMPROVE THE STABILITY OF LOESS. USED IN SUCH AMOUNTS, THE COST OF THE CHEMICALS PER SQUARE YARD OF BASE COURSE SIX INCHES THICK RANGES FROM ABOUT \$0.14 TO \$1.13, WHICH IS ECONOMICALLY FEASIBLE FOR HIGHWAY CONSTRUCTION. IT IS BELIEVED THAT CONVENTIONAL HIGHWAY CONSTRUCTION EQUIPMENT AND PROCEDURES COULD BE USED FOR THE PROCESSING OF SOIL WITH ORGANIC CATIONIC CHEMICALS. THE MOST PRACTICAL METHOD OF APPLYING THE CHEMICALS TO THE SOIL IS AS SOLUTIONS OR DISPERSIONS IN WATER, AND A SOLUTION OR DISPERSION WOULD BE ADDED TO THE SOIL IN THE AMOUNT NECESSARY FOR COMPACTION TO NEAR STANDARD PROCTOR DENSITY. IN THE CONCENTRATIONS USED, THE VISCOSITY OF THE SOLUTION OR DISPERSION IS LOW ENOUGH TO PERMIT SPRAYING. FIELD EXPERIMENTATION WILL BE NECESSARY TO EVALUATE MORE FULLY THE EFFECTIVENESS OF THE CHEMICALS. /AUTHOR/

Hoover, JM Davidson, DT *Highway Research Board Bulletin 1956*

2A 237738

DIGITAL SOLUTION OF MODIFIED BERGEREN EQUATION TO CALCULATE DEPTHS OF FREEZE OR THAW IN MULTILAYERED SYSTEMS

A METHOD IS PRESENTED FOR A DIGITAL COMPUTER SOLUTION USING THE FORTRAN LANGUAGE, OF THE MODIFIED BERGEREN EQUATION FOR COMPUTING DEPTHS OF FROST AND THAW PENETRATION IN NON-HOMOGENEOUS (MULTILAYERED) SOIL SYSTEMS. A PROGRAM SOURCE LISTING, SAMPLE SOLUTIONS, AND TABLES OF THERMAL PROPERTIES SOILS AND CONSTRUCTION MATERIALS ARE PRESENTED. /AUTHOR/

Aitken, GW Berg, RL *Crrrel Special Reports, Army Dept /US/ Oct. 1968*

2A 237776

PROBLEMS OF FROZEN SOIL MECHANICS IN ENGINEERING PRACTICE

MORE THAN A QUARTER OF THE WORLD'S LAND AND ABOUT 47 PERCENT OF THE USSR TERRITORY ARE COVERED BY PERMANENTLY FROZEN SOILS. THE DEFORMATIONS OF STRUCTURES BUILT ON PERMANENTLY FROZEN SOILS ARE DUE TO THEIR SETTLING AT UNPROPORTIONAL THAWING AND THE HEAVING OF SOILS AND FOUNDATIONS AT FREEZING. THE MOST IMPORTANT PARAMETERS OF FROZEN SOILS

ARE: (1) SHEARING STRENGTH, AS THE INITIAL VALUE FOR LIMIT LOAD AND DEFORMATION MODULUS OF FROZEN SOILS DETERMINATION, WHEN THEY ARE CONSIDERED AS FOUNDATIONS, (2) CONTINUOUS STRENGTH AND DEFORMATION MODULI OF FROZEN SOILS, AS CONSTRUCTIONS MATERIALS, AND (3) HEAVING FORCES, CONGELATION STRENGTH, SOLIDITY COEFFICIENTS OF FROZEN SOILS AS A MEDIUM FOR CONSTRUCTION. FIGURES PRESENT THE RESULTS OF EXPERIMENTAL INVESTIGATIONS OF FROZEN SOIL MECHANICS: (1) THE PRINCIPLE OF DYNAMIC BALANCE OF WATER AND ICE IN FROZEN SOILS, (2) THE CONDITIONS OF WATER MIGRATION IN FREEZING AND FROZEN SOILS, (3) DEPENDENCE OF FROZEN SOIL STRENGTHS ON THEIR COMPOSITION, TEMPERATURE AND STRUCTURE, (4) DECREASE OF FROZEN SOIL STRENGTH TO EXTERNAL FORCES WITH TIME DUE TO THE RELAXATION OF STRESSES, (5) THE CONDITIONS OF FROZEN SOIL DENSIFICATION AND THE BEGINNING OF PLASTIC FLOW, (6) THE DEPENDENCE OF FROZEN SOILS SETTLEMENTS AT THAWING ON THE VALUE OF EXTERNAL PRESSURE, AND (7) THE BREAKING OF STRUCTURAL BONDS IN FREEZING-THAWING CYCLES. SOME GENERAL SOLUTIONS ARE PRESENTED OF ENGINEERING PROBLEMS CONCERNING THE MECHANICS OF FROZEN SOILS INCLUDING THE CALCULATIONS OF FOUNDATIONS WITH PRESERVATION OF PERMAFROST ACCORDING TO THE CONSTRUCTIVE METHOD, TAKING INTO ACCOUNT THE THAWING SETTLEMENTS, AND BY THE METHOD OF PRECONSTRUCTION THAWING.

Tsytovich, NA *Highway Research Board Special Reports* 1960

2A 237790

SHRINKAGE AND SWELL PROPERTIES OF LIME-SOIL MIXTURES

THE ENGINEERING PROPERTIES OF FINE-GRAINED SOILS CAN BE IMPROVED BY THE ADDITION OF SMALL AMOUNTS OF LIME. PLASTICITY IS REDUCED, WORKABILITY IMPROVED, SHRINKAGE DECREASED, AND WITH REACTIVE SOILS SUBSTANTIAL STRENGTH INCREASES ARE OBTAINED. IN A REACTIVE SOIL, THE STRENGTH INCREASE IS DUE TO A POZZOLANIC REACTION WHEREBY LIME REACTS WITH THE SOIL SILICA AND/OR ALUMINA TO FORM VARIOUS CEMENTING AGENTS. THE SOILS WHICH DEVELOP SUBSTANTIAL STRENGTH INCREASES ARE NORMALLY TERMED 'LIME REACTIVE'. SOME OF THE STABILIZED MATERIALS USED IN HIGHWAY CONSTRUCTION ARE ADVERSELY AFFECTED BY VOLUME CHANGES WHICH RESULT FROM MOISTURE INDUCED SHRINKAGE AND SWELL. ALTERNATE CYCLES OF SHRINKAGE AND SWELL CAN CAUSE CRACKS WHICH WILL REDUCE THE STRUCTURAL INTEGRITY AND LOAD CARRYING CAPACITY OF A STABILIZED SOIL LAYER. THE PURPOSE OF THIS STUDY WAS TO EVALUATE THE SHRINKAGE AND SWELL PROPERTIES OF COMPACTED LIME-SOIL MIXTURES AND TO DETERMINE IF THESE PROPERTIES WOULD RESTRICT THE APPLICATION OF THESE MATERIALS FOR HIGHWAY CONSTRUCTION. /AUTHOR/

Dempsey, BJ Thompson, MR *Ill Univ Hwy Res Lab Civil Eng Studies, Clearinghouse Fed Sci & Tech Info* 1969

PB 183 906, 1P64206422

2A 237864

CONTROLLING THE EFFECTS OF FROST ACTION IN MICHIGAN

EARLY EFFORTS OF FROST-ACTION CONTROL IN MICHIGAN CONSISTED OF EXCAVATING SILT WHERE IT OCCURRED IN THE SUBGRADE WITHIN FROST RANGE. THE EFFECT OF FROST ACTION ON HIGHWAY PAVEMENTS IS CONTROLLED BY SELECTING CONSTRUCTION MATERIALS LEAST AFFECTED BY FREEZING AND THAWING. THE AMOUNT AND QUALITY OF CLAY BINDER TO USE IN STABILIZED GRAVEL AND THE CHARACTER OF AGGREGATES TO BE USED IN BITUMINOUS AND PORTLAND-CEMENT CONCRETES ARE STUDIED CAREFULLY IN AN ATTEMPT TO KEEP THE DESTRUCTIVE EFFECT OF FROST ACTION TO A MINIMUM. SOIL

MATERIALS CAPABLE OF CAUSING FROST HEAVING OF SUFFICIENT MAGNITUDE TO BE DESTRUCTIVE OF PAVEMENTS AND DANGEROUS TO TRAFFIC ARE REMOVED FROM THE HIGHWAY SUBGRADE. FROST-HEAVE EXCAVATIONS ARE BACKFILLED WITH SOIL MATERIALS SIMILAR TO THE MATERIAL SURROUNDING THE FROST HEAVE POCKET. DRAINAGE IS CAREFULLY WATCHED BECAUSE POOR DRAINAGE MAY ALSO BE THE CAUSE OF FROST HEAVING. SPRING BREAKUP IS MOST COMMONLY EXPERIENCED ON FLEXIBLE LAND-ACCESS ROADS. AN ADEQUATE GRANULAR SUBBASE IS THE MOST EFFECTIVE MEANS FOR CONTROLLING SPRING BREAKUP.

Stokstad, OL *Highway Research Board Special Reports* 1952

2A 237919

GROUND FREEZING, CENTURY-OLD, GETS SPACE-AGE APPLICATIONS

THE PROCESS OF GROUND FREEZING IS BEING APPLIED IN STABILIZING SOILS IN CONSTRUCTION SITES FROM THE ALASKAN PERMAFROST TO THE SUMMER BAKED VALLEY OF PHOENIX, ARIZONA. THE REFRIGERATION RIGS WHICH MAKE ALL THIS POSSIBLE RANGE FROM A MULTITON BEHEMOTH ON WHEELS TO A SPECIALLY DESIGNED PLANT THAT FITS SNUGLY INTO A CARGO AIRLINER AND CAN THEN BE TRANSPORTED TO ITS FINAL DESTINATION BY HELICOPTER. UNSTABLE GROUND IS FROZEN WITH A SERIES OF BRINE-BEARING DUAL PIPES INSERTED AT NECESSARY INTERVALS. THE BRINE IS GENERALLY CIRCULATED THROUGH THE SYSTEM AT -8 TO 10 DEGREES. VARIOUS APPLICATIONS ARE REPORTED, INCLUDING FREEZING THE GROUND ON EITHER SIDE OF THE CUT FOR INTERSTATE 94'S TUNNEL IN MINNEAPOLIS.

Norland, J

Air Conditioning, Heating & Refrig News Sept. 1970

2A 237951

THERMAL CONDUCTIVITY OF SOME HIGHWAY CONSTRUCTION MATERIALS. PART I. THE ROLE OF THE THERMAL CONDUCTIVITY IN THE FROST PROBLEM /IN NORWEGIAN/

HAVING ILLUSTRATED A SIMPLIFIED METHOD FOR COMPUTING THE FROST PENETRATION IN A HOMOGENOUS MATERIAL (STEFAN'S EQUATION), WATZINGER'S EQUATION IS USED FOR COMPUTING THE FROST RESISTANCE OF A COMBINED LAYERED SYSTEM. BY MEANS OF THIS EQUATION THE EFFECT ON FROST PROTECTION BY VARIATION IN MOISTURE CONTENT IN DIFFERENT COMBINATIONS OF MATERIALS HAS BEEN INVESTIGATED, FURTHER MORE A DISCUSSION OF THE POSSIBILITY OF FINDING COMBINATIONS OF MATERIALS WITH NEXT TO CONSTANT FROST RESISTANCE AT FLUCTUATING MOISTURE CONTENTS IS GIVEN. THE SIGNIFICANCE OF THE DIFFERENT FACTORS ARE DISCUSSED AND IT IS POINTED OUT THAT THE MAIN FACTOR CONCERNING THE PROPERTIES OF A MATERIAL AS A FROST RESISTING LAYER IS DEPENDENT MOSTLY ON THE HEAT CONDUCTIVITY OF THE MATERIAL AND ON ITS VARIATION WITH WATER CONTENTS. THE SIGNIFICANCE OF A BETTER KNOWLEDGE OF THE AMOUNT OF HEAT SUPPLIED BY THE SUBSOIL IS STRESSED. /PRA/

Johansen, O

Royal Norwegian Council Sci & Indus Res, Public Roads Administration /Norway/

2A 237980

FROST INVESTIGATIONS AT DOW FIELD, BANGOR, ME.

AN INVESTIGATION WAS MADE TO DETERMINE THE EFFECT OF FROST ACTION IN SUBGRADE SOIL BENEATH THREE PAVED AREAS UPON THE LOAD SUPPORTING CAPACITY OF THE PAVEMENTS. THREE DIFFERENT PAVEMENT CONSTRUCTIONS WERE TESTED AS TO: (1) PAVEMENT BASE, AND SUBGRADE CONDITIONS; (2) PAVEMENT HEAVING AND ICE LENS FORMATION IN THE SUBGRADE; (3) PERFORMANCE UNDER

WHEEL LOADS OF FROM 10,000 TO 40,000 LB; (4) FIELD CBR TESTS ON SUBGRADE SOILS AND FIELD BEARING TESTS. THE INVESTIGATION INDICATES THE NECESSITY FOR CONSIDERING THE EFFECTS OF FROST ACTION IN SUBGRADES UPON THE PLANE SUPPORTING CAPACITY OF PAVEMENTS. /AUTHOR/

Shannon, WL *Highway Research Board Proceedings* 1944

2A 237988

SILICIC CHEMISTRY IN HIGHWAY RESEARCH

THE COLLOID CHEMISTRY OF SILICON, OR SILICIC CHEMISTRY, IS THE CHEMISTRY OF SILICEOUS MATTER CHARACTERIZED BY A PREPONDERANCE OF SURFACE OVER TOTAL VOLUME. THIS RESULTS IN STRUCTURES CHARACTERIZED BY AN UNBALANCED DISTRIBUTION OF ELECTRIC CHARGES, WHICH EXPLAINS THEIR REACTIVITY AS COMPARED TO THAT EXHIBITED BY THE SAME CHEMICAL COMPOUND IF PRESENT IN A COARSER STATE OF SUBDIVISION THAN THAT WHICH HAS BEEN TERMED THE COLLOIDAL RANGE OF DIMENSIONS. THE COLLOID CHEMISTRY OF SILICEOUS MATTER IS APPLIED TO HIGHWAY CONSTRUCTION AND SOIL STABILIZATION. COLLOID CHEMISTRY IS EQUALLY APPLICABLE TO ORGANIC COLLOIDS. /AUTHOR/

Hauser, EA *Highway Research Board Proceedings* 1947

2A 237990

PRESENT ATTEMPTS AT SOLVING THE PROBLEM OF FROST IN ROAD CONSTRUCTION

THE MECHANISM OF ICE FORMATION IN SOIL AND THE DAMAGE OCCURRING DURING THE THAWING PROCESS ARE EXPLAINED. THE VARIOUS FROST CRITERIA ARE CRITICALLY DISCUSSED, AND HYDROLOGICAL VIEWPOINTS INTRODUCED. IN COMBINATION WITH THE HEIGHT OF CAPILLARY RISE, THE DETERMINATION OF WHICH CAN BE REPLACED BY PERMEABILITY MEASUREMENT, IT IS POSSIBLE TO REPLACE THE CONCEPT OF "FROST-RESISTANT MATERIAL" BY THE "FROST-RESISTANT STATE" CONCEPT OF A STRUCTURE, TAKING ACCOUNT OF ENVIRONMENTAL INFLUENCES. IT IS PROPOSED THAT IN FUTURE MORE ATTENTION SHOULD BE PAID TO THE THERMAL PROPERTIES OF THE LAYERS, AND THAT ROADBASES (OR HEAT INSULATING COURSES) SHOULD BE BUILT WHICH, APART FROM ADEQUATE BEARING CAPACITY, HAVE A LOW HEAT CONDUCTION COEFFICIENT. VARIOUS RELEVANT PROPOSALS (PLASTIC MATERIAL, BITUMEN-COATING, LIGHTWEIGHT AGGREGATE) ARE COMPARED FOR THEIR SUITABILITY FOR CONSTRUCTION. /AUTHOR/

Gragger, F *Strassen Und Tiefbau /Germany/* 1970

2A 238066

HIGHWAY CONSTRUCTION ON SOILS OF THE TYPE

"MASSAPE" /IN PORTUGUESE/

SPECIFIC METHODS OF PAVING IN THE RECONCAVO BAHIANO ARE DISCUSSED WITH REGARD TO THE SOIL PROPERTIES THERE. SPECIFIC STUDIES OF SOILS AND ECONOMIC SOLUTIONS FOR THE PAVEMENTS ARE PRESENTED. /RRI/

Monteiro, R

Fed Dist Hwy Dpt, Salvador /Braz/

ACKNOWLEDGMENT: Road Research Institute /Brazil/

2A 238155

OCCURRENCE AND TESTING FOR DELETERIOUS SALTS IN ROAD CONSTRUCTION MATERIALS WITH PARTICULAR REFERENCE TO CALCRETES

THE TYPES OF SOLUBLE SALTS PRESENT IN ROAD CONSTRUCTION MATERIALS ARE REVIEWED AND IT IS CONCLUDED THAT SODIUM CHLORIDE, SODIUM SULFATE, SODIUM CARBONATE, MAGNESIUM SULFATE, AND CALCIUM SULFATE ARE LIKELY TO BE THE DELETERIOUS SALTS MOST COMMONLY ENCOUNTERED. SIMPLE CONDUCTIVITY METHODS

ARE SUGGESTED FOR THE ROUTINE CHECKING OF SOILS, CRUSHED ROCKS, AND WATERS FOR USE IN ROAD CONSTRUCTION IN ARID AND SEMI-ARID AREAS.

Netterberg, F

Nat Inst Road Research /S Africa/ May 1970, 8 pp, 3 Fig, 3 Tab, 27 Ref

2A 238250

OCCURRENCE AND TESTING FOR DELETERIOUS SALTS IN ROAD CONSTRUCTION MATERIALS WITH PARTICULAR REFERENCE TO CALCRETES

THE TYPES OF SOLUBLE SALTS PRESENT IN ROAD CONSTRUCTION MATERIALS ARE REVIEWED AND IT IS CONCLUDED THAT SODIUM CHLORIDE, SODIUM SULPHATE, SODIUM CARBONATE, MAGNESIUM SULPHATE AND CALCIUM SULPHATE ARE LIKELY TO BE THE DELETERIOUS SALTS MOST COMMONLY ENCOUNTERED. SIMPLE CONDUCTIVITY METHODS ARE SUGGESTED FOR THE ROUTINE CHECKING OF SOILS, CRUSHED ROCKS AND WATERS USED IN ROAD CONSTRUCTION IN ARID AND SEMI-ARID AREAS. /TRRL/

Netterberg, F *Conf Paper* 1971, pp 87-92, 3 Fig, 5 Tab, 27 Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

2A 238256

DEEP PLOUGHING

LAYERS OF LENSES OF FROST SUSCEPTIBLE CLAY/SILT ARE OFTEN FOUND IN ALLUVIAL (NON-FROST SUSCEPTIBLE) SAND DEPOSITS. AS THE LENSES OCCUR FREQUENTLY IN SMALL SIZES, IT IS NOT POSSIBLE TO LOCATE THEM DURING SOIL SURVEYS. PAVEMENT DESIGN SHOULD BE BASED ON THE PROPERTIES OF THE SAND (DESIGN THICKNESS APPROXIMATELY 0.5 M), NOT OF THE SILT (DESIGN THICKNESS APPROXIMATELY 1.0 M). DURING CONSTRUCTION VISIBLE LUMPS OF SILT/CLAY IN THE FORMATION LEVEL IN CUTS ARE REMOVED DOWN TO HALF A METER BELOW THE FORMATION LEVEL, AND SAND IN DEPTH IS BROUGHT IN. THE REMAINDER OF THE FORMATION LEVEL IS THEN PLOUGHED IN DEPTH IN HALF A METER THICKNESS, WHICH ENABLES THE LOCATION AND REMOVAL OF FROST SUSCEPTIBLE MATERIALS. THE PRICE OF PLOUGHING IS LOW (APPROXIMATELY 0.30 KR./M³). THE SAVINGS IN COSTS COMPARED TO THE COST OF DESIGNING THE PAVEMENT FOR INFERIOR-QUALITY FROST SUSCEPTIBLE MATERIALS ARE HIGH (100,000 KR. ON THE KILOMETER OF MOTORWAY, WHERE THE PRINCIPLE WAS INTRODUCED). THE TECHNIQUE OF DEEP PLOUGHING MAY BE USED TO BREAK UP STRATA UNDER THE FORMATION LEVEL, MAKING THE SUBSOIL MORE HOMOGENEOUS, THUS REDUCING THE NECESSARY THICKNESS OF THE PAVEMENT.

Christiansen, G *Dansk Vejtidskrift /Denmark/* Vol. 49 No. 9, 1972, pp 181-4, 2 Fig, 3 Phot

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/IRRD 205 108, 2C64305108

2A 238348

ANTITRUST LAWS AND HIGHWAY CONTRACTS

ANTITRUST LAWS ARE REVIEWED WHICH RELATE TO HIGHWAY CONSTRUCTION. BIDS RECEIVED FOR HIGHWAY CONSTRUCTION COMMODITIES SHOULD BE REVIEWED TO DETERMINE IF UNUSUAL SIMILARITIES APPEAR OR IF THERE IS INDICATION OF ALLOCATION OF TERRITORY OR FAILURE TO BID IN CERTAIN AREAS. RECORDS SUBMITTED BY PRIME CONTRACTORS FOR UPCHARGE OF MATERIAL SHOULD BE EXAMINED TO SEE WHETHER ANY UNUSUAL CIRCUMSTANCES APPEAR. INVESTIGATIONS BY HIGHWAY ATTORNEYS MUST BE CONDUCTED WHERE INDICATED AND IN THE ENFORCEMENT OF ANTITRUST LAWS, AS WELL AS OTHERS PERTAINING TO THE HIGHWAY PROGRAM.

Hyder, RL

Highway Research Board 11 pp, Apr. 1964

2A 242120

ESTIMATE OF COST: GRAVITY VACUUM TRANSIT TUBES, RAILS, SUPPORTS

THE REPORT DOCUMENTS PROJECTED CONSTRUCTION COSTS FOR MAJOR GUIDEWAY COMPONENTS OF A PROPOSED GRAVITY VACUUM TRANSIT (GVT) SYSTEM. SEVERAL DIFFICULTIES WERE ENCOUNTERED IN MAKING SUCH COST ESTIMATES, PARTICULARLY IN THAT THE ANTICIPATED HIGH SPEED OF INDIVIDUAL GVT TRAINS AND THE PNEUMATIC REQUIREMENTS NECESSARY FOR THEIR OPERATION REQUIRE THAT TUBES AND ATTACHED RAILS BE FABRICATED AND INSTALLED TO AN UNPRECEDENTED DEGREE OF PRECISION. FOR THIS REASON, THE COST PROJECTIONS MAY FLUCTUATE IN REALITY ACCORDING TO: (1) THE NEED TO FABRICATE SPECIAL STEELS FOR CONSTRUCTION, AND (2) THE ABILITY FOR BUILDERS TO RELAX CERTAIN SPECIFIED TOLERANCES DUE TO FUTURE IMPROVEMENTS IN GVT DESIGN. SUBSEQUENT ESTIMATES PRESENTED IN THE REPORT ARE PREDICATED ON THE ASSUMPTION THAT FABRICATION AND DEVELOPMENT PROBLEMS ARE ELIMINATED. THE REPORT OUTLINES THE ACCOUNTANTS' COST ESTIMATES FOR TWO PROPOSED GVT SYSTEMS, IN NEW YORK AND SAN FRANCISCO. ALL ASPECTS OF CONSTRUCTION COSTS ARE CONSIDERED, INCLUDING CONSTRUCTION METHODS, LABOR, PERMANENT MATERIALS, PLANT AND EQUIPMENT, EQUIPMENT OPERATION, JOB MATERIALS AND SUPPLIES, ETC. SEPARATE ACCOUNTINGS ARE PROVIDED WHERE CHOICES AMONG METHODS OR MATERIALS EXIST. THE FINAL CONCLUSION LISTS TOTAL COSTS FOR THE NEW YORK GVT PROPOSAL AT APPROXIMATELY \$3,941,000 PER MILE AND \$3,508,000 PER MILE FOR SAN FRANCISCO. A COMPREHENSIVE ESTIMATE OF ANNUAL MAINTENANCE COSTS IS ALSO INCLUDED. /UMTA/

Jacobs Associates July 1970

ACKNOWLEDGMENT: UMTA

2A 242763

ENVIRONMENTAL QUALITY ASSURANCE THROUGH DEMONSTRATION HPROJECTS

FOUR DEMONSTRATION PROJECTS, PART OF THE FEDERAL-AIR HIGHWAY PROGRAM TO IMPROVE THE ENVIRONMENT, ARE DESCRIBED. THE FIRST PROJECT DEMONSTRATES THE USE OF THE SERRATED SOFT-ROCK CUT SLOPE TECHNIQUE OF DESIGN AND CONSTRUCTION; THE SECOND SHOWS THE PRACTICABILITY OF SALVAGING AND CONVERTING WOODY GRADED AREAS; THE THIRD IS DIRECTED AT IMPROVING THE APPEARANCE AND SAFETY OF HIGHWAYS THAT ARE IMPAIRED BY BADLY ERODED DITCHES, AND THE FOURTH ILLUSTRATES THE PRACTICAL USE AND ECONOMIC FEASIBILITY OF WASTE-PRODUCTS AS ROAD BUILDING AND MAINTENANCE MATERIALS. /TRRL/

Darby, LM *Public Roads, Us Fed Highway Admin* Vol. 37 N Sept. 1972, pp 57-60, 1 Fig, 12 Phot

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

2A 242992

AUSTRALIAN-NEW ZEALAND BIBLIOGRAPHY ON ROADS AND ROAD TRAFFIC (1957-65)

APPROXIMATELY 2,000 REFERENCES ARE PRESENTED IN THIS BIBLIOGRAPHY OF AUSTRALIAN AND NEW ZEALAND PUBLICATIONS ON ROADS AND ROAD TRAFFIC. AUTHOR AND SUBJECT INDEXES ARE PRESENTED. SUBJECT AREAS COVERED ARE: ACCIDENTS AND ROAD SAFETY, ADMINISTRATION, BITUMINOUS CONSTRUCTION, BRIDGES, CONCRETE CONSTRUCTION, DRIVER CHARACTERISTICS, EARTHWORK, GEOMETRIC HIGHWAY DESIGN, MATERIALS, TRAFFIC RESEARCH, PAVEMENT DESIGN, STRUCTURAL DESIGN, HIGHWAY MAINTENANCE, SOIL STABILIZATION, TRAFFIC CONTROL, TRAFFIC FLOW, AND TRANSPORT VEHICLES.

Mathieson, J

Australian Road Research Board Nov. 1969

2A 242993

AUSTRALIAN-NEW ZEALAND BIBLIOGRAPHY ON ROADS AND ROAD TRAFFIC (1966-67)

APPROXIMATELY 1,640 REFERENCES ARE PRESENTED FROM AUSTRALIA AND NEW ZEALAND ON: ACCIDENTS AND ROAD SAFETY, ADMINISTRATION, BITUMINOUS CONSTRUCTION, BRIDGES, CONCRETE CONSTRUCTION, DRIVER CHARACTERISTICS, EARTHWORK, GEOMETRIC HIGHWAY DESIGN, MATERIALS, TRAFFIC RESEARCH, PAVEMENT DESIGN, STRUCTURAL DESIGN, HIGHWAY MAINTENANCE, SOIL STABILIZATION, TRAFFIC CONTROL, TRAFFIC FLOW, AND TRANSPORT VEHICLES. AN AUTHOR INDEX IS PRESENTED.

Mathieson, J

Australian Road Research Board 172 pp, Nov. 1969

2A 243058

THE LOWRY HILL TUNNEL FREEZE WALL

THE PROBLEM OF EXCAVATING IN FINE SAND, WITHIN 25 FEET OF CHURCH FOOTINGS, WAS SOLVED BY GROUND-FREEZING, RATHER THAN BY USING SHEET PILING OR UNDERPINNINGS. METHODS AND PROBLEMS OF APPLICATION ARE DISCUSSED. COST IS ESTIMATED AT \$10,000 LESS THAN UNDERPINNING.

Osterby, NR *Highway Research Record, Hwy Res Board* 1971

2A 260034

THE SOIL-CULVERT-TEMPERATURE SYSTEM UPON FREEZING

The freeze-thaw problem is discussed which occurs at or near culverts installed in highway earthworks. In an attempt to elucidate the thermal conditions in connection with soil freezing, thawing and soil anti-frost insulation around culvert walls, attention is drawn to the thermal system soil-culvert-temperature. This thermal system explains the heat and moisture migration in soil under the influence of freezing thermal gradients, and may indicate savings in the amount and construction of earthworks by consideration of: (1) the thickness of the unfrozen overburden soil between the crest of the culvert as related to the frost penetration depth below the surface of the pavement; and (2) the repairs on road surfaces brought about by culvert settlements upon thawing of soil around culverts. Theoretically, insulation may be installed around the inside of the culvert walls. However, in such cases, the culvert insulation should have sufficient thermal and strength properties to prevent its being abraded and quickly worn out by sediment carrying drainage waters flowing through the culvert. Under these conditions, the insulation will fail prematurely. Anti-frost insulation, must therefore, be installed around the outside walls of a culvert.

Symposium on Frost Action on Roads, Paris (1973).

Jumikis, AR (Rutgers University, New Brunswick)

Organization for Economic Cooperation and Devel Vol. 1 Oct. 1973, pp 235-248, 2 Fig., 9 Ref.

2A 260094

FIELD MEASUREMENT OF PERMEABILITY USING AUGER HOLES

The technical and commercial aspects of site investigation are reviewed and the results of a survey of this subject are discussed. Two approaches to improving the state of site investigations are identified (1) modification of the codes and contracts and possibly even alteration of the present structure of the design/construct system; (2) improvement (via general education), of the working of the present system. A combination of both processes will be necessary to effect improvement. Competitive bidding is seen to be at the root of many of the present ills of site investigation. A strong case is seen for selective tendering. The question of culpability is discussed as well as the contractors safeguard to cover all likely risks. The economics involved in site investigation are discussed and three ways in which the work maybe organized are outlined. The analysis of site investigation costs related to various construction projects have shown that it is a key factor in efficient design and construction. For the most complex operations site investigations represented 1.0-1.5 percent of the total cost while for residential development the figure was 0.03-0.13 percent. Comments are made on the site investigation activities of firms in Britain. Failing a restructuring of the industry, action is urged to improve the standards of the investigation, standardization of terminology or classifications, and the dissemination of information. The

possibility is discussed of the establishment of a data bank for soil survey information. Area data banks or at least geological and hydrological maps would prove most helpful.

Neely, WJ (Frankipile (South Africa) Pty Limited) *Ground Engineering* Vol. 7 No. 1, Jan. 1974, pp 38-42, 3 Fig., 1 Tab., 11 Ref.

2A 260270

THE IMPACT OF THE ENERGY CRISIS ON HIGHWAY CONSTRUCTION CONTRACTS

The energy crisis has created shortages of highway construction materials. This in turn creates difficulties in bidding on contracts and problems in long range contracts because of the uncertainty of prices. This article reviews the actions taken by the Federal Highway Administration in allocating fuel for highway construction. It also discusses the shortages of asphalt and what is being done about it. AASHTO suggestions for combating shortages of materials and fuels are given. The problem of price escalation and the interrelation with materials and contracts are also reviewed.

This report is from the WASHO Conference held in Portland, Oregon From June 2-6, 1974.

Peebles, FB (Federal Highway Administration)

Western Assn State Hwy Officials Ann Meet (53rd) Proceeding June 1974, 15 pp, 4 App.

2A 260275

ENERGY RESOURCES SHORTAGE-HIGHWAYS

The number of construction projects in Colorado has dropped from March of 1972 (147) and March of 1973 (124) to March of 1974 (115). While it is conceded that other factors are at work, energy shortages, real or potential, have definitely limited the number, value and type of projects that Colorado is willing to obligate. Costs have increased due: (1) higher administrative and supervisory expenses; (2) scheduling (when is the best time to award grants?) uncertainties; (3) more travel time; (4) higher equipment rental rates. The quality of the projects may suffer due to: (1) supervising personnel seeking jobs in more stable fields of employment; (2) substitution of materials and designs. To supplement benefits achieved through material substitutions, Colorado is considering various changes in construction requirements. Under advisement are: 1) Designation as mandatory, material pits that will effect fuel saving. 2) Thicker lifts in embankment construction as long as density specifications are met. 3) Most economical balance of surface course and emulsified asphalt treated base thicknesses. 4) Use of dryer-drum mixers; and for standard asphalt plants, temperature-viscosity relationships to establish the lowest permissible mixing temperatures. In the area of transportation planning emphasis is being placed on: preferential treatment for high occupancy vehicles, car pooling, and the National Transportation Energy Conservation Action Plan. The effect of the energy crisis on truck travel, air quality and travel demand are being analyzed. Traffic counting methods are being employed extensively. The reduction in the availability of asphaltic materials has given rise to investigation of the following problems: (1) elimination of the use of rapid curing "cut-back" liquid asphalt; (2) partial elimination of and substitution for medium curing "cut-back" liquid asphalt; (3) improving the penetrating quality of emulsified asphalt for use as a prime coat; (4) substituting other stabilizing agents for emulsified stabilized base. The rapidly improving cost position of rigid vs. flexible pavement is being closely watched. Bridge design personnel are investigating construction methods and design procedures that could reduce fuel consumption and materials usage. Maintenance changes revolve around reduced consumption of energy: 1) More efficient planning in use of equipment and personnel. 2) Mowing is being restricted. 3) Reduction of some interchange lighting has been accomplished. 4) Rejuvenation of old asphalt mats is being actively considered.

This report is from the WASHO Conference held in Portland, Oregon from June 2-6, 1974.

Haase, EN (Colorado Department of Highways)

Western Association of State Highway & Transp Off Proceeding June 1974, 14 pp

2A 260445

MEMBRANE ENCAPSULATED SOIL LAYERS (MFSL) FOR ROAD CONSTRUCTION IN COLD REGIONS

The possible use is examined of membranes to encapsulate frost susceptible soils, compacted at water contents below optimum, to inhibit frost action by maintaining the water content at a low level. Laboratory test data are

presented to show the effects of soil type and compaction conditions on the potential field performance of such encapsulated soils. The three soils tested in the laboratory are: a moderately plastic clay from Ellsworth, S.D.; a sandy silt; from Hannover, N.H.; and lean clay from Elmendorf, Alaska. Soils similar to those tested will also be utilized in field trials subjected to freezing and thawing. The results of the unfrozen water content determinations, and freezing tests on the Ellsworth clay are described and discussed. The Ellsworth clay seems ideally suited to use in membrane encapsulated soil layers (MESL) in a frost area. The behavior of Hannover silt in a brief test program was very different. CBR values for unsoaked samples of Hannover silt decrease much more rapidly with increasing water content on the wet side of optimum than values for Ellsworth clay. On the dry side of optimum, the CBR of the silt is essentially constant. Freezing tests, post thaw strength and possible chemical treatment are also considered. Investigations indicate Elmendorf clay is less plastic ($PI=18$) and of more uniform particle size than the Ellsworth clay ($PI=25$). Freezing point depression tests suggest that a significant percentage of the soil water may remain unfrozen at temperatures only a few degrees below zero deg. C. Freezing tests, lime treatment and placement requirements related to Elmendorf clay are also considered.

This paper was presented during the Symposium on Frost Action on Roads held in Oslo, Norway, 1-3 October, 1973.

Quinn, WF Carbee, D Johnson, TC (Cold Regions Research and Engineering Laboratory)

Organization for Economic Cooperation and Devel Conf Paper 1973, pp 417-438, 12 Fig., Tabs., Refs.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 214595)

2A 260457

DURABILITY AND FROST RESISTANCE OF LIME AND CEMENT STABILIZED SOILS

The various aspects of freeze-thaw durability are considered and basic concepts of a recently developed durability evaluation system are presented. Adequate strength must be achieved in the cured stabilized material prior to the first winter of service. Both cyclic freeze-thaw and heaving types of deterioration may need to be considered, depending on field conditions. If it is assumed that acceptable quality stabilizing additives (lime and cement) are used and adequate quality control is being achieved in mixture preparation and construction, then mixture design becomes a key process. In many mixture design analyses, it has been found that durability considerations control and establishment of stabilizer content levels and/or limit the utilization of the stabilized material relative to its location (base-subbase-modified subgrade) in the pavement system. Freeze-thaw durability testing and evaluation consists of 4 broad areas. (1) Characterizing the field environment: This would involve development of a model that accurately simulates the temperature regime in a pavement system. An idealized freeze-thaw cycle is proposed (and illustrated) for describing the time-temperature history of a particular point in a pavement. (2) Realistic Simulation of field conditions: A laboratory simulation is outlined which utilizes an automatic programmed freeze-thaw unit which provides independently programmed top and bottom temperature control for a series of cylindrical specimens and a water table provided at the bottom of the specimens if desired. (3) Based on a comprehensive consideration of various evaluation procedures and a large quantity of cyclic freeze-thaw data, it was concluded that the compressive strength of a stabilized material after various numbers of freeze-thaw cycles is the best procedure for evaluating freeze-thaw durability. (4) Establishment of durability criteria: A discussion of the development of durability criteria based on the residual strength concept gives consideration to the key factors of minimum tolerable strength cured strength, residual strength and strength time profile.

This paper was presented during the Symposium on Frost Action on Roads held in Oslo, Norway, 1-3 October, 1973.

Thompson, MR (Illinois University, Urbana)

Organization for Economic Cooperation and Devel Conf Paper 1973, pp 377-393, 8 Fig., 1 Tab., 12 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 214598)

2A 260465

USING SHOTCRETE TO SUPPORT UNDERGROUND STRUCTURES

A conference was conducted to discuss the making, testing, and using of shotcrete for underground support. With regard to the making of shotcrete, quality control was considered essential. It was believed that average 28-day compressive strengths in the range of 3,000-4,000 psi (20.6-27.5 million N/sq m) were more realistic than the presently specified 5,000 psi (34.4 million N/sq m) compressive strength at 28 days. Opinion on the maximum size of coarse aggregate to be used in a shotcrete mix favored at least 1/2-inch (13 mm) maximum size. The importance of compatibility tests of the cement and accelerator to be used was emphasized. Though remotely controlled nozzles and wet mix shotcrete equipment has had wider use in Europe, there was considerable interest shown in the use of skilled nozzlemen as employed in the U.S. Cube, core, probe, impact, and pull-out tests were discussed, and it was concluded that such tests need further development. In discussions of where to use shotcrete, it appeared that shotcrete offered economies in nominally unlined water tunnels built by the drill and blast method, where it could serve the dual function of support and final lining. It also appeared to offer economies where a drill and blast tunnel had a persistent need for support and coverage of the rock to prevent deterioration due to moisture change or stress relief. Though it is not believed to be presently compatible with the tunneling machine, an example was presented where a tunneling machine had been designed to accommodate the use of a specific shotcrete system.

Morris, JW (Bureau of Reclamation) *ASCE Civil Engineering* Vol. 43 No. 9, Sept. 1973, p 17

2A 260484

DRAINAGE IS THE FIRST ROAD ESSENTIAL: MAYBE MCADAM WAS RIGHT, AFTER ALL

Excess water that enters structural sections (primarily from rain water and other surface infiltrations) is causing serious pavement damage, greatly shortening pavement life and increasing the annual costs of a great many important pavements. Tests indicate damages during periods of free water present in the structural sections were 100 to 200 times greater than when no free water was present. Research on inflow into surface cracks in PCC pavement revealed that 70 to 95 percent of surface precipitation of 2in/hour entered into cracks with widths of 0.35 to 0.125 in. All joints and cracks have been observed to be filled to overflowing within a half-hour or less after rain started. The detrimental action that takes place when "flooding" occurs is outlined. Unless high-permeability drainage layers are installed under the full widths of the traveled ways of important pavements, the water that enters often remains on the subgrade or within the layers of the structural section for weeks and even months after it stops raining. Experience is recounted which contrasts with the belief that any aggregate material with not more than 2 percent (or even 5 percent) of minus 200 fines will provide ample drainage for most roadbeds. The suitability of various classes of aggregate materials for seepage control is discussed. Even crude estimates with roughly approximated values for permeabilities, when used with good judgement and experience, can aid in eliminating serious errors in selecting types of materials for various kinds of jobs. Tell-tale signs which indicate the very slow rates of drainage provided by the normal pavement are described. Designing and building pavements as rapidly draining systems (using fundamental engineering principles such as Darcy's law) can greatly extend their useful life and can save billions of dollars in total costs.

Cedergren, HR *Rural and Urban Roads* Vol. 11 No. 5, May 1973, 4 pp, 2 Fig.

2A 260537

A DESIGN PROGRAM FOR THE ESTIMATION AND ABATEMENT OF SOIL LOSSES FROM HIGHWAY SLOPES

A computerized design program is described which estimates the soil loss from a highway slope or median strip. The program which was intended for use in new construction and scheduled erosion control maintenance of existing projects, is designed for the IBM model 370. Input into the program consists of a basic description of the slope (location, soil erodibility, slope length and gradient) and duration of construction. The output consists of an estimated annual soil loss and a peak loss assuming a 10-year storm event over the construction period. The preventive measures required to control this peak soil loss from getting into streams are in terms of the number of straw barriers needed per 100 feet of roadway. An equivalency table is also

output for alternate siltation controls and procedures in terms of straw barriers. The use is discussed of the Universal Soil Loss Equation (and modification of it) for estimation of soil loss from highway construction. A mathematical description of the method of calculation, the data input format and program listing are included in appendices.

Poche, DJ

Virginia Highway Research Council VHRC 73-R51, May 1974, 22 pp, 2 Fig., 6 Ref., 3 App.

2A 260632

MODERN CONCEPTS FOR DENSITY CONTROL PHASE III: EMBANKMENT MATERIALS

From 1967 through 1972 density data were obtained on embankment materials that were being constructed on several Minnesota trunk highways. Data were collected and analyzed from randomly selected locations on five embankment projects. A statistical analysis was also performed on historical data results from five embankment projects selected at random from office files. Variation was determined from these data by computing the mean and standard deviation to reveal existing variability in acceptable construction of embankment materials. The results were used to evaluate present specifications and to prepare a new acceptance sampling plan. The plan is based on statistical concepts that will define the degree of acceptable variation upon which decisions can be made with an established degree of confidence. Proposed statistical specifications are presented. /FHWA/

Minnesota Department of Highways Final Rpt. 1973, 51 pp

ACKNOWLEDGMENT: Federal Highway Administration (P-0048)

PURCHASE FROM: NTIS Repr. PC, Microfiche

PB-231552/AS

2A 260911

BOTTOM ASH AND BOILER SLAG

This paper presents the results of laboratory studies conducted at West Virginia University to determine the physical, chemical, and engineering properties of bottom ash and boiler slag. The identification tests consisted of a determination of (1) the shape and surface texture of the particle with the use of photomicrographs, (2) grain size distribution, and (3) specific gravity, as well as (4) a complete chemical analysis of each bottom ash. Tests to evaluate the bottom ash as an aggregate and construction material included (1) sulfate soundness, (2) Los Angeles abrasion, (3) relative density, (4) standard Proctor compaction, (5) constant head permeability, (6) one-dimensional compression, and (7) shear strength. The various test values and properties are compared to the properties of representative granular soils or to appropriate specifications. Also included in the paper is a review of experience accumulated during the past 3 years on the utilization of bottom ash and boiler slag in actual construction in West Virginia and the surrounding States. It is concluded from the data presented that the properties of most bottom ashes and boiler slags compare favorably with those of conventional natural aggregates, and that these materials can be successfully utilized in one form or another in the construction industry.

Proceedings: Third International Ash Utilization Symposium. Sponsored by National Coal Association, Edison Electric Institute, American Public Power Association, National Ash Association, and Bureau of Mines, Pittsburgh, Pa., March 13-14, 1973.

Moulton, LK (West Virginia University)

Bureau of Mines Proceeding No. 8640, Mar. 1973, pp 148-169, 4 Fig., 12 Tab., 10 Ref.

2A 260914

MARKETING POWERPLANT AGGREGATES AS A ROAD BASE MATERIAL

This paper identifies the variety of ash forms, their many applications, and availability. Marketing information from 8 years of experience is given concerning quality, transportation, economics, and the importance of generating confidence through research and testing. Results from West Virginia Department of Highways projects on Route 2 construction, secondary road improvement, backfilling slide areas, and grouting bridge approach slabs along Interstate 79 are presented as representative proof that PPA is a valuable addition to the Myriad of construction materials being utilized in building and maintaining our highways. /Author/

Proceedings: Third International Ash Utilization Symposium. Sponsored by National Coal Association, Edison Electric Institute, American Public Power Association, National Ash Association, and Bureau of Mines,

Pittsburgh, Pa., March 13-14, 1973.

Blocker, WV (Highway Materials); Morrison, RE (American Electric Power Service Corporation); Morton, WE (Highway Materials); Babcock, AW (Monongahela Power Company)

Bureau of Mines Proceeding No. 8640, Mar. 1973, pp 208-223, 8 Fig., 8 Ref.

2A 260962

RESULTS OF THE 1973 QUESTIONNAIRE ON HIGHWAY APPLICATIONS OF NUCLEAR TECHNIQUES

The responses are summarized of 50 state agencies and Canadian Provinces and cities to questionnaires related to the development and use of nuclear gauges on highways. Thirty nine states are using nuclear systems for specification control of the moisture and density of soils and aggregates. Nuclear systems for specification control of the density of bituminous concrete are used in twenty nine states, and systems for non-specification uniformity checks are used in an additional 10 states. Fifteen states measure asphalt content by nuclear systems. Data concerning the distribution of 1,473 portable surface M/D Systems are tabulated. A tabular comparison is presented of the nuclear questionnaire results over a period of 11 years. In Canada, five provinces utilize nuclear systems for specifications control of the moisture and density of soils and aggregates and 3 provinces use them for specification control of bituminous concrete. The results of the Canadian survey are tabulated.

Highway Research Circular No. 159, July 1974, 5 pp, 1 fig., 2 Tab

PURCHASE FROM: TRB

2A 260980

CONSTRUCTION COSTS REDUCED BY PAVEMENT REJUVENATION AND OVERLAYS

A method (which is seen as a means of stretching available funds in this time of economic crisis) is described of restoring badly cracked pavements through a process of heater scarification followed by an asphaltic concrete finishing course application. The surface of the existing crack-up and usually dried-out pavements will be heated and scarified to a depth of approximately 0.75 inch, the scarified material will be rejuvenated and recompacted followed by the placement of an asphaltic concrete finishing course. Pavements of this type of rehabilitation have been in service for 2 or 3 years and the performance is judged exceptionally good. The procedure is outlined, and the characteristics of the heater unit used in the operation are discussed. The required depth of heat must be accomplished before any scarification is attempted, for once the surface is scarified, the fluffed up material acts as an insulator opposing any subsequent heat that might be applied. It is not effective to have a heater scarification combination followed by a second such unit. With proper balance of heater units to pavement conditions, with the flame shielded and/or positioned other than directly upon the pavement surface, the heating phase can be accomplished effectively and without emission control problems. Specifications require that in addition to scarifying the pavement to a depth of approximately 0.75 inch, the system should be designed that a tumbling action of the scarified material is effected. This will break and cause some mixing of the material. The leveling device is discussed. It has been found effective to accomplish the compaction while the material is still hot and before the rejuvenating agent is applied. Pneumatic tired rollers are used and the specification is made that the rolling shall be completed within one hour from scarification. The asphaltic concrete finishing course is described and the results of a cost study are discussed.

This report was presented at the 53rd Annual Conference of WASHO, held in Portland, Oregon from June 2-6, 1974.

Allen, GJ Howard, RL

Arizona Highway Department No. 491, 1974, pp 52-59, 5 Fig., 14 Ref.

2A 260983

FUEL USAGE FACTORS FOR HIGHWAY CONSTRUCTION

Data are summarized that were obtained from more than 400 highway contractors in response to action by a task force seeking to formulate fuel usage factors which would enable computation of fuel requirements for highway construction jobs. The figures presented here are intended as guides in making job estimates. The fuel factors represent gallons of fuel required per unit of construction. Fuel requirements are presented for the three excavation items (earth, rock and other), and include the total of both diesel and gasoline. The on-site aggregate production fuel usage factors must be

used only when the contractor contemplates erecting a plant to produce aggregates for a particular project. The usage factors for aggregate base include fuel for hauling, spreading, compacting and finishing the base. The factor for asphalt concrete production includes all requirements to produce a ton of Z asphalt concrete, including the material handling at the plant site, drying and heating of aggregates, heated asphalt storage and generating power for all plant machinery. The factors for both asphalt concrete hauling and placement represent the total fuel requirement for the item. If both gasoline and diesel haul units are used, appropriate adjustments should be made. Usage factors are also presented for production, hauling and placement of portland cement concrete. Fuel usage factors and fuel requirements for structures and miscellaneous construction are also outlined.

This report was presented at the WASHO Conference held in

Highway Research Circular No. 158, July 1974, 7 pp

PURCHASE FROM: TRB Repr. PC

2A 260986

TIMBER CRIB INSTRUMENTATION STUDY

This report describes the instrumentation of a timber crib retaining wall constructed in Mt. Hood National Forest, Oregon, during the late summer of 1973. The instrumentation program, experimental in nature, was limited to instrumentation of one crib near the middle of the wall. Nine pressure transducers were placed at various locations in this crib, 26 strain gages were affixed to stretchers and headers, and one Slope Meter tube was positioned on the face of the wall. From these instruments, cribfill pressures, member strains, and lateral movement of the crib were measured. The pressures measured in the cribfill were compared with theoretical pressures obtained by means of the Janssen and Airy bin pressure equations. In all cases the measured pressures were found to be greater than the pressures predicted by theory. Recommendations are made that instrumentation be installed in selected future retaining structures. /DOT/

Schuster, RL Sack, RL Jones, WV
Idaho University, Moscow June 1974, 60 pp

PURCHASE FROM: NTIS Repr. PC, Microfiche

PB-234250

2A 261480

PROPOSED REVISION OF ACI 311-64: RECOMMENDED PRACTICE FOR CONCRETE INSPECTION

This recommended practice sets forth standards and procedures relating to concrete construction which will serve as a guide to owners, architects, and engineers in planning their inspection program. The need for adequate inspection as a requirement for high quality, attractive appearing concrete at the least cost is emphasized.

Reported by ACI Committee 311.

American Concrete Institute, Journal of Vol. 71 No. 7, July 1974, pp 347-352, 2 App.

2A 261674

ALTERNATES FOR ASPHALT CEMENT

The use of asphalt cement is re-assessed in the light of the current energy crisis and economic situation. There are no currently available cements that can compete in cost with asphalt even at the present price of asphalt, and there is no outlook for a competitive cement in the foreseeable future. The next most economical cementing material for pavement is portland cement. Portland cement is 28 percent higher than asphalt based on the amounts of each required to produce a given amount of pavement. Cement is in limited supply and it is estimated that the cement industry would be hard pressed to provide additional cement equivalent to as much as 4 percent of the 1973 supply of asphalt. Tar could provide pavements equivalent to about 5 percent of the volume provided by asphalt in 1973 at a cost of binder of about 2.5 to 3.0 times that of asphalt. The fumes from tar paving will bother plant and laydown personnel. Sulfur can be emulsified in asphalt and the resulting binder used with conventional aggregates and equipment. If mixes made with sulfur-asphalt emulsions prove durable and if hydrogen sulfide gas is not a safety hazard, sulfur offers a means of extending the supply of asphalt. Currently there is no surplus sulfur, but a surplus may develop in the future which could be used to extend the asphalt supply. Total production, quantities used in pavements, and relative price data are

provided for asphalt, portland and tar. The relative quantities of cements required to produce equal volumes of pavement are tabulated. An extensive research program by the Federal Highway Administration on alternate paving material including binders is outlined. In an open letter, the National Asphalt Pavement Association described the institution of an energy conservation program designed to conserve fuel oil, asphalts and other components of the energy barrel, without reduction in quality of the final product. It also affirms its commitment to the use of full-depth hot-mix asphalt for new paving construction.

Foster, CR
National Asphalt Pavement Association June 1974, 4 pp, 9 Ref.

2A 261675
THE POTENTIAL FOR USING HIGH TYPE EMULSION-AGGREGATE MIXTURES FOR BASE AND SURFACE COURSES

The need is stressed for the design and construction of high type pavements with asphalt emulsion aggregate mixes in this current period of shortages (particularly of petroleum fuel). Problems that must be overcome in the successful utilization of such mixes are set forth. These relate to the need for standardization of the more than 35 grades and types of asphalt emulsions, the need to use only emulsions without the lighter distillates and only very little if any, of the oil distillates, the need for leaner than normal hot mixes and its attendant problems, the addition of cement or lime at the cold feed to increase stability, the supply of chemicals, the base stock, and the lack of experience in the procedures. Recommendations are presented related to the need for a high quality aggregate, a larger maximum size aggregate, the need for aggregate that is evenly graded from coarse to fine, but on the coarse, somewhat open-graded side of the maximum density curve, the need for laboratory tests, and other factors related to aggregate, mix and design.

For presentation at Annual WASHO Meeting, Portland, Oregon, June 3-6, 1974.

Bohman, RA (Federal Highway Administration)
Western Association of State Highway & Transp Off Conf Paper June 1974, 17 pp, 3 Fig., 9 Ref.

2A 261677
CONSERVATION OF PETROLEUM PRODUCTS IN HIGHWAY CONSTRUCTION

Suggestions are presented here related to petroleum conservation which have been gathered through correspondence with members of this association and publications of the Asphalt Institute and the Associated General Contractors. The avoidance is urged of over design (in the number of traffic lanes, lane widths etc.) as well as the reduction of stop and go traffic and fluctuating speeds (through the construction of overpasses, interchanges, special turn lanes etc.). The use of borrow and waste sites will shorten haul length, and the use of multiple trailers with a single tractor on off-highway haul roads will reduce the number of trips. The use of native soils upgraded through the use of lime, portland cement and other additives, can reduce the excavation quantities and crushing required of mineral aggregates, and so reduce hauling and fuel requirements. Increasing the maximum size of aggregates, reducing fracture requirements and modification of compaction specifications are fuel saving measures. The use of petroleum products for the burning of debris must be prohibited and new clearing must be avoided where possible. Early attention to permanent erosion control measures will reduce repair work of slopes and ditches. The use of portland cement concrete instead of asphalt concrete, elimination of prime coats under asphalt concrete pavement, and the use of emulsions in lieu of cutback asphalt are further suggestions for conserving petroleum products. Reduction of the mixing temperature of bituminous mixtures, reduction of the average moisture content of the aggregate, the use of dryer-drum or turbulent mass type mixing plants for asphalt concrete, reduction of stack temperatures, improved combustion, reduction of the volume of air used in drying aggregates, and the elimination of diesel sprayed in track beds, would all contribute to saving fuel. Project scheduling which would take advantage of warmer weather, and provision of additional coverings (where cold weather operations are unavoidable) will reduce the fuel requirements. Other measures suggested here include the reduction of the number of lifts and allowing thicker lifts (as long as compaction requirements are met) in projects where full depth or thick bituminous bases and pavement are required, improved communication systems, cost reduction incentive programs, alternate designs and the development of improved specifications.

Suggestions are also included regarding cast-in-place structure, temporary stage work on higher type detours, car pooling, tire pressures and vehicle operation speeds.

Presented at the 1974 Meeting of the Western Association of State Highway and Transportation officials, Portland, Oregon, June 2-7, 1974.

Shumway, PE (Alaska Department of Highways)
Western Association of State Highway & Transp Off Conf Paper June 1974, 7 pp, 4 Ref., 1 App.

2A 261768
GROUND FREEZING TECHNIQUES AT SALERNO

The article describes the construction of the Santa Lucia Tunnel, under Salerno, and considers the use of soil freezing in one tunnel section in detail. A geological section of ground under Salerno is shown; four types of strata present are volcanic, alluvial deposits, and dolomite (tectonic and non-tectonic in origin). Tunnelling difficulties caused by water are discussed. Water and soil cave-ins from the face were stopped by injection. A hydrological study was prepared. Preference of soil freezing over other techniques is discussed. Low temperature brine circulating in freeze pipes causes water in the voids to freeze, giving sealing and stabilization of the soil. The arrangement of freeze pipes is shown. Frost penetration and mechanical properties of frozen soil are considered. The freeze wall conditions of design and their practical realisation are given. The construction method of calottes with a preliminary lining of steel beams and reinforced gunnite was adopted. Relevant construction data are listed. No settlement of structures on the surface occurred where soil freezing was applied, and the method was cheaper and safer than the chemical injection method. /TRRL/

Braun, B Macchi, A *Tunnels and Tunnelling* Vol. 6 No. 2, Apr. 1974, pp 81-89, 4 Fig.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 209603)

2A 261895
DESIGN AND DIMENSIONS OF STANDARDISED BITUMINOUS PAVEMENTS IN THE FEDERAL REPUBLIC OF GERMANY; DATA, REQUIREMENTS, PERFORMANCE, DEVELOPMENTS

The paper presents a survey of current practice in using standardised bituminous road constructions in West Germany. Data, requirements and wearing qualities of bituminous mixtures and road constructions are laid down in Technical Standards and Guidelines. They permit a large number of different base constructions using hot mixed bituminous material. Methods for classifying traffic and for determining the type and thickness of construction needed for each class are discussed, as are the standardised thickness for surface and base courses. The layer equivalencies of different base materials are discussed. The five standard construction types using bituminous mixtures are presented together with the requirements concerning subsoil, subgrade and frost protection course for standardised pavements. The paper further discusses the bearing capacity of road base and surfacing and examines the relation between construction, live-load and road serviceability. Research work carried out on test sections of standardised pavements is reported as well as theoretical considerations. Suggestions are made for amending and improving some of the standards. /Author/

Presented at the Third International Conference on the Structural Design of Asphalt Pavements, Grosvenor House, Park Lane, London, England, Sept. 11-15, 1972.

Vogt, H Von Becker, P (Federal Transport Ministry, Germany)
International Conf Struct Design Asph Pvmnts (3rd) Proceeding Vol. 1 Sept. 1972, pp 1102-16, 7 Fig., 28 Ref.

2A 262077
LIME STABILIZATION OF FROST-SUSCEPTIBLE SOILS

Depending on (1) nature and composition of the soil, (2) curing (time-temperature), (3) lime type, (4) lime percentage, and (5) density of compacted mixture, lime-treated soils display a wide range of engineering properties. Extensive studies have shown that all fine-grained soils react with lime to effect beneficial changes in workability, plasticity and swell properties. The extent to which the lime-soil pozzolanic reaction proceeds is influenced primarily by natural soil properties. The difference between the compressive strengths of the natural and lime-treated soil is an indication of the extent to which the lime-soil pozzolanic reaction has proceeded. Substantial strength increase indicates that the soil is reactive with lime and can

probably be stabilized to produce a quality paving material (base or subbase). The validity of using initial unconfined compressive strength (0-cycles) as a measure of freeze-thaw resistance was demonstrated in extensive studies. Recent studies of different types of cementitious stabilized materials (lime-soil, soil-cement, lime-flyash) have confirmed that initial mixture compressive strength can be used to predict the cyclic freeze-thaw resistance of a stabilized soil. Factors influencing strength development, influence cyclic freeze-thaw resistance in the same fashion. Studies show that cured lime-soil mixtures with good freeze-thaw resistance can be developed when reactive soils are stabilized with quality lime. The strength required to prevent excessive heaving of cured lime-soil mixtures, approximately 200 psi, compares favorably with the strength required to restrict the heave of cement stabilized materials. Adequate mixture design, construction, and quality control procedures must be utilized to insure the successful utilization of lime stabilized soils in pavement construction.

Thompson, MR (Illinois University, Champaign) *Frost J*ord No. 10, July 1973, pp 45-52, 6 Fig., 4 Tab., 10 Ref.

2A 262154

TEST SECTIONS TO CHECK VALUE OF STABILIZED ROADS

The first phase is reported in the testing of sections of surface treated gravel roads. The test sections are 1,000 ft long and have been prepared and treated according to specifications of the material supplier. Load bearing tests were conducted before and after construction. Three methods of road construction were employed: surface application of dust palliatives intended for only relatively short term improvement; additives mixed into the top 4 in of an existing roadbed as an interim measure; additive application to a depth of 6 to 8 in. for creation of a high type base course. Although material applications varied according to desires of the manufacturer, the general construction procedure was the same for all materials. The test sections were first scarified by the grader. A partial addition of water was made to facilitate mixing and the additive was placed on the roadbed. The treated roadbed was mixed in place by a soil stabilizer. Water was added to bring the mix to optimum water content final pulverizing and mixing was done after moisture was controlled. The roadway was then compacted with pneumatic and steel-wheel rollers, and the final shaping was then accomplished with the grader and a final rolling was made. Dust palliatives were put down with spray-bar equipment at material suppliers recommended dosages. The number and types of test sections as well as the quantities of various materials used are tabulated.

Better Roads Vol. 143 No. 11, Nov. 1973, pp 30-1, 1 Tab., 4 Phot.

2A 262163

REINFORCED EARTH-DESIGN AND CONSTRUCTION

Reinforced earth, which may be used in high quality construction with substantially reduced costs over competitive alternates, is a designed structure whereby a soil is internally reinforced with metal strips so as to form a friction transfer mechanism between soil and reinforcement. This frictional transfer allows the soil-strip mass to exhibit tensile strength under exterior imposed loadings. The basic design of a reinforced earth structure consists of the following considerations: earth reinforcements, foundation stability and settlement, and internal and external drainage. Principally the fill used within the reinforced earth mass is confined (top and bottom) by a layered system of reinforcing strips. Any lateral strain that takes place is that which is taken by the reinforcement, providing that the frictional force that is mobilized between the strips and the soil is sufficiently large. Hence there is the need for soil exhibiting essentially frictional characteristics. Details are given of the design and construction of reinforced earth structures. An example is given of a wall configuration to be designed for level backfill loading. Shearing stresses due to earth pressure behind the wall must be considered in the design. The most difficult element in the otherwise simple construction of reinforced earth structures, is foundation preparation where excavations are required to provide adequate resistance to sliding on talus slopes or landslide areas. Case histories are described which illustrate these points. Other applications of reinforced earth are presently under study. Reinforced earth structures are categorized in 4 categories: temporary (dry), temporary (submerged), permanent (dry) and permanent (submerged). Submerged structures involve special design and construction procedures.

This paper is part of the proceedings of the Ohio River Valley Soils Seminar held in Lexington, Kentucky, October 5, 1973.

Gedney, DS Walkinshaw, JL (Federal Highway Administration) *Kentucky Soil Mechanics and Foundations Group Proceeding* Oct. 1973, 9 pp, 10 Fig.

2A 262219

ANCHORED INCLINED WALLS—A STUDY OF BEHAVIOR

This paper attempts, in a semi-quantitative manner, to show the differences in behavior between vertical and inclined walls supported by rows of prestressed anchors and also to indicate factors which must be considered both during design and construction. The case of a dry, medium-dense, normally consolidated sand is considered with the sand surface horizontal. Small scale laboratory tests are described and details are given of the apparatus. A rigid-sided flume 0.91 m by 1.83 m in plan at the top and 0.91 m by 10. m at the base and 0.71 m high, holds the soil and the 0.6 m high duralumin test wall, which was suspended near to the center of the flume. One of the objectives of the tests was to examine a number of different design assumptions. Earth pressure, anchor load, wall movements, sand subsidence, wall base shear and normal reaction, photographic study, and the mechanics of wall behavior are described. Conclusions based on the study are detailed. The design of an inclined wall supported by rows of prestressed anchors should incorporate a rectangular earth pressure envelope. As the excavation in front of the retaining wall was deepened, the wall and the retained soil moved. Generally, for positively inclined walls the largest lateral movements were at the top of the wall while with negatively inclined walls the largest movements were at the base of the wall. The sand subsidence behind the wall was the largest adjacent to the wall, the magnitude depending on the wall lateral movements. As construction progressed the individual anchor load values changed. Since the mechanics of inclined wall behavior are similar to those of the vertical wall and are controlled by the interaction between the wall and the anchor supports, the forces which act on the wall member must be appreciated. The semiquantitative tests using the two dimensional pin model apparatus demonstrate the mechanics of soil, wall and anchor interaction.

Hanna, TH Ding, AO (Sheffield University, England) *Ground Engineering* Vol. 6 No. 6, Nov. 1973, pp 24-33, 15 Fig., 3 Tab., 18 Ref.

2A 262223

THE BEHAVIOR OF GROUPED INCLINED ANCHORS IN SAND

The research is described which provided evidence contributing towards the decision to change the end-result specification to a method specification in the British Ministry of Transport's Specification for Road and Bridge works. Site investigations carried out are outlined. The standard deviations of the test results and the numbers of tests which would have been required to achieve given levels of accuracy in the determination of mean air content of the compacted fill are tabulated. It was concluded that high rates of testing were required for adequate control of compaction of earthworks using an end result specification. Two basic types of nuclear apparatus are described which have been developed for determining the bulk density of surface layers. They are, the back-scatter and direct transmission types. Work, however, has showed that there is little increase in rate of testing by nuclear means and it does not justify the high cost of the equipment. Method specification is discussed in which the compactive effort used to formulate the specification is that which would achieve a state of compaction of 10 percent air voids at a moisture content slightly lower than the average for each type of soil. Examination of methods of earthmoving (which did not rely upon a high bearing capacity in the soil and which were compatible with vertical-force excavation) and the possible use of overhead ropeways and light railways, indicated that belt conveyors showed the most promise of being economically competitive with conventional methods of earthmoving. The most suitable method of achieving vertical-force excavation to provide material for transportation by belt conveyor was to employ bucket-wheel excavators. Details are given of a feasibility study of the possible use of belt conveyors in road construction and a full-scale trial which followed.

Larnach, WJ (Bristol University, England) *Ground Engineering* Vol. 6 No. 6, Nov. 1973, pp 34-41, 11 Fig., 1 Tab., 3 Ref.

2A 262224

ARTESIAN PRESSURE CHALLENGES PILING TECHNIQUES

The construction is described, of a platform in the sea (sea is 105m to 130m deep) from which drilling and production operations (for Oil) will be carried out. Construction will take place ashore in assembly basins and when fully assembled, the basin will be flooded and the structure floated out to the

oilfield using its own buoyancy. Three sections of the work within the basin required the construction of special foundations to carry heavy imposed loads. The first was for the jacket structure (the main structure of the platform) during its construction, the second for the tracks for the two gantry cranes, and the third to support the oil beneath the floating gates for the basin which will replace the temporary bund wall on the seaward side. Four hundred piles varying in diameter from 900 mm to 1500 mm were used. The piles which were designed for both horizontal and vertical loading were founded at about 2 m into the sandstone. During boring, water was encountered in the sandy zones of the clay and artesian pressure was present in the sandstone. The highest groundwater level recorded in the site investigation was 5 m.o.d. and water spilled over the top of the casings when pile borings were made. To eliminate the risk of water piping through the unset concrete, each hole was bored and cased to rock, and the drilling was continued until the necessary rock socket was achieved and the casing was filled with water. During this process the water level within the bore was up to the top of the casing, before the artesian water condition was encountered in each case. The base of the bore was then cleared of sediment and the reinforcing cage was lowered into position. Attached to the reinforcing cage and arranged to extend from the bottom of the boring to just above ground surface, were four 'bleed' pipes which were later to serve to relieve water pressure at the pile base. Thus the flow of artesian water was channelled away through the pipes away from the concrete. The technique employed to ensure the consistent success of the method is outlined.

Ground Engineering Vol. 6 No. 6, Nov. 1973, pp 18-9, 1 Fig., 4 Phot.

2A 262275

REPORT ON THE CONSTRUCTION AND INITIAL INSPECTIONS OF A FULL-SCALE EXPERIMENT ON ROAD P43/5, ORKNEY-BOTHAVILLE, TO EVALUATE THE EFFECTIVENESS OF VARIOUS TECHNIQUES IN THE APPLICATION OF PVC/TAR SURFACE TREATMENTS

This report describes the construction of a full-scale single-hand double-surface treatment experiment in the Northern Orange Free State. The principal object of the experiment is to evaluate the performance of PVC/tars which comply with the NIRR low-volatile specification. The construction variables under study are: double-and heavy and light pneumatic and flat steel-tired rollers, and also the effect of precoating the aggregate. A number of small-scale sections were laid to determine the correlation between the performance of full-scale and small-scale sections. The results of control tests on binder and chipping applications are included as are initial binder and aggregate properties. Assessment of the condition of the surfacings after one, three and six months service are given.

Via Vol. JG14 No. 2, RB/1/73, Sept. 1973, pp 1-2

2A 262402

SOIL PARAMETERS FOR DESIGN OF MOUNT BAKER RIDGE TUNNEL IN SEATTLE, A DISCUSSION

The discussant concludes from the information provided in the paper, that use factor (ratio of traffic area to whole internal cross-sectional area) is about 0.37. This low value indicates a large volume of unproductive excavation. A cross section is suggested (and illustrated) in which the lower part of the tunnel is enclosed in a semicircle of 8.5 m radius, and the upper part is enclosed by a half ellipse having a b/a ratio of 0.75. The whole internal cross-sectional area is about 199 m² and the use factor is 0.51. There is a saving of 27 percent of the area of an 18.7 m ID circular tunnel and a cost saving of about \$1,000,000. It is sometimes feared that for tunnels of elliptical cross section the permanent lining may be subjected to high bending movements and that the cost of providing for these may outweigh savings in quantity of excavation. Modern methods of stress analysis may be used to investigate the interaction of lining and ground on a number of hypotheses about the behavior of the ground. These show that although some tension may develop at the inner face of the lining at the crown of the tunnel such effects are very local and very small.

A discussion of SOIL PARAMETERS FOR DESIGN OF MT. BAKER RIDGE TUNNEL IN SEATTLE by M.A. Sherif and R.J. Strazer, Proc Paper 9511, Jan. 1973

Howells, DA (Humphreys (Howard) and sons, England) *ASCE Journal of Soil Mechanics & Foundations Div* Vol. 99 No. SM10, Proc Paper 10038, Oct. 1973, pp 899-900, 1 Fig., 3 Ref., 1 App.

2A 262467

LIGHTER, ORTHOTROPIC DESIGN REPLACES DETERIORATED DECK

An experiment is described in which a 60-ft long section of deteriorated bridge roadway will be replaced with a steel orthotropic deck of two different designs. Test results will determine the methods and materials to be used when the entire 4,650-ft long, eight-lane upper deck is rebuilt next year. In an effort to compare costs, the experiment will involve both open and closed-rib designs. While closed ribs provide better torsional stiffness in the transverse direction, open ribs are more economical by about 10 percent, because they require less fabrication and welding. Open ribs require thicker steel plates for extra thickness. When the 6.5-in. thick orthotropic deck sections are bolted to the floor-beams through the existing rivet holes, workmen in another test will weld the plates longitudinally in some areas and bolt them in other areas.

Engineering News-Record Vol. 192 No. 19, May 1974, p 18, 1 Fig., 1 Phot.

2A 262578

COMPACTION-AN ESSENTIAL INGREDIENT FOR GOOD BASE PERFORMANCE

In this paper, the subject of compaction is briefly reviewed and a "state-of-the-art" of compaction control for unbound graded aggregate materials used in pavement construction is given. Factors influencing compaction of granular materials are discussed and technical data that demonstrate the effect of compaction on specific properties of graded aggregate mixtures are presented. Further, "in-service" compaction of granular base materials by traffic is reviewed and the resulting "densities" are compared with densities that are achievable with modern-day compaction equipment. The inadequacy of many current state highway department compaction requirements of unbound granular materials is discussed. Finally, appropriate conclusions based on sound technical data are drawn and recommendations for compaction requirements for unbound granular materials are made.

Marek, CR Jones, TR, Jr

National Crushed Stone Association Mar. 1974, 46 pp

PURCHASE FROM: National Crushed Stone Association 1415 Elliot Place, NW, Washington, D.C., 20007 Orig. PC

2A 262788

FOUNDATION FAILURE

Striking cases of foundation failure are reviewed and the causes of failure are analyzed. A structural failure is described of a post-tensioned concrete mat for a 14-story building and multiple garage basements. The only remedy in this case was to reconstitute the broken area, drill rings of vertical soil anchors into the subsoil at considerable depth below subgrade and vertically post-tension the mat. The necessary addition of the vertical loads to simulate future column loads more than neutralized any economy of the post-tensioned over a normal reinforced foundation mat. The assumption of straight line variations inherent in grid boring has resulted in many foundation failures. Serious masonry cracking in a number of two-story garden apartments were plotted and found to conform to the location of a backfilled creek. Exploration revealed the cause to be that all piles were of the same length based on borings which had missed the creek trough and were driven to the necessary resistance. A program of rock face protection is described in which about 75 percent of the rock exposure to subgrade was covered with timber battens, 5 x 10 ft in area, with a channel wall attached and two sets of three 0.5 in post-tensioned cable anchors drilled on a 15 degree slope and grouted into rock. The case of subgrade heave is discussed. Changes in pressure intensity against walls often causes failure, especially in the usual unreinforced concrete basement walls of residential buildings. Ice caused pile distortion is outlined as well as unequal settlement (a condition which structures cannot tolerate). Conditions caused by partly vacant pile filling and faulty piles are reviewed. Minor oversights which cause failures are noted.

Feld, J *ASCE Civil Engineering* Vol. 43 N June 1973, pp 89-92, 5 Phot.

2A 262990

THE BEHAVIOR OF AXIALLY LOADED SHAFTS IN SAND

This study is mainly concerned with analysis of behavior of five full-scale instrumented drilled shafts cast in soil profiles containing sand and test loaded to failure. Two shafts were cast by the dry method and three by the

slurry displacement method. From field observations and measurements taken during construction and load tests, important findings were made concerning the construction and the design of drilled shafts. With respect to construction, the slurry displacement method was found to possess a great potential for future use, but this method must be used with care, to prevent the entrapment of mud and sediments at the tip and sides of the shaft and in the concrete. With respect to design, the measured load transfer was correlated with the properties of the sand measured by dynamic penetrometers. Pressure-settlement curves were obtained for the tips of shafts in very dense sand and sand of medium density. The total side load transfer was correlated with the integral over the periphery of the shaft of the product of the effective overburden pressure times the tangent of the effective friction angle. The coefficient of correlation was found to be about 0.7 for shafts with penetrations in sand not exceeding 25 ft. There were indications that this coefficient decreases with depth and, therefore, care must be exercised when the results are extrapolated to deeper shafts. /AUTHOR/

This report was prepared for the Texas Highway Department in cooperation with the U.S. Department of Transportation, Federal Highway Administration by the Center for Highway Research, the University of Texas at Austin December 1972.

Touma, FT Reese, LC
Texas University, Austin, (176-1) Intrm Rept CFHR3-5-72-176-1, Oct. 1972, 259 pp, 79 Fig., 8 Tab., 2 Phot.

Contract 35-5-72-176

2A 263110 CEMENT STABILIZED PAVEMENTS-AN EVALUATION OF THEIR LOAD FATIGUE AND SHRINKAGE PROPERTIES

The purpose of this paper is to describe the present day thinking with regard to the design and construction of cement stabilized pavements and bases, giving emphasis to the areas in which current knowledge is deficient. The areas covered include quality requirements, basic structural properties, load deflection characteristics, fatigue properties, thickness design procedures, shrinkage and cracking. In conclusion it is pointed out that cement stabilized pavements: (1) have been proven viable by the performance of existing pavements; (2) can be rationally designed by reference to empirically derived methods for soil cement as a unique material; (3) while possessing inherent properties of shrinkage and cracking, must appropriately be designed and constructed to minimize the effects of these properties; and (4) offer an economical method for construction which will compete most favorably with traditional flexible pavements.

Proceedings of Roading Symposium, 1971, held at Victoria University of Wellington, 17-19 August, 1971.

Ralston, J (New Zealand Portland Cement Association)
National Roads Board, New Zealand Proceeding Vol. 2 1972, pp 534-541, 4 Fig., 6 Tab., 14 Ref.

2A 263174 ROAD EMBANKMENTS ON SOFT FOUNDATIONS. LAUNCESTON, TASMANIA

The provision of a new expressway at Launceston requires the construction of embankments across alluvial mud flats. This paper describes the construction and performance, to date, of three instrumented test embankments having: (a) no sub-soil drainage, (b) vertical sand drains, and (c) vertical cardboard wick drains. Installation techniques for the sub-soil drains are described and a comparison is made of the settlement and pore pressure dissipation for the three embankments. The paper concludes by showing that the effectiveness of cardboard wick and sand drains is comparable and that considerable savings can be made in time and money by the adoption of cardboard wicks where sub-soil drainage is found necessary for accelerated consolidation.

Cooper, ID Meyer, PA (Department of Public Works, Tasmania)
Australian Road Research Board Conf Proc (6th) Vol. 6 No. t4, Paper No 821, 1972, pp 88-108, 8 Fig., 15 Ref.

2A 263175 CHANGES IN THE BEHAVIOURAL AND STRUCTURAL CHARACTERICS OF A REPETITIVELY STRESSED SAND-CLAY

Under the action of repeated loading, pavement materials exhibit complex behavioral and structural changes. This paper reports an experimental examination of these changes in a sand-clay, subjected to repeated triaxial

compressive stress. A variety of techniques was employed to study the behavioral and structural changes in the soil. These included the use of mercury intrusion porosimetry which enabled alterations in the pore system to be observed. Based on the experimental observations, some of the mechanisms associated with the structural changes were the identified.

Shackel, B (New South Wales University /Australia/) *Australian Road Research Board Conf Proc (6th)* Vol. 6 No. t4, Paper No 910, 1972, pp 123-136, 9 Fig., 2 Tab., 29 Ref.

2A 263383 PETROGRAPHIC STUDIES, AREA DISTRIBUTION, AND TECHNICAL QUALITIES OF TUFAS USED AS AGGREGATES IN THE PROVINCE OF BUENOS AIRES

In this paper the geological and economic background information on tufa is analyzed, especially as regards its distribution and characteristics in the province of Buenos Aires. The frequent use of tufa as a material for highway construction is a cause of concern to geologists and engineers, who are conducting studies to define these calcareous materials on the basis of their geological and technological characteristics. The first chapter describes the tufa deposits and their distribution. A map on a scale of 1:2,000,000 is appended. The petrography of this sedimentary rock is studied in another chapter, considering the structural and textural characteristics, with accompanying microphotographs and drawings. The mineralogy and chemical composition of the tufas is discussed briefly, and to the afore-mentioned map are added the figures showing the average calcium carbonate content in the respective areas. In the chapter on technical qualities of the materials, samples are described on the basis of tests on absorption, specific gravity, "Los Angeles" abrasion, and permeability. Graphs are appended which show the ratio of calcium carbonate content to absorption, specific gravity to absorption, Los Angeles abrasion to texture, permeability to calcium carbonate content, and permeability to absorption. The conclusions reached from these studies are of a petrographic and technological nature. /Author/

Ninth Pan American Highway Congress, May 6-18, 1963.

Kilmurray, JO *Pan American Highway Congresses Proceedings* No. 142, Chapter VI, Topic 8, May 1963, pp 790-803, 4 Fig., 20 Ref.

2A 263397 SOIL MECHANICS TEST METHODS IN ROAD CONSTRUCTION

The aims and applications of the most important test methods for road construction are described. Knowledge of the particle-size distribution in soil facilitates accurate classification of all types of soil and gives information about the characteristic features of the various types. The grain-size distribution indicates the grain-size groups in a specific type of soil in percentages by weight. The particle sizes determined by sieving are designated according to the lengths of the sides of the holes of the square perforated plate sieve or by the inside mesh width of the wire sieve. The classification of coarse or fine-grained soils may be carried out by the grain distribution method. For further identification and classification of cohesive soil, additional test methods are necessary. Methods of determining the liquid limit of the soil, and the lowest moisture content at which the soil is plastic are described. The calcium carbide method of water content determination is outlined as well as the air-pycnometer method. Tests necessary in compacting soil are reviewed. Dry density tests are described as well as devices which determine the density by radioactive isotopes. "K" plate-bearing tests are also described.

Paulmann, G *Trends-German Constructional Engineering for Expo* No. 31, Mar. 1964, pp 59-64, 14 Fig., 11 Ref.

2A 263451 ASPHALT FINGERPRINTING

Under present conditions of crude oil shortages, the quantity of asphalt available for highway construction is likely to be reduced. The extent of reduction is still somewhat uncertain. Equally uncertain is the extent to which the quality of the available asphalt may be affected. Some states may be faced with the necessity of using materials from unfamiliar crude sources or even with modifying their specification. For this reason, it appears that we should take a closer look at the usefulness of the system of cataloging and identifying asphalts that was developed under a Federal Highway Administration (FHWA) Research and Development Contract in 1971. Although the system is not completely definitive, nor foolproof, when

properly employed it can provide valuable guidelines to those faced with evaluating the effects of specification changes or judging the acceptability of new materials. The final report of the research is published in Report No. FHWA-RD-72-18 and is available from the National Technical Information Service. This article reviews some of the background and findings of this work as well as the rationale for the system. It is basically an abridgement of an article "Fingerprinting of Highway Asphalts," published by the Association of Asphalt Paving Technologists (AAPT).

Halstead, WJ Ogllo, ER *Public Roads* Vol. 38 No. 2, Sept. 1974, pp 52-59, 2 Fig., 1 Tab., 20 Ref

2A 263463
IDENTIFICATION OF PROBLEM LATERITE SOILS IN HIGHWAY ENGINEERING: A REVIEW

Some laterite materials are known to be either inferior pavement aggregates or troublesome highway and earth dam construction materials. However, not all laterite soils belong to this group. A criterion for distinguishing problem laterite soils from non-problem ones for highway construction is proposed. Such a differentiation would be a considerable asset to highway engineers in determining the quality and suitability of doubtful laterite soils for highway and airfield construction. Laterite soils range in performance from excellent to poor, and in spite of considerable field and laboratory studies on these soils it is still not yet possible to predict accurately the behavior of all grades and genetic groups of laterite soils. From an engineering viewpoint, a criterion based on significant engineering characteristics, including such genetically inherent properties as sensitivity to drying and remolding, degree of potential swell and self-stabilization, and predominant clay minerals, may be more useful in predicting probable in situ behavior of laterite soils than the existing temperate-zone soil classification systems.

Gidigasu, MD (Building and Road Research Institute, Ghana) *Transportation Research Record* No. 497, 1974, pp 96-111, 3 Fig., 3 Tab., 126 Ref.

PURCHASE FROM: TRB Orig. PC

2A 263479
DESCRIPTION AND CLASSIFICATION OF FROZEN SOILS

The description and classification of frozen soils is presented as an extension of the Unified Soil Classification System adopted by the U. S. Army Corps of Engineers and the U. S. Bureau of Reclamation in 1952. Descriptions, based on physical appearance, are nongenetic and are applicable to both naturally and artificially frozen soils. Field identification data pertaining to frozen soils and those pertinent properties of frozen materials which can be measured by physical tests are indicated. Also, guides are presented for construction on soils subject to freezing and thawing. The report includes photographic illustrations of frozen soil types; a chart showing relationships between unit dry weight of soil, water content, and ice volume; and an example of graphical presentation of frozen soil data. /AUTHOR/

Conducted for Corps of Engineers, U. S. Army.

Linell, KA Kaplar, CW
Cold Regions Research and Engineering Laboratory Tech Rpt. TR-150, Aug. 1966, 15 pp, 7 Fig.

2A 263486
INVESTIGATION OF THE USE OF SOFT AGGREGATES FOR SOIL STABILIZATION IN HIGHWAYS

For development of rural areas we need roads which can stand moderate traffic, but their cost of construction should be low. In the present study, attempts are made to study the suitability of the use of soft aggregates for road purposes. Soils with varying sand contents, and soft aggregates in different percentages are used to study the strength variations. 37% of soft aggregate for soils with higher sand contents, and 44% of aggregates for soils with lower sand contents have given maximum strength. 36' long test track with various soil-aggregates mixes was also constructed for field investigation. C.B.R. triaxial and plate bearing tests were conducted to study the strength and stability of various soil aggregates mixes. It has been concluded, that soil aggregate stabilized roads are the cheapest and can be substituted for conventional type of brick paved roads. These roads can later be used as base courses for better type of pavements when more funds are available.

Thatte, PM
Roorkee University, India Mar. 1965, p 36

2A 263491
SURCHARGES MINIMIZE POST-CONSTRUCTION SETTLEMENT

The benefits of surcharges and waiting periods in highway construction are predicted by the application of the principles of soil mechanics. The use of these methods of construction minimizes the amount of detrimental settlement subsequent to paving. Time-consolidation data are used to determine the length of waiting periods. Unconfined and quick-undrained triaxial compression test results are used to determine the safe height of embankments. Berms permit construction to greater heights. Time studies and consolidated quick-undrained triaxial compression test data can be used to determine the increase in strength compatible with controlled rate of loading, but interpretation of test data and engineering judgment are significant factors. Comparison of field measurements and calculations based on test data indicate that the predictions of amount of settlement are somewhat more reliable than the predictions of the rate of settlement.

Kleiman, WF (California Division of Highways)
Engineering Geological & Soil Engineering Symp Proceeding 1966, p 10

2A 263509
SOME COMMENTS ON THE DESIGN, TESTING AND SPECIFICATION OF STABILIZED SOILS FOR HIGHWAY CONSTRUCTION

Comments on procedures for the design, testing, and specification of stabilized soils are made in the light of recent developments, and some suggestions are made for modifications in current practice. The paper is limited to consideration of cement-and lime-stabilized soils although many points also apply to bituminous stabilization. The problems of design for a pavement material whose performance is intermediate between flexible and rigid behavior are examined, and the testing of such a material for acceptance and for construction control is discussed with particular reference to mixing, curing and compaction. On this basis suggestions are made for the specification of stabilized soil pavements. /Author/

Metcalf, JR *Institution of Engineers, Journal of* Vol. 38 No. 1-2, Jan. 1966, pp 1-7, 4 Fig., 16 Ref.

2A 263680
DEVELOPMENT OF SHOTCRETE FOR METRO CONSTRUCTION IN WASHINGTON

The use of shotcrete in the Washington, D.C. Metro System is reviewed. Shotcrete in this instance is defined as coarse aggregate as opposed to the ACI definition which is broader and includes fine aggregate and non-structural uses. Six-inch shotcrete linings in fair to good rock with moderate overbreak used in conjunction with rock bolts was considered to be an economical solution. Such linings could also be used as temporary supports eliminating steel ribs, and serve as the first step in building up a permanent lining with further layers of shotcrete. This paper which outlines basic steps utilized in developing shotcrete, also outlines the experience gained in implementing the specifications. The early set of shotcrete was selected at 500 psi at 8 hours and the 28 day strength was specified to be 5000 psi. The high early and final strength values must be selected for optimum effect and a trade-off has to be made between high early strength and high final strength for durability. The two gradations are presented which were specified for the combined coarse and fine aggregates. In the accelerating admixture needed to reduce rebound, two to 3 percent by weight of cement is used. A maximum of 3 minutes for initial set and 12 minutes for final set for the cement-accelerator paste, and a paste strength of 800 psi in 8 hours are specified. Control aggregate gradation was achieved by selecting fine-coarse aggregate gradation bands which could be met with available local aggregates. In the testing of shotcrete mix in laboratory for conformity with specifications, two sizes of aggregate with maximum sizes of 0.75 and 0.5 inch were selected. Field trials by nozzlemen, quality control during production and construction testing are also discussed. Of the accelerators tested, Sigunite and Triacasol T-1 conformed to requirements. Tests were made to determine the compatibility of cements with the selected acceleration and the ability of the combinations to produce the desired early strength.

In "Use of Shotcrete for Underground Structural Support: Proceedings of the Engineering Foundation Conference, South Berwick, Maine, 16-20 July 1973".

Bawa, KS (Lorezi, Dodds and Gunnill)
American Society of Civil Engineers, American Concrete Institute Conf. Proc SP-45, 1974, pp 33-49, 6 Fig.

2A 263687

USE OF SHOTCRETE FOR TUNNELLING IN DIFFICULT GROUNDS

The use of shotcrete in Europe is discussed. Experience in the use of shotcrete in a hydroelectric plan tunnel in Italy is described. Special reinforced shotcrete was used to line the tunnel immediately after excavation. The reinforcement consisted of steel mesh ribs placed at distances varying from 0.5 to 1.20 m and completed by secondary rods and by a large steel mesh behind the steel mesh ribs. Details are outlined of this construction which, subsequent studies indicate, was completely successful. A second project is detailed which consisted of road tunnels which underpassed built-up zones and garden zones. The ground consisted of various types of argillaceous slates inserted with chalky sandstone strata, some part of which were greatly decomposed and others totally decomposed. The problems presented in this particular situation could be solved only by the shotcrete system. A section in which the shotcrete ring was the only support of the tunnel up to the completion of the excavation works (2 years later), was continuously tested by survey of bench marks installed from 5 up to 7 on a part of the steel mesh ribs. The maximum subsidences (on single bench marks) were of 0.30 mm after 272 days and of 0.416 mm after 242 days at another point. These data confirm the validity of the shotcrete method. Comparisons are made of the results of the shotcrete method with those constructed according to traditional methods. The successful use of the shotcrete method for the construction of the Milan Subway System (1967-1970) is described. Attention is drawn to certain points which are of importance for the shotcreting method. Shotcrete must be applied only where the ground characteristics require it. The widths employed must be adequate to support the ground. The steel mesh ribs and metal support must be distributed and placed in such a way that they will be integrated in a resistant, calculable complex with the shotcrete. The components of the concrete must incorporate an ideal and accurate granulation for the kind and percent of accelerators employed.

In "Use of Shotcrete for Underground Structural Support: Proceedings of the Engineering Foundation Conference, South Berwick, Maine, 16-20 July 1973".

Curzio, PQ Barazzoni, G Nobili, F Anselmi, A (Quadrio Curzio S.p.A., Italy)
American Society of Civil Engineers, American Concrete Institute Conf. Proc SP-45, 1974, pp 79-95

2A 263763

ROADWAY DESIGN IN SEASONAL FROST AREAS

The study which consisted of a literature review, a questionnaire survey of North American road design agencies, and visits to ten agencies for discussion of their practices, synthesizes current pavement design procedures in seasonal frost areas, as well as construction and maintenance practices and identifies those that are of greatest value. The primary approach for minimizing the detrimental effects of frost action in the subgrade is to deal with any frost-susceptible soils during the design and construction process. This may be effected by either removal of such soils to below the level of frost penetration and replacement with non-frost susceptible soils, or accommodation of the frost action during the structural design process by eliminating the discontinuities leading to differential heave and by strengthening the pavement structure. The methods used to acquire soils and materials data (essential for the pavement design process) are: those reliant on pre-existent data such as pedological and geological surveys; indirect assessment such as airphoto interpretation and remote sensing; and direct approaches such as geophysical surveys and direct sampling. The characterization of temperature regime in pavement structures affected by frost action includes such parameters as depth of frost penetration, number of freeze-thaw cycles, and duration of freezing and thawing periods. The sources of water contributing to freezing are separated into the categories of surface water and subsurface water. Drainage is a fundamental feature of the pavement design process. Specific locations along the route where problems are likely to occur should be identified, investigated, and corrected during construction. Selective grading is a technique for reducing frost action by placing the more frost-susceptible soils in the lower portions of the embankments and the less susceptible materials on the upper portion of the subgrade. The importance is stressed of the inspection of the subgrade, and the achievement of the highest possible density of subgrade and base courses. Other methods used to reduce frost action include soil stabilization, thermal barriers and encapsulation. Spring load restrictions which may be considered as preventive maintenance are also discussed.

An NCHRP staff digest of the essential findings from a report, "Roadway

Design in Seasonal Frost Areas," by T.C. Johnson, R.L. Berg, K.W. Carey, and C.W. Kaplar, Cold Regions Research and Engineering Laboratory, Army Corps of Engineers, Hanover, New Hampshire.

Transportation Research Board NCHRP Reports No. 64, Aug. 1974, 9 pp, 5 Fig.

2A 263784

USE OF COLOR AERIAL PHOTOGRAPHY IN ENGINEERING MATERIALS SURVEYS

The opportunity to use aerial color photographs in a comprehensive construction materials survey presented itself in Yellowstone National Park (area-3,472 sq. mi.) where a critical construction material shortage exists in certain portions of the Park. This project was undertaken by the Federal Projects Office, Region 9, U.S. Bureau of Public Roads, and was sponsored by the U.S. National Park Service. Strip aerial photographs were taken along the major highway system at a scale of 1:6,000. The aerial reversal color positive transparencies obtained were examined stereoscopically. The color transparencies at this scale proved most effective for the material survey. Special considerations in the procurement of color aerial photography are presented together with descriptions of field and office procedures. The use of aerial color photography for construction materials searches is still limited but is likely to increase due to technological improvements, reduced costs, and a general awareness by potential users of its advantages over conventional photography. Recent significant trends in aerial color films are increase in emulsion speed, a widening of exposure latitude, improvement of color reproduction, and an increase in resolution. Negative aerial color film now provides a greater variety of possible products and thus affords greater flexibility in use than reversal color film processed to a positive transparency. Areas are indicated where research on conventional color films and false color films for aerial photographic interpretation for highways is needed. /AUTHOR/

Chaves, JR (US Bureau of Public Roads)
Engineering Geology & Soils Engineering Symp 1966, p 21

2A 263786

FIELD INVESTIGATION TECHNIQUES FOR HIGHWAY DESIGN PURPOSES

It is the responsibility of the engineering geologist, soils engineer and the materials engineer to develop a thorough understanding of the terrain, climatic conditions, drainage, material availability and the land use of the region and their impact upon the project. The considerations of route location are discussed, and the desirable investigation program which could be followed in order to eliminate potential hazards in final design phases. The need for and use of various investigation techniques compatible with the natural features and the projected facility are discussed and compared to previously acceptable practices. It is concluded that standardized programs of investigation cannot be adopted and efficiently utilized to fit all terrain conditions, subsurface characteristics and projects, but the programs should be compatible with each of these, with due consideration of costs, projected maintenance and project value. /AUTHOR/

Kremer, DJ
Engineering Geology & Soils Engineering Symp Proceeding 1966, p 9

2A 263844

DETERMINATION OF COMPACTION PROPERTIES AND BEARING CAPACITY CHARACTERISTICS OF VARIOUS SOILS

In the financial year under review, the Road Foundation Department has made studies of the American report on the results of the large-scale road tests at Ottawa, Illinois, U.S.A., known under the name of the AASHO Road Test. In conjunction with these studies, the Department has carried out a relatively detailed investigation of a sample which had been taken from the homogenised layer in the subgrade during the AASHO Road Test. The Department made laboratory tests with the object of determining the road engineering properties of this material, primarily its compaction properties and bearing capacity characteristics. These tests will be described and their results will be presented in a separate report. The above-mentioned investigation formed part of a series of systematic laboratory investigations dealing with the bearing properties of various road construction materials. This series had been started earlier, and was continued in 1963-1964. /Author/

Statens Vaginstitut No. 45A, 1963, pp 14-15, 1 Tab

2A 263865

A REVIEW OF LITERATURE ON SWELLING SOILS

This report, which is based on review of selected literature available to the authors and deemed pertinent to the study of expansive clays, may be briefly summarized as follows: High volume change clays have been encountered in many parts of the world and frequently have caused severe damage to structures. Differential movement of these soils may be due to shrinkage swelling, or cyclic volume changes. Of these, swelling is the most detrimental. Swelling of soil may result from any combination of increase in the availability of water, alteration of clay so that its thirst for water is increased, and reduction of the applied load on the clay. Because of their electrical colloidal nature, clay particles have a great attraction for water. The osmotic imbibition of water by clay minerals combined with relaxation of effective stress provides the principle mechanism involved in the swelling of soils. Identification of high volume change soils can be accomplished by methods of mineralogical identification or by methods based on volume change characteristics of the soil. In a complete study of high volume change soils both types of studies should be made. For many laboratories, however, some of the specialized mineral identification methods, such as X-ray diffraction or differential thermal analysis, may prove to be too complicated and expensive, and identification may have to be based entirely on the simpler and more practical tests of volume change characteristics. The quantitative prediction of potential volume change of a clay is essential to solution of the engineering problems arising from volume change. The use of the consolidometer, which has proved the most satisfactory means of prediction of potential volume change, still needs further study. Reduction of the detrimental effects of swelling soils has been the object of numerous research studies. Probably the most satisfactory single remedial procedure in use has been the removal of the expansive soil and its replacement with stable material, but surcharge loads, prevention of ingress of water, prewetting, and chemical stabilization all have had some success in reducing detrimental swell. It is evident that investigation into all aspects of swelling soils has been extensive in many parts of the world as is indicated by the extent and diversity of published literature. It is also evident that some aspects of the swelling soil problem have been solved reasonably satisfactorily from the point of view of the engineer, some aspects are moderately understood, and some aspects will bear further research. From the point of view of the engineer, clay mineralogy, the behavior of water in a clay system, and the mechanisms leading to the swelling of a soil are basically understood. However, the interdependence of the several factors upon which a particular behavioral relationship depends is not always clear. An example of this is the disagreement noted in this review over the effects of the combination of stress history and climatic history on the subsequent swelling of a soil. In regard to identification of swelling soils for engineering purposes, the qualitative aspect appears essentially solved, utilizing classification test data as done by Seed, Woodward, and Lundgren. In research work more complex methods are applicable. The problem of quantitative prediction of swell has not been solved as successfully, but it appears that further investigation into the use of the consolidometer test will be profitable. In this regard the double oedometer test appears to hold promise. The control of swelling of expansive soils appears to be the largest problem yet to be solved satisfactorily. Control of compacted swelling soils apparently is best achieved by moisture and density management, though further work seems necessary. Numerous methods of control of swell of undisturbed soils are reported in the literature, but the efficacy of any method or group of methods in a particular instance is often speculative until attempted. This is

Colorado Division of Highways 1964, pp 1-65, 178 Ref.

2A 263941

PROCEDURE FOR ECONOMIC DEVELOPMENT OF SOIL-CEMENT MIX DESIGN

The purpose of this paper is to provide design engineers and planning agencies with a method that incorporates economic considerations in developing the mix design of a soil-cement for highway construction. Modifications of the procedure can be made for other types of projects such as airfields, dam facings, and erosion control projects. The procedure is a step-by-step method incorporating planning, field sampling, preliminary laboratory testing, cost analysis, and final testing to develop a cement factor for construction.

Duval, HH (Duval and Associates, Incorporated); Alexander, JH (Southwestern Laboratories, Incorporated) *Transportation Research Record* No. 501, 1974, pp 28-34

PURCHASE FROM: TRB Orig. PC

2A 263943

IMMEDIATE AMELIORATION OF WET COHESIVE SOILS BY QUICKLIME

Immediate amelioration of wet cohesive soils by lime, a current practice in earthwork operations for highway construction in Belgium, is performed with 1 to 1.5 percent quicklime. Such small doses are effective because they agglomerate the soil into crumbs that are stable in free water and retain their individuality after kneading and compaction. Procedures for evaluating the crumb stability have been developed. Additions of 1 percent quicklime produce not only the immediate amelioration effects but long-term strength gains as well. Strontium and barium hydroxides produce the same immediate effects as equivalent amounts of lime but far lower long-term strength gains. Lime percentage has far less incidence on immediate amelioration than on long-term strength gains.

Van Ganse, RF (Centre de Recherches Routiere, Belgium); Glenn, GR (Rutgers University, New Brunswick) *Transportation Research Record* No. 501, 1974, pp 42-53, 2 Fig., 5 Tab., 26 Ref.

PURCHASE FROM: TRB Orig. PC

2A 263974

THE VARIATION OF SOIL TEST RESULT IN RELATION TO ROAD FOUNDATION DESIGN

A STATISTICAL analysis of the soil test results of several road projects has revealed that a large reduction in the number of subgrade samples tested appears to be warranted. On the other hand, greater attention in the control of quality of materials used in the subbase and basecourse of roads in South Africa seems necessary. A simple concept is introduced for the rejection or acceptance of materials on a section of road based on the sample mean and the coefficient of variation. The use of soil engineering maps should lead to a more balanced approach to road foundation design. /AUTHOR/

Proceedings of the Diamond Jubilee Convention, South African Institution of Civil Engineers, Johannesburg, 1963.

Williams, AAB

National Institute for Road Research, South Africa *Proceeding* 1963, PP 171-176, 5 Fig.

2A 263980

NUCLEAR EXPLOSIVES IN CIVIL CONSTRUCTION

Nuclear explosions offer a means of reducing both costs and time for some types of major civil construction projects. Hardrock can be rapidly and predictably reduced to high-quality aggregate. Linear craters resulting from five or more simultaneous explosions can be connected to form cuts for use in highway, railroad, and canal construction. Broken rock for aggregate is produced in maximum amount by burial of the nuclear explosive deeper than for normal cratering; the result is a mound of rubble rather than a depression. The size distribution of the rubble depends primarily on the physical properties of the pre-explosion rock, especially the natural fracture characteristics. Costs are estimated at 10, per ton for a 10-kt explosion. Multiple charges produce linear craters whose shape, depth, and width depend on charge yield and spacing. Optimum conditions result in a trench with scalloping of less than 10 percent of the average width, and rubble at the trench ends of less than 3 percent of the total ejecta. Seismic shock problems are minimized by blasting the cut in separate connecting sections. Current research efforts are directed to obtaining experience and to gaining better understanding of variable (such as those resulting from surface topographic irregularities and variable geologic conditions) as they pertain to problems of crater slope stability and the use of crater fallback as foundation material. Significant recent cratering experiments in hard rock include three with nuclear explosives and eight with large chemical high explosives. /AUTHOR/

Hansen, SM (California University, Berkeley)

Engineering Geology & Soils Engineering Symposium *Proceeding* 1966, p 18

2A 263988

PAVEMENT DESIGN FOR ROADS IN BANGKOK

An analysis of the subgrade strength for the soil conditions occurring in Bangkok is made from considerations of the soil suction characteristics of clays, the surcharge of the pavement structure and the water table. It is shown that this is not likely to be greater than 1.5 percent CBR. On this basis comparative designs for flexible and rigid pavements are developed using

three widely used design methods for four levels of traffic. The differences between the pavement thickness given by the different design methods are discussed. It would appear that unreinforced concrete slabs should be marginally more economical than flexible construction. The machinery required is simpler and the construction lends itself to labor-intensive methods. An experiment is recommended to compare the comparative designs. /Author/

Williams, FHP *Geotechnical Engineering* Vol. 3 No. 2, Dec. 1972, pp 105-126, 5 Tab., 16 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 209559)

2A 264167

FEASIBILITY STUDY OF THE MARKETABILITY OF THE RMI, THERMO-MATIC PLANT FOR RECYCLING PAVEMENTS

In this assessment of the marketability of a newly developed mixing plant through which discarded asphalt concrete may be recycled, consideration is given to the economic, technological, environmental and marketing aspects. The mixing plant consists of a drum mixer so designed that the flame and exhaust from the burner does not come into direct contact with the material being mixed. This allows the recycling of old pavement asphalt by burning in a conventional drum mixer. Provision is made for the addition of a softening agent, and more asphalt if necessary in order to arrive at the proper consistency and amount of asphalt in the recycled asphalt concrete. The plant produces virtually no pollution. This recycle operation has the advantages of lower cost, reduction of the use of scarce natural resources and an improvement in the quality of the environment. There are also indications that a recycled pavement may perform better than one made of virgin asphalt.

Dunning, RL

Dunning (Robert L) July 1974, 15 pp, 1 Tab., 15 Ref.

2A 264243

ABSTRACTS OF REPORTS PREPARED BY THE ROADS DIVISION

Abstracts are presented of reports relating to traffic planning for smaller towns, road construction and road traffic. A representative cross-section includes the following: report on Administration of Arterial Road Program; A Study of Highway Construction and Maintenance Operational Management in the Republic of Ireland; The International Road Research Documentation System: Civil Engineering Technicians in the Local Authority Service; Dublin Transportation Study Report; Road Construction with Gravel in Ireland; Nailed Timber Post and Rail Fences; Public Lighting in Ireland; The Influence of Traffic on the Design of Road Pavement in Ireland; A Pilot Scale Experiment to Study the Performance of Small-bore Slotted Plastics Pipes; Stained Wire Fence; Frost Penetration under Roads in Ireland; The Drainage of Rural Roads; Draft Specification for Road Works; Studies to Assess the Implications of Increased Single Axle Loads; A Review of the Regulations for Weights and Dimensions of Commercial Vehicles; Some Guidelines on Road Fence in the Landscape; A Study of Dense Aggregate Gradations Specified for Bituminous Mixtures; An Analysis of Road Asphalt Samples; Coated Chippings in Rolled Asphalt; The Influence of Asphaltic Cement on the Resistance to Skidding of Rolled Asphalt; The Wear and Skid-Resistance Characteristics of Selected Road Aggregates; Accounting Procedures for Local Authority Engineering Services; A review of Analysis Results for Samples of Rolled Asphalt and Coated Macadam; A Study of the Effects of Temperature on Pavement Friction; Polished Stone Values and Engineering Properties of Road-making Aggregates in Ireland; The Use of the Deflection Beam in Evaluating the Strength of Flexible Road Pavement; Road Accident Facts; A Computer Program to Analyze SCRIM Data; Report on Visual Classification Counting on the Arterial Road Network; Road Inventory Manual; Proposed Warrants for the Installation of Traffic Signals at Intersections; Vehicle Number Projections; and A Road Needs Study.

An Foras Forbartha May 1974, 24 pp, 90 Ref.

2A 264262

ENGINEERING CHARACTERISTICS OF THE LOESSIAL SOILS OF WEST TENNESSEE

The 25 to 30 mile wide loess belt which extends west of the Mississippi River is described, and the data is presented of the analysis of approximately 100

samples in which standard A.A.S.H.L. testing methods were employed. Field moisture content was determined on samples collected from line holes. Field observations were made of cut and fill slopes along existing roadways that cross the loess belt. Test data from eroded roadway cuts were compared with the data from the more stable vertical to near-vertical slopes. The results of these comparisons, the field observations, and the studies of the design policies of other highway departments indicate that near-vertical slopes are preferable over conventional soil slopes. If near-vertical slopes are chosen, certain construction and maintenance procedures must be followed if the slopes are to remain stable. If the more conventional soil slopes are utilized, slope ratios no steeper than 2-5:1 with immediate sodding or heavy seeding are suggested. The emplacement of loess in embankment at or very near optimum moisture content is essential if maximum stability is to be achieved. Whatever type slope design is chosen, proper maintenance is necessary if continued stability is to be insured.

In: 'Tennessee Highway Conference Proceedings', 1 March 1965, pp 12-38.

Royster, DL

Tennessee Department of Highways Bull. No. 29, Mar. 1965, pp 12-38, 7 Fig., 13 Tab., 6 Ref.

2A 264272

OPTIMUM DENSITY AND MOISTURE CONTENT OF NEW MEXICO CLAYS

A summary is presented of the paper which discussed the most beneficial density and moisture content for compacted New Mexico Triassic clay subgrades. Current specifications do not consider environmental changes after the soil is in place under a roadway, and the density required is based on an arbitrary compactive effort. An infinite number of compactive efforts is available and the true problem is to determine which compacted dry density and moisture content will give the highest strength and minimum swell after environmental changes such as shrinkage due to drying before the base and pavement have been installed and by capillary wetting after the pavement is installed and evaporation is prevented. Research results are presented and a different method of specifying compacted densities for New Mexico subgrades is suggested.

Thompson, LJ (New Mexico State University, Las Cruces) *New Mexico Highway Engineering Conference Proc Bulletin* Number 28, Jan. 1964, pp 43-47, 12 Ref.

2A 264282

MINOR FLAWS IN THE COMPACTION OF BASES PRODUCE MAJOR EFFECTS

It has been found in the construction of certain highway projects that the compaction test methods and compaction equipment currently being used do not insure that stability of highway bases over a period of time, especially if the highway is subjected to fairly high frequencies of heavily-loaded vehicles. The paper presents conclusions concerning the causes of such instability and makes several specific recommendations for overcoming it in future highway construction programs. The principal recommendations concern the use of extremely heavy compaction equipment, a critical study of the stability of various base material, and the inclusion in the construction specifications that projects be opened to traffic for specific periods of time to allow cohesion of materials and the correction of any deformation caused by traffic. /Author/

Proceedings of the Ninth Pan American Highway Congress, Washington, D.C., May 6-18, 1963.

Hermosillo, JG *Pan American Highway Congress Proceedings* Vol. 2 No. 166, May 1963, p 1013

ACKNOWLEDGMENT: Organization of American States

2A 264283

STUDY OF STABILIZED MATERIALS FOR THE CIENAGA-BARANQUILLA HIGHWAY

This paper deals with the design of soils stabilization for the Cienaga-Barranquilla Highway, located in the northern part of Colombia. There were two main problems in the construction of this highway: (a) some sectors appeared to have excessive settlements, and (b) the rocky materials for the layers of base and sub-base were very scarce. Because of this reason, it was necessary to stabilize the sandy materials that were found along the road. At the beginning, it was proposed to use a soil cement stabilization of the

"hard type" or the "modified soil cement." At the same time several tests with liquid asphalt RC-2 (sand-bitumen dense mix) were performed and resulted in the conclusion that it would be more advantageous to use asphalt as a sand additive. At the end of the report some of the conclusions are discussed. The use of this type of stabilization can be a good solution for certain locations where only sandy materials are found. /Author/

Proceedings of the Ninth Pan American Highway Congress, Washington, D.C., May 6-18, 1963.

Pan American Highway Congress Proceedings Vol. 2 No. 195, Mar. 1963, p 1014

ACKNOWLEDGMENT: Organization of American States

2A 264287

RELATIVE DENSITY AS COMPACTION CONTROL FOR GRANULAR SUB-BASE MATERIALS

Relative density has often been used for foundation and earth dam construction control, but it has not been used extensively for compaction control of highway sub-base materials. A review of the principles of relative density indicates its applicability to highway construction and design work, while certain limitations are noticed in the application of the Standard Compaction Test to the control sub-bases. The results of two brief testing programs are presented in which the application of the relative density concept was found useful. It was found that it could be used as a suitable specification for the control of fine sand sub-base materials, and for three of four gravelly coarse sand materials. Limitations to the tests and lack of standardization prevent the immediate use of this method as a construction control, and these points require further testing. /Author/

Proceedings of the Ninth Pan American Highway Congress, Washington, D.C., May 6-18, 1963.

Townsend, DL *Pan American Highway Congress Proceedings* Vol. 2 No. 78, May 1963, p 979

ACKNOWLEDGMENT: Organization of American States

2A 264420

MOISTURE-DENSITY RELATIONS OF SOIL-AGGREGATE MIXTURES AS AFFECTED BY THE GEOMETRIC CHARACTERISTICS AND GRADATION OF COARSE AGGREGATES

This paper summarizes the results of a laboratory study concerning the effects of the geometric characteristics and gradation of coarse aggregates on the moisture-density relations of soil-aggregate mixtures. Six coarse aggregate materials with discernible geometric characteristics, including both gravel and crushed stone materials, were used in the investigation. The geometric characteristics of these aggregates were determined by the particle index test and expressed quantitatively as particle index values for positive identification. Each coarse aggregate material was combined with various percentages of fines aggregate and soil materials to form nine different and fully controlled gradations according to a mathematical expression. The moisture-density relations of these mixtures were determined according to AASHTO Designation: T-99-57. The results of this investigation show that the percentage of voids in a compacted soil-aggregate mixture of a given gradation increases more or less linearly with increasing values of the particle index of the coarse aggregate; that is, as the coarse aggregate particles become more irregular in shape, angular, and roughly surfaced. For the soil-aggregate mixture containing coarse aggregates of given geometric characteristics, there is an optimum gradation at which maximum dry density is achieved. The optimum moisture content is also a minimum for this gradation. These results indicate convincingly that both the geometric characteristics and the gradation of the coarse aggregate materials deserve consideration in the construction control of soil-aggregate road materials. /Author/

Huang, EY

Michigan Technological University 1966, 23 pp

2A 264642

THE FAILURE OF A ROAD CONSTRUCTED ON A COLLAPSING SOIL

The occurrence of damage to buildings founded on certain silty sands and residual granites due to sudden collapse of the soil structure upon inundation has come to be well recognized. It has recently become apparent that these

collapsing soils can also cause damage to roads, and a case is reported where extensive settlement failures occurred on a heavily-trafficked road founded on such material. Agreement was found between the observed settlements of four or six inches and the results of computations based on both the increase of density beneath the road and the results of double consolidometer tests. Collapse extended down to a depth of three or four feet. Such soils cover wide areas in Southern Africa, and collapse could constitute an important road problem. The first essential to achieving a satisfactory design is the recognition of the soils and their inherent danger. Since this is not guaranteed by normal soil survey procedures, a number of criteria to aid recognition of such soils are given. In construction it is essential that the soil be improved to a considerable depth, and some possible construction procedures are discussed.

Proceedings of the 3rd Regional Conference.

Knight, K Dehlen, GL

Africa on Soil Mechanics and Fdn Engineering Conf Proceeding June 1963, pp 31-34

ACKNOWLEDGMENT: CSIR Research Review, Aouth Africa

2A 264688

LATERITIC GRAVEL EVALUATION FOR ROAD CONSTRUCTION

In this closure to the discussion of the paper, the authors comment on durability tests, and state that the selection of the aggregates (0.5 min-0.375 min) for testing was such that the influencing factors would be limited and the significance of the properties of the aggregate to durability may be assessed. The work tried to relate the formation conditions of laterite with performance. The deposition at lower slopes is described of a mixture of pisolitic gravel, pieces of free quartz particles and quartz particles as nucleus with a coating of sesquioxide. Short silicate analysis of the aggregate of this mixture, excluding the free quartz, will give variations in the silica/alumina ratio because free quartz and silica have the same chemical formula. Definitions based on the different properties of laterite are reviewed. Concerning the field performance of pavements, the author agrees that there are other factors such as subgrade strength, drainage conditions, and construction techniques which influence the strength of the pavement. Of such factors the strength of the aggregates has a significant influence on pavement performance. Field compaction in developing countries is discussed. The analogy of compression strength of concrete is used to explain why aggregates (0.5 in to 0.375 in) were isolated and mechanical strength conducted on them.

Closure of Proc Paper 9375, published November 1972.

de Graft-Johnson, JWS Bhatia, HS Hammond, AA (Building and Road Research Institute, Ghana) *ASCE Journal of the Geotechnical Engineering Div* Vol. 100 No. GT8, Proc Paper 10695, Aug. 1974, pp 947-949, 5 Ref., 1 App.

2A 264754

DENSITY OF BITUMINOUS SURFACE COURSES

Research is reported that was designed to determine the probable causes of low densities obtained during construction of bituminous surface courses designed with slag aggregate, and to determine the effect of low densities on the performance and durability of in-service bituminous surface course throughout Tennessee. The research literature in this field is reviewed and the causes of low density are examined. The probable primary causes of low densities in bituminous surface courses were found to be the lack of rolling in the breakdown and intermediate rolling sequences, the low mat temperatures during rolling operations, and the asphalt contents below the design asphalt content. The effect of density on surface performance is discussed and tables are presented of record densities, core densities and ratings from field inspections. As a result of this project more widespread use is being made of nuclear density surface gauges. A large number of tests may be conducted in a short time after laydown and rolling operations and a closer quality control of paving operations may be maintained.

Proceedings of the 55th Annual Tennessee Highway Conference, 1973.

Marks, BD (Department of the Air Force); Ford, HO

Tennessee University, Knoxville Proceeding Bulletin No. 40, Jan. 1974, 6 Fig., 6 Ref.

2A 264758

SKID RESISTANCE STUDIES IN KENTUCKY (AN OVERVIEW-1974)

Kentucky studies relating to pavement slipperiness are reviewed. Considerable effort has been devoted to the development of better methods of skid resistance testing and to standardization of testing devices. The development and standardization of a trailer method of test represented significant progress in measurement techniques. Effort was expanded to relate skid resistance data to accident statistics. Relationships between wet-surface accidents and skid resistance were established. These indicated that surfaces with skid resistance less than a "critical" value have disproportionately higher wet accident rates. The development of skid-resistant surface courses to operational status has been studied. The development was undertaken of a sand asphalt in which full reliance for skid resistance would be given to hardness, sharpness and angularity of quartz sand. This was an attribute of Kentucky rock asphalt and sandstone aggregates excelling in skid resistance. Pavement design alternatives using indigenous materials appear to be sand asphalts and open-graded friction courses. Aggregate incorporated in these mixes must be angular and resistant to polishing. These aggregates include: crushed quartz gravel, slag, lightweight (expanded) shale, and possibly sandstones.

Prepared for presentation to the 33rd Annual Meeting of SASHTO, October 16-19, 1974, Louisville, Kentucky.

Havens, JH Burchett, JL Rizenbergs, RL
Kentucky Department of Highways Research Rpt. 399, Sept. 1974, 25 pp, 10 Fig., 1 Tab., 18 Ref., 2 App.

2A 264782

MIX DESIGN METHODS FOR ASPHALT CONCRETE AND OTHER HOT-MIX TYPES

This manual which provides engineering data for the instruction of design and construction personnel in the use of hot-mix design methods, contains information on the latest methods to ensure high performance of asphalt pavements in modern traffic conditions. The application is reviewed of design testing to general construction practice. Testing references and detailed procedures are outlined for routine analysis of materials and paving mixtures. A number of typical examples of routine computations and calculations related to mix design are included in the appendix. Details of the Marshall method and the Hveem method of asphalt paving mix design are outlined. The method of design and the test criteria are presented free from specification requirements for materials and construction. The objectives of asphalt paving mix design and the evaluation and adjustment of mix designs are described as well as the design method and requirements. The coordination of mix design testing is discussed, and aggregate gradations and fractions are described. Examples are presented to illustrate the application of the requirements. Analytical procedures are described which apply either to paving mixtures that have been compacted in the laboratory or to undisturbed samples that have been cut from a pavement in the field. Definitions are set forth and a table illustrates the influence of type of specific gravity on determination of VMA (voids in the mineral aggregate) and air voids. A procedure for analyzing a compacted paving mixture is outlined and the determination of effective specific gravity of aggregate is described. The maximum specific gravity of mixtures with different asphalt contents, asphalt absorption, effective asphalt content of a paving mixture, percent VMA in a compacted paving mixture, and the calculation of percent air voids in compacted mixture are other aspects covered. Notes are appended relating to the analysis of aggregate gradations and the combining of aggregates to obtain desired gradation.

Asphalt Institute Series No. 2 (MS-2), Mar. 1974, 102 pp, Figs., Tabs., 1 App.

PURCHASE FROM: Asphalt Institute Headquarters, Asphalt Institute Building, College Park, Maryland, 20740 Repr. PC

2A 264868

NOTES ON THE PROBLEMS OF THE INTERNAL STRUCTURE OF SURFACING MATERIALS WITH REFERENCE TO THE VARIOUS MATERIAL COMPONENTS [Anmerkungen zu Problemen der Inneren Struktur von Deckenbaustoffen unter Beruecksichtigung der Verschiedenen Baustoffkomponenten]

As regards the internal structure of aggregates, information can be obtained from the observation of enlarged coloured slides of rock slices, which provide data on their suitability for bituminous road construction. Individual

particles of basalt having a rounded, conical or mixed structure, of gneiss rock having significant layering, of sandstone having quartz particles cemented by silicic acid, and of quartz rock behave differently when subjected to practical stress in the road surfacing. For example it can be seen the rock slices that sandstone always remains skid resistant but will not for long resist marked stress by studded tyres. With reference to conical basalt particles, the possibility of adding asbestos fibres to the bituminous mortar is discussed. [German]

Brand, W *Bauwirtschaft* Vol. 26 No. 20, 1972, pp 760-761

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 300852)

2A 264887

RESEARCH PROBLEM STATEMENTS: DESIGN AND CONSTRUCTION OF TRANSPORTATION FACILITIES GROUP

Statements are presented which represent the composite of efforts of seventeen committees whose function it was to identify transportation problems and develop and disseminate research problem statements which will provide guidance to financial sponsors such as governmental agencies, research institutions, industry and the academic community. Each contributing committee identified and presented 2 problem statements. These were then screened and two top priority statements were chosen from the collective efforts of the section. The Standing Committee then reviewed the statements and rated them in three priority categories: (a) top priority statements from each Section, (b) top priority statements from each category category A, (c) and all other statements. This publication outlines the details of each problem statement. The scope of each problem is defined and its objectives are set forth. Current activity in the area is reviewed and an assessment is made of the degree of urgency of the problem. The committees contributing the statements in this issue covered the following fields: geometric design; hydrology, hydraulics and water quality; safety appurtenances; shoulder design; pavement design; dynamics and field testing of bridges; characteristics of non-bituminous components of bituminous paving mixtures; performance of concrete (physical aspects); performance of concrete (chemical aspects); mineral aggregates; sealants and fillers; adhesives bonding agents and their uses; lime and lime-flyash stabilization; subsurface drainage, exploration and classification of earth materials; environmental factors except frost.

Transportation Research Circular Number 160, Nov. 1974, 79 pp

PURCHASE FROM: TRB

2A 264900

LIQUID SULPHUR

Liquid sulphur, a by-product of the oil and natural gas industries, has given ecologists a king-sized headache in the past because it is so difficult to get rid of, but recent tests by the Ontario Department of Transport and Communications, and Shell Canada, show that it greatly improves the stability of sand-asphalt mixes when added at the rate of 10-15 percent by weight. Contractors may be interested to know that further research by Professor Robert Gallaway at Texas A & M University is aimed at improving mix and thickness design for sulphur mixes. Looks like a good way to build pavements and improve the environment at the same time. /ART/

Roads and Streets Vol. 116 No. 12, Dec. 1973, P 62, 1 Phot.

2A 264913

DEVELOPMENT IN QUALITY CONTROL OF CONCRETE DURING CONSTRUCTION

New methods of quality control of concrete during pavement construction have successfully been carried out in Switzerland on all main road projects since 1969. A combined quantitative and qualitative microscopic analysis has been carried out on thin slices of 2-day-old concrete in more than 800 tests. Quantitative analysis determines the frost-salt (F-S) resistance. In addition to the spacing factor, nine other factors are being considered. The evaluation of F-S resistance foresees a subdivision in five groups according to the durability factor. The qualitative, morphological control analysis is done on the same slice and at the same time the quantitative analysis is carried out. The morphological quality control determines precisely the faults in the concrete as well as their causes. It also makes it possible to rectify these faults during further construction. Concrete

"hard type" or the "modified soil cement." At the same time several tests with liquid asphalt RC-2 (sand-bitumen dense mix) were performed and resulted in the conclusion that it would be more advantageous to use asphalt as a sand additive. At the end of the report some of the conclusions are discussed. The use of this type of stabilization can be a good solution for certain locations where only sandy materials are found. /Author/

Proceedings of the Ninth Pan American Highway Congress, Washington, D.C., May 6-18, 1963.

Pan American Highway Congress Proceedings Vol. 2 No. 195, Mar. 1963, p 1014

ACKNOWLEDGMENT: Organization of American States

2A 264287

RELATIVE DENSITY AS COMPACTION CONTROL FOR GRANULAR SUB-BASE MATERIALS

Relative density has often been used for foundation and earth dam construction control, but it has not been used extensively for compaction control of highway sub-base materials. A review of the principles of relative density indicates its applicability to highway construction and design work, while certain limitations are noticed in the application of the Standard Compaction Test to the control sub-bases. The results of two brief testing programs are presented in which the application of the relative density concept was found useful. It was found that it could be used as a suitable specification for the control of fine sand sub-base materials, and for three of four gravelly coarse sand materials. Limitations to the tests and lack of standardization prevent the immediate use of this method as a construction control, and these points require further testing. /Author/

Proceedings of the Ninth Pan American Highway Congress, Washington, D.C., May 6-18, 1963.

Townsend, DL *Pan American Highway Congress Proceedings* Vol. 2 No. 78, May 1963, p 979

ACKNOWLEDGMENT: Organization of American States

2A 264420

MOISTURE-DENSITY RELATIONS OF SOIL-AGGREGATE MIXTURES AS AFFECTED BY THE GEOMETRIC CHARACTERISTICS AND GRADATION OF COARSE AGGREGATES

This paper summarizes the results of a laboratory study concerning the effects of the geometric characteristics and gradation of coarse aggregates on the moisture-density relations of soil-aggregate mixtures. Six coarse aggregate materials with discernible geometric characteristics, including both gravel and crushed stone materials, were used in the investigation. The geometric characteristics of these aggregates were determined by the particle index test and expressed quantitatively as particle index values for positive identification. Each coarse aggregate material was combined with various percentages of fines aggregate and soil materials to form nine different and fully controlled gradations according to a mathematical expression. The moisture-density relations of these mixtures were determined according to AASHTO Designation: T-99-57. The results of this investigation show that the percentage of voids in a compacted soil-aggregate mixture of a given gradation increases more or less linearly with increasing values of the particle index of the coarse aggregate; that is, as the coarse aggregate particles become more irregular in shape, angular, and roughly surfaced. For the soil-aggregate mixture containing coarse aggregates of given geometric characteristics, there is an optimum gradation at which maximum dry density is achieved. The optimum moisture content is also a minimum for this gradation. These results indicate convincingly that both the geometric characteristics and the gradation of the coarse aggregate materials deserve consideration in the construction control of soil-aggregate road materials. /Author/

Huang, EY
Michigan Technological University 1966, 23 pp

2A 264642

THE FAILURE OF A ROAD CONSTRUCTED ON A COLLAPSING SOIL

The occurrence of damage to buildings founded on certain silty sands and residual granites due to sudden collapse of the soil structure upon inundation has come to be well recognised. It has recently become apparent that these

collapsing soils can also cause damage to roads, and a case is reported where extensive settlement failures occurred on a heavily-trafficked road founded on such material. Agreement was found between the observed settlements of four or six inches and the results of computations based on both the increase of density beneath the road and the results of double consolidometer tests. Collapse extended down to a depth of three or four feet. Such soils cover wide areas in Southern Africa, and collapse could constitute an important road problem. The first essential to achieving a satisfactory design is the recognition of the soils and their inherent danger. Since this is not guaranteed by normal soil survey procedures, a number of criteria to aid recognition of such soils are given. In construction it is essential that the soil be improved to a considerable depth, and some possible construction procedures are discussed.

Proceedings of the 3rd Regional Conference.

Knight, K Dehlen, GL

Africa on Soil Mechanics and Fdn Engineering Conf Proceeding June 1963, pp 31-34

ACKNOWLEDGMENT: CSIR Research Review, Aouth Africa

2A 264688

LATERITIC GRAVEL EVALUATION FOR ROAD CONSTRUCTION

In this closure to the discussion of the paper, the authors comment on durability tests, and state that the selection of the aggregates (0.5 min-0.375 min) for testing was such that the influencing factors would be limited and the significance of the properties of the aggregate to durability may be assessed. The work tried to relate the formation conditions of laterite with performance. The deposition at lower slopes is described of a mixture of pisolithic gravel, pieces of free quartz particles and quartz particles as nucleus with a coating of sesquioxide. Short silicate analysis of the aggregate of this mixture, excluding the free quartz, will give variations in the silica/alumina ratio because free quartz and silica have the same chemical formula. Definitions based on the different properties of laterite are reviewed. Concerning the field performance of pavements, the author agrees that there are other factors such as subgrade strength, drainage conditions, and construction techniques which influence the strength of the pavement. Of such factors the strength of the aggregates has a significant influence on pavement performance. Field compaction in developing countries is discussed. The analogy of compression strength of concrete is used to explain why aggregates (0.5 in to 0.375 in) were isolated and mechanical strength conducted on them.

Closure of Proc Paper 9375, published November 1972.

de Graft-Johnson, JWS Bhatia, HS Hammond, AA (Building and Road Research Institute, Ghana) *ASCE Journal of the Geotechnical Engineering Div* Vol. 100 No. GT8, Proc Paper 10695, Aug. 1974, pp 947-949, 5 Ref., 1 App.

2A 264754

DENSITY OF BITUMINOUS SURFACE COURSES

Research is reported that was designed to determine the probable causes of low densities obtained during construction of bituminous surface courses designed with slag aggregate, and to determine the effect of low densities on the performance and durability of in-service bituminous surface course throughout Tennessee. The research literature in this field is reviewed and the causes of low density are examined. The probable primary causes of low densities in bituminous surface courses were found to be the lack of rolling in the breakdown and intermediate rolling sequences, the low mat temperatures during rolling operations, and the asphalt contents below the design asphalt content. The effect of density on surface performance is discussed and tables are presented of record densities, core densities and ratings from field inspections. As a result of this project more widespread use is being made of nuclear density surface gauges. A large number of tests may be conducted in a short time after laydown and rolling operations and a closer quality control of paving operations may be maintained.

Proceedings of the 55th Annual Tennessee Highway Conference, 1973.

Marks, BD (Department of the Air Force); Ford, HO
Tennessee University, Knoxville Proceeding Bulletin No. 40, Jan. 1974, 6 Fig., 6 Ref.

2A 264758

SKID RESISTANCE STUDIES IN KENTUCKY (AN OVERVIEW-1974)

Kentucky studies relating to pavement slipperiness are reviewed. Considerable effort has been devoted to the development of better methods of skid resistance testing and to standardization of testing devices. The development and standardization of a trailer method of test represented significant progress in measurement techniques. Effort was expanded to relate skid resistance data to accident statistics. Relationships between wet-surface accidents and skid resistance were established. These indicated that surfaces with skid resistance less than a "critical" value have disproportionately higher wet accident rates. The development of skid-resistant surface courses to operational status has been studied. The development was undertaken of a sand asphalt in which full reliance for skid resistance would be given to hardness, sharpness and angularity of quartz sand. This was an attribute of Kentucky rock asphalt and sandstone aggregates excelling in skid resistance. Pavement design alternatives using indigenous materials appear to be sand asphalts and open-graded friction courses. Aggregate incorporated in these mixes must be angular and resistant to polishing. These aggregates include: crushed quartz gravel, slag, lightweight (expanded) shale, and possibly sandstones.

Prepared for presentation to the 33rd Annual Meeting of SASHTO, October 16-19, 1974, Louisville, Kentucky.

Havens, JH Burchett, JL Rizenbergs, RL
Kentucky Department of Highways Research Rpt. 399, Sept. 1974, 25 pp,
10 Fig., 1 Tab., 18 Ref., 2 App.

2A 264782

MIX DESIGN METHODS FOR ASPHALT CONCRETE AND OTHER HOT-MIX TYPES

This manual which provides engineering data for the instruction of design and construction personnel in the use of hot-mix design methods, contains information on the latest methods to ensure high performance of asphalt pavements in modern traffic conditions. The application is reviewed of design testing to general construction practice. Testing references and detailed procedures are outlined for routine analysis of materials and paving mixtures. A number of typical examples of routine computations and calculations related to mix design are included in the appendix. Details of the Marshall method and the Hveem method of asphalt paving mix design are outlined. The method of design and the test criteria are presented free from specification requirements for materials and construction. The objectives of asphalt paving mix design and the evaluation and adjustment of mix designs are described as well as the design method and requirements. The coordination of mix design testing is discussed, and aggregate gradations and fractions are described. Examples are presented to illustrate the application of the requirements. Analytical procedures are described which apply either to paving mixtures that have been compacted in the laboratory or to undisturbed samples that have been cut from a pavement in the field. Definitions are set forth and a table illustrates the influence of type of specific gravity on determination of VMA (voids in the mineral aggregate) and air voids. A procedure for analyzing a compacted paving mixture is outlined and the determination of effective specific gravity of aggregate is described. The maximum specific gravity of mixtures with different asphalt contents, asphalt absorption, effective asphalt content of a paving mixture, percent VMA in a compacted paving mixture, and the calculation of percent air voids in compacted mixture are other aspects covered. Notes are appended relating to the analysis of aggregate gradations and the combining of aggregates to obtain desired gradation.

Asphalt Institute Series No. 2 (MS-2), Mar. 1974, 102 pp, Figs., Tabs.,
1 App.

PURCHASE FROM: Asphalt Institute Institute Headquarters, Asphalt Institute Building, College Park, Maryland, 20740 Repr. PC

2A 264868

NOTES ON THE PROBLEMS OF THE INTERNAL STRUCTURE OF SURFACING MATERIALS WITH REFERENCE TO THE VARIOUS MATERIAL COMPONENTS [Anmerkungen zu Problemen der Inneren Struktur von Deckenbaustoffen unter Berücksichtigung der Verschiedenen Baustoffkomponenten]

As regards the internal structure of aggregates, information can be obtained from the observation of enlarged coloured slides of rock slices, which provide data on their suitability for bituminous road construction. Individual

particles of basalt having a rounded, conical or mixed structure, of gneiss rock having significant layering, of sandstone having quartz particles cemented by silicic acid, and of quartz rock behave differently when subjected to practical stress in the road surfacing. For example it can be seen the rock slices that sandstone always remains skid resistant but will not for long resist marked stress by studded tyres. With reference to conical basalt particles, the possibility of adding asbestos fibres to the bituminous mortar is discussed. [German]

Brand, W *Bauwirtschaft* Vol. 26 No. 20, 1972, pp 760-761

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 300852)

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Transportation Research Circular Number 160, Nov. 1974, 79 pp

PURCHASE FROM: TRB

2A 264900

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Roads and Streets Vol. 116 No. 12, Dec. 1973, P 62, 1 Phot.

2A 264913

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will medium or low F-S resistance (according to the quantitative analysis) or with a high percentage of morphological faults (disturbance factor greater than or equal to 10) is controlled by a frost-thaw-salt (F-T-S) resistance test with rapid cycles. This new Dobrolubov-Romer (D-R) method makes rapid testing of concrete possible (500 cycles within a fortnight). Practical application of control on site during construction is demonstrated.

Wilk, W Dobrolubov, G (Betonstrassen AG); Romer, B (LPM Laboratory) *Transportation Research Record* No. 504, 1974, pp 1-26, 43 Fig., 1 Ref.

PURCHASE FROM: TRB Orig. PC

2A 264914

VOID PARAMETERS OF CONCRETE CORES FROM A SECTION OF I-64

In the hope of determining whether variables in unit weight were caused by variations in the air void system or segregation of the aggregate, micrometric air void and aggregate analyses were made on 24 core samples from six test sections of I-64 near Charlottesville, Virginia. The test design included paver speeds of 3, 4.25, 5.5, 11, 12, and 14 ft/min (0.0152, 0.0261, 0.0279, 0.061, and 0.071 m/s), vibrator frequencies ranging from 130 to 167 revolutions/sec, and slumps from 1 to 2.75 in. (25.4 to 70 mm). Analyses showed that for any particular concrete, the faster the motion of the vibrators through the concrete and the greater the spacing, the less the consolidation will be. Between batches, the greater the slump or workability is, the greater the consolidation achieved by a set of vibrator conditions. Frequencies of the vibrators used covered such a narrow range that no correlation between frequency and consolidation was possible. Insufficient sampling precluded the determination of aggregate segregation. For the type of concrete and kind of vibrators used, data seem to indicate that, if the slump approaches 1 in. (25.4 mm), then the forward speed of the vibrator screed should be no more than 6 ft/min (0.0305 m/s) when the spacing of the vibrators is about 2 ft (0.61 m). Higher speeds will probably produce high-void, low abrasion-resistant areas of pavement.

Walker, HN (Virginia Highway Research Council) *Transportation Research Record* No. 504, 1974, pp 27-36, 6 Fig., 1 Tab., 7 Ref.

PURCHASE FROM: TRB Orig. PC

2A 265056

STRENGTH COEFFICIENT OF MATERIALS

This study investigates the relationship of strength to thickness and type of material for six different construction materials; two bituminous paving materials, the same two aggregates without asphalt and two gravels typical of those normally used for base or subbase materials. Testing was conducted at a test site where each material was placed in thickness of 3 to 24 inches in 3 inch increments. In addition to normal laboratory and construction test procedures, plate bearing, Benkelman beam and Dynaflect tests were performed. Coefficients of strength were determined for the test materials and examples of design based upon these coefficients are shown. /FHWA/ Notice of NTIS Number Pending.

Crawford, RA Anderson, DW
South Dakota Department of Transportation Final Rpt. SD 613 (70), Dec. 1973

ACKNOWLEDGMENT: Federal Highway Administration (S0280)

PURCHASE FROM: NTIS

2A 265088

DETERMINATION OF THE PERCENTAGE OF WEAR (LOS ANGELES) ON SMALL SAMPLES OF STONE AGGREGATE FOR USE IN ROAD CONSTRUCTION [Determinazione della percentuale di usura los angeles su piccole quantità di pietrischetti e graniglie per uso stradale]

AN APPARATUS, TERMED THE L.A.M., FOR THE MEASUREMENT OF WEAR IN ROCKY MATERIALS, IS DESCRIBED. THE APPARATUS IS A MODIFICATION OF THE STANDARD LOS ANGELES EQUIPMENT, AND A SERIES OF TESTS CARRIED OUT WITH THE TWO DEVICES ON SAMPLES OF THE SAME MATERIAL, SHOWED 98.66 PER CENT AGREEMENT. TEST PROCEDURES ARE DESCRIBED AND TABLES AND GRAPHS GIVE DETAILS OF THE MATERIALS TESTED AND THE RESULTS OBTAINED. /TRRL/ [Italian]

Lancieri, F *Strade* No. 10, Nov. 1973, pp 605-609, 2 Fig., 3 Tab., 6 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 209935)

2A 265101

EXPERIMENTAL SECTION CONTAINING GRAVEL STABILISED WITH PRECRUSHED GRANULATED SLAG

[Blanche expérimentale d'une grave traitée au laitier granulé prébroyé]

Difficulties of manufacturing all the granulated slag class 40/60 needed and the problems encountered in the use of granulated slag class 20/25 led to the experiment of using precrushed granulated slag already employed in fields other than road construction. Two experimental sections, 250 M each were built, one containing conventional granulated slag, the other containing the same granulated slag precrushed in a rod grinder, on the national road RN80, just outside Montcenis, in the Saone-et-Loire. The sections will be observed by the Autun Laboratory. The aim of the experiment was to study the new method on a very short section prior to a more detailed study due to start in 1972. Details are given of the precrushed granulated slag, of the study of the mix design conducted before laying on the site, and observations carried out during construction. The first conclusions reached by the authors are that the use of precrushed slag does not present any great problems of manufacture and application compared to that of conventional granulated slag. However it seems that precrushing results in a high-density slag rather sensitive to water. /TRRL/ [French]

Hermann, M Colombier, G (Laboratoire Regional des Ponts & Chaussées d'Autun) *Bulletin de Liaison des Lab des Ponts et Chaussées* No. 57, Jan. 1972, pp 18-23, 5 Fig., 3 Tab., 5 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 100253)

PURCHASE FROM: Laboratoire Central des Ponts et Chaussées Repr. PC

2A 265139

ROLE OF UNBOUND AGGREGATE-PAST, PRESENT AND FUTURE

This paper which purposes to indicate a means of determining what may be done in the future relative to pavement construction, suggests how the present concern for energy conservation, or any future socio-economic factors, can be understood and dealt with by those interested in the use of aggregates for flexible pavements. History is considered in the light of its implications for the present and future use of flexible pavements. Economic and social-environmental concerns as well as technological changes that will affect the future of flexible pavements are discussed. The need is indicated at the present time for analyses in which the measures for effectiveness will be much more complex than cost per mile of highway. New analytic techniques and criteria must be developed. The continuing need for construction materials will lead to shortages which will require objective appraisals of how best to achieve the desired pavement performance.

Proceedings from A Conference on Utilization of Graded Aggregate Base Materials in Flexible Pavements, held March 25-26, 1974, Oakbrook, Illinois.

Baker, RF

National Crushed Stone Association Conf Paper Mar. 1974, 12 pp

2A 265140

QUALITY ASSURANCE-A COOPERATIVE EFFORT FROM PRODUCER TO CONTRACTING AGENCY

In this effort to demonstrate that costly materials rejection can be avoided when control of material quality is applied from commencement of production and continued until the material is incorporated into the work, a quality control program is described which has proved effective especially in furnishing graded aggregate to jobs some distance from the processing plant. The evolution is described of quality assurance method in Virginia. Statistical quality control specification is described, and key points in the specification are detailed. Attachments present information on the concepts of sampling, and Virginia's special provisions for subbase and aggregate base courses. The presentation is followed by a discussion.

Proceedings from A Conference on Utilization of Graded Aggregate Base Materials in Flexible Pavements, held March 25-26, 1974, Oakbrook, Illinois.

Fielding, RV (Virginia Department of Highways and Transportation)
National Crushed Stone Association Conf Paper Mar. 1974, 21 pp, 6 Tab.

2A 265211

BUILDING EMBANKMENTS WITH SHALES

Indiana Shales (which cover a wide behavior spectrum from hard and durable ones, to those which will rapidly weather into soil, are of relatively low plasticity and do not possess highly expansible characteristics) were studied with a view to assessing their suitability for use in highway embankments. Existing tests were modified and new tests were developed for the engineering classification of shales which ranked them in different embankment use categories. Fifteen sampling sites were selected and the quantity of material varied between 150 to 1,500 lb, depending upon its type and ease in sampling. Shales of three sites were used as embankment material in small dams and shales from four locations were used in highway embankments. The details are outlined of 4 groups of tests: degradation type tests, soil type standard identification tests, compaction and load deformation tests, and miscellaneous tests. It was determined that the shales could be suitably rated with only 4 tests, viz., a slaking test of one cycle in water; a slake durability test on soaked samples; and a modified soundness test. The results (tabulated) of slaking in one cycle of wetting (broken piece of shale was immersed at least 0.5 inch below water surface) revealed that only 2 of the 15 shales were significantly affected. A slake durability test was conducted which measured the weight loss in water which can be expressed as a durability number. The modified soundness test measured the degradation of shales when subjected to five cycles of alternate wetting and drying in a sodium sulfate solution. The performance of the shales is reviewed, and on the basis of 4 simple degradation type tests, the shales are classified into 4 groups. Based upon the experimental data, qualitative statements are made about the strength and durability of these shales in embankments.

Wood, LE Lovell, CW, Jr (American Testing and Engineering Corporation); Deo, P
Purdue University Reprints CE292, June 1974, 19 pp, 15 Fig., 3 Tab., 10 Ref.

2A 265216

A COMPARISON OF USEFULNESS OF WHEELED AND CATERPILLAR BULLDOZERS AT EXECUTION OF EARTHWORKS [Porównanie przydatności spycharek kołowych i gąsienicowych przy wykonywaniu robot ziemnych]

The scope and advisability of application of wheeled and caterpillar bulldozers is discussed particularly as related to technical parameters and efficiency. The results are discussed of tests of a prototype of the wheeled bulldozer and of caterpillar bulldozers. Basic and auxiliary operations for which bulldozers are utilized are listed, and the calculation is described of exploitation effectiveness. The effective capacity of the blade, adherence coefficients for both wheeled and caterpillar bulldozers, the towing power, the coefficient of operational time utilization, the influence of the coefficient of land gradient, and the time of operational cycle are among the factors reviewed. Conclusions drawn on the basis of the study are presented. It is concluded that for a large volume of earthworks on all types of grounds, and particularly in the execution of excavations and embankments, it is advisable to apply caterpillar bulldozers. However, for horizontal displacement of sandy soils at relatively longer distances, for grading of land and for auxiliary works, it is advisable to use wheeled bulldozers.

English Translation of "Przegland BUdowlony"

Przycnodzien, T (Military Technical Academy, Poland) *Building Review*
Vol. 43 No. 9-10, 1971, pp 61-76, 5 Fig., 16 Ref.

PURCHASE FROM: NTIS Repr. PC

2A 265221

COLCHESTER NORTHERN BYPASS-A 12

Construction details of the Colchester Northern Bypass scheme are given. Sixteen structures are incorporated in the bypass, which is 11.6km. long. The scheme involves approximately 1.2 million cubic meters of earth moving. The principal soils are glacial gravels, ana loam, and London clay. An embankment, 1km long and with a maximum height of 13m, is built across the River Colne Valley. Granular toe beams are built where the embankment height exceeds 6m. The dual carriageway road is drained by French drains located in the verges and central reserve. Details of the flexible pavement, which is 240,000 sq. meters in area, are included. Construction of the three major bridges is described and illustrated.

Highways and Road Construction Vol. 42 No. 1772, Apr. 1974, pp 11-14, 7 Fig., 6 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 209571)

2A 265334

ENERGY CONSERVATION IN PAVEMENT CONSTRUCTION

Effective use of energy in the construction of asphalt pavements can result in significant conservation and in most cases reduce the cost. Through the planned use of stage construction, the pavement may be developed only as required by traffic growth. Although this does not reduce the total energy requirement, it does result in the energy and cost being spread over a longer period of time and used only if demanded by traffic. Paving should be planned for completion during the summer months, which will also result in a lower energy demand for preparation of hot-asphalt mixes because aggregates in most areas will contain less water and require less heat for drying at that time. Use of the drum mixer so that lower mixing temperatures may be used will also reduce energy requirements as will use of emulsified asphalt, obviating the need to heat or dry the aggregate.

Lovering, WR *Military Engineer* Vol. 66 No. 434, Dec. 1974, pp 356-357

2A 265415

VBW COMMUNICATIONS 43 [VBW Mededelingen 43]

THIS ISSUE OF THIS LOOSE-LEAF SERIAL INCLUDES CHAPTERS ON THE PROCEEDINGS OF THE 1973 ANNUAL MEETING OF VBW AND ON THE FOLLOWING PAPERS PRESENTED DURING THE MEETING: (1) CORNELISSEN, PAM: POLITICAL CONSIDERATIONS OF ROAD CONSTRUCTION. (2) VERBOST, GP: STARTING POINTS AND CONSIDERATIONS OF THE CONSTRUCTION OF GOOD ASPHALT ROADS IN RURAL DISTRICTS. (3) RITMEESTER, MW: STARTING POINTS OF THE CONSTRUCTION OF GOOD ASPHALT ROADS IN URBAN DISTRICTS. (4) HAMELINK, JG: ASPECTS OF THE CONSTRUCTION OF GOOD ASPHALT ROADS FOR INTERREGIONAL CONNECTIONS. A MAP SHOWING THE POSITIONS OF ASPHALT PLANTS IN THE NETHERLANDS IS APPENDED. [Dutch]

Mededelingen Conf Paper Vol. 43 Dec. 1973, pp 585-624, 14 Fig., 7 Tab., 15 Phot., 8 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 209819)

2A 265565

WATERTIGHT CONCRETE CONSTRUCTION

The booklet discusses the factors which a designer should consider when preparing a design for a watertight structure, and the practical problems which must be foreseen by those on site concerned with the supervision and actual construction. It is not a manual, and reference is made to other publications for theoretical treatment and to codes of practice. Types of construction considered are service reservoir structures which have to retain water without leakage, basement structures in water bearing ground, which have to be water retaining to prevent ingress of water, and retaining walls, particularly those associated with highway works, which have to be constructed so that ground water cannot percolate through cracks of joints and thus cause disfiguring stains on the concrete surface. Large mass concrete structures, such as gravity dams, are not included. Materials, design construction, and jointing materials and linings are described.

Deacon, RC

Cement and Concrete Association R&D Rpt. 1973, 18 pp, 13 Fig., 2 Tab., 7 Phot., 22 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 207616)

2A 265581

MANUFACTURE, SUPPLY AND SUPERVISION OF READY-MIXED CONCRETE IN THE FEDERAL REPUBLIC OF GERMANY [Herstellung, Lieferung und Ueberwachung von Transportbeton in der Bundesrepublik Deutschland]

The author describes the development of ready-mixed concrete and requirements as regards delivery, construction materials and the ready-mixed concrete itself. The execution of quality control and testing on site is also outlined. [German]

Wischer, G (Forschungsinstitut der Zementindustrie, W Germany) *Zement und Beton* Vol. 1972 No. 65, Dec. 1972, pp 19-23, 1 Tab., 1 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 301116)

2A 265599

PORE STRUCTURE, MODULUS OF ELASTICITY AND MEASUREMENT OF DEFORMATIONS IN A COLD STATE WITH A VIEW TO DETERMINING THE RESISTANCE OF CONSTRUCTION MATERIALS TO FROST [Structure des pores, module d'élasticité et dilatometrie au Froid en vue de la détermination de la résistance au froid des matériaux de construction]

Based on the knowledge of the frost behavior of water in capillary systems and the filling process of capillaries with water, it is possible to accept the fact that only pores of average size can be held responsible for the damage to materials caused by frost. Thus if a satisfactory understanding of the frost resistance of a material is to be obtained, analyses of pore distribution must be conducted and supplemented with microscopic studies of the shape of the pores. On their own, the mechanical properties of a material give little information on the resistance of a material to frost, but it is possible to assess this resistance by studying the variations in the modulus of elasticity, especially in the case of repeated stresses caused by frost. [French]

Lehmann, H Rauschenfels, E *Industrie Ceramique* No. 643, Sept. 1971, pp 635-648, 5 Fig., 24 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 100114)

2A 265666

PLANNING OF ROAD PROJECTS-EARTHWORKS-FINLAND

The principle is described of the Finnish Digital Terrain Model which has been developed for the comparison of different alignment and gradeline alternatives. In order to ensure that the use of DTM is as efficient as possible, a model process analysis of the road planning project has been prepared which contains the different phases of planning and construction. In a study of the swelling of soils from 5 different construction sites, the permanent swell was calculated (i.e. the ratio of in-situ unit weight to the unit weight to the unit weight in construction). The results revealed a distinct grouping according to different soils. Studies are reported which were planned to determine the angle of internal friction of stone materials. The effect of particle shape, angularity, density, percentage of fines and moisture content were also studied. Determination of the friction angle carried out in laboratory conditions show that the shape of the gradation curve has a noticeable effect on the friction angle, even within the relatively narrow area specified for the base course. Other factors of importance are density, particle shape and angularity, moisture content, and to some extent the percentage of fines. A survey was made to clarify the adequacy of lightweight aggregate as embankment fill under certain conditions. The importance is emphasized of knowing the unit weight of material, its behavior at the stage of embankment construction, variations in unit weight resulting from moisture in course of time, and the need of strengthening the upper part of the embankment or the required pavement thickness. Lightweight aggregate has proved a suitable material in many construction projects where it has provided adequate stability and prevented uneven settlement. Investigations are reported of 4 different insulation materials, concerning their ability to protect the subgrade from freezing, and their long-term behavior in operation.

Presented at the XIVth World Road Congress, Prague, Czechoslovakia, 1971.

Hakala, J Eerola, M Hailikari, T Kankare, E Orama, R Ylosjoki, M
Permanent International Association of Road Congr Book I-7, 1971, 31 pp, 17 Fig., 1 Tab.

2A 265669

PLANNING OF ROAD PROJECTS-EARTHWORKS-HUNGARY

A new Hungarian soil classification system is described and the results are presented of compactibility tests. Intermediate soils (soils which fall between sands and clays with a fine average granularity) are perfectly elastic above a critical moisture content in the course of compaction and their voids can only be decreased slightly. The examination of the changes of state which have taken place during compaction has made possible the definition of

states of developed soil and the field of the critical state. Research in permanent and elastic deformations and resiliometric tests have contributed to an understanding of the critical field. Compaction tests on sands have proved that the shape of the granulometric curve exerts a very important effect on the value of the dry density of the soil, measurable in a slightly warped state. The stabilization is discussed of the upper layers of foundation soil with cement and the results are presented of the amount of cement and the effect of the amount of lime. Experimental results of the study of the influence of the mix are reviewed. Experiments are reported of drainage of the foundation layer under a concrete pavement. Details are outlined of a technique of embankment construction on compressible soils.

Presented at the XIVth World Road Congress, Prague, Czechoslovakia, 1971.

Kezdi, A (Polytechnic University of Hungary); Gaspar, L (Institute of Road Research, Hungary); Janoshegi, F (Faculty of Road Railway Research); Matus, E Mihalyfi, A (Roads Department, Hungary); Nagyvati, B (Polytechnic University of Hungary)
Permanent International Association of Road Congr Book I-11, 1971, 31 pp, 26 Fig., 3 Tab.

2A 265673

PLANNING OF ROAD PROJECTS-EARTHWORKS, MEXICO

The reactivation of faults by the construction of a road is described, and the application is discussed of soil and rock mechanics to problems arising from the great masses of moving soil at km 15 500 on the Tijuana-Ensenada highway. Strategically placed measuring devices and the correct interpretation of values corresponding to the deformation were important in the foreseeing of critical situations. Various alternatives for stabilization are proposed and the one selected was a filtering adit designed to reduce the pressure of the water and thereby increase the stability of the slope. Photographs, graphs and diagrams are presented which illustrate the various aspects of the project.

Presented at the XIVth World Road Congress, Prague, Czechoslovakia, 1971.

Romano, JD Rodriguez, AR Oecero, GM Altamirana, GG
Permanent International Association of Road Congr Book I-16, 1971, 15 pp, 10 Fig.

2A 265677

PLANNING OF ROAD PROJECTS-EARTHWORKS, PORTUGAL

Methods of photographic surveying and electronic calculation which were used in motorway and main road projects, have now been extended to projects for roads of low traffic volume. Efforts are described which have been designed to make aerial photographic surveying an economic process. Instead of plotting topographical plans on a medium scale, photographic plans were plotted whenever possible on scales of 1/5000 and 1/10,000, mounted on general photographs on a scale of 1/25000, and, if they exist, on maps of the layout of the countryside on scales of 1/5000 and 1/2000. An experiment is reported which was carried out in mountainous area based on the aerial photographic coverage described and from which a 1/2000 scale plan was plotted. A check of the volumes of cutting and embankment made during the course of the works indicated that there was a difference of approximately 9 percent. In the area of earthworks, greater use is reported of geotechnical studies supported by geology and geophysics. Soils are classified in accordance with characteristics of grading obtained by summary analysis, liquid limit, plastic limit and sand equivalent. A study is also made of the ground on which embankments will be constructed. Types of ground are classified in terms of cutting strength or in terms of the need to make use of explosives. The best soils having a sand equivalent greater than 10 are used for the top layers. The treatment of the upper layers of earthworks and the construction of earthworks are briefly reviewed.

Presented at the XIVth World Road Congress, Prague, Czechoslovakia, 1971.

Pinto, JR Boavida, JDCG Veloso, MMR Castilho, AN Silva, NP Dias, MFM
Permanent International Association of Road Congr Book I-20, 1971, 10 pp

2A 265682

PLANNING OF ROAD PROJECTS-EARTHWORKS, USSR

The results of field methods for determining the strength characteristics of soils are presented, a method of determination of moisture conductivity

coefficient is described, recommendations are presented for the improvement overwettered clay soils by the addition of quicklime and cement, and the problem is considered of the evaluation of the general and local stability of slopes of high fills and deep cuts as well as that of ensuring the required stability. Data on predicting the design characteristic of roadbed soils by the use of electronic computers are given. The need is emphasized for strengthening of the underlying soil of a road which is exposed to the repeated action of traffic. The characteristic features are discussed of fill construction at low temperatures, planning and constructing roadbeds in severe climates, road construction in peat-bog areas, as well as using soils with specific properties which are conditioned by their chemical and mineralogical composition. The methods of design and construction are described of frost-protective layers. The possibility of using local soils in such layers was investigated. The properties of local swelling soils were improved by addition of cement. Positive results were obtained by the use of synthetic porous materials such as foamplast. Measures are outlined for the draining of the upper part of the roadbed and so increase the stability of sections where the underground water is close to the ground surface.

Presented at the XIVth World Road Congress, Prague, Czechoslovakia, 1971.

Motylev, YL (All-Union Highway Research Institute, USSR)
Permanent International Association of Road Congr Book I-25, 1971, 28 pp, 11 Fig., 9 Tab., 13 Ref.

2A 265684 FLEXIBLE PAVEMENTS, BELGIUM

The development is reported of a practical method of pavement design and attention is drawn to the importance of the probability factor in any design method. A synthesis of the characteristics of vehicles and traffic to be used in pavement design is drawn up, and it is shown that it is possible to use a pseudo-elastic approximation for the calculation of the stresses in visco-elastic multilayer systems. Considerable experimental research has been undertaken into the systematic determination of mechanical properties under repeated stress (fatigue) and/or compression of various types of road making materials (fine soils, lean concretes, granular and bitumen bound materials). Systematic observations and comparisons were made of the behavior of 4 bituminous and macadamised base courses. Changes are reported of the characteristics of 18 types of bitumen recovered from an experimental asphaltic concrete road built in 1958. Base courses of stabilized materials and stress fatigue phenomena of lean concretes and bituminous coated materials are considered. Bituminous coated materials are discussed, as well as thin surfacings such as sand asphalts, slurries and tacky coats.

Presented at the XIVth World Road Congress, Prague, Czechoslovakia, 1971.

Reichert, J (Road Research Centre, Belgium)
Permanent International Association of Road Congr Book II-2, 1971, 40 pp, Tabs.

2A 265687 FLEXIBLE PAVEMENTS, FINLAND

Waxy bitumens are less suitable for road bitumen purposes, especially owing to their weak resistance to the effects of water and poor rheological properties at low temperatures. On the other hand, road oil derived from waxy crude oil and used with a proper adhesive agent is quite suitable for, e. g. cold-mixed oil gravel pavements. The use of studded tyres increased rapidly in Finland so that by February, 1969, 75 per cent of the total road traffic travelled on studded tyres. The average wear sustained by asphalt pavements has been about 10 mm after one million runs. The circular test track has proved to be highly successful in comparing the resistance of different pavements to the action of studded tyres. The most resistant asphaltic pavements have proved to be dense-graded asphalt mixtures rich in mortar, and precoated coarse chippings rolled into the surface. The surface dressings also have good resistance to studded tyres. The best binder is hot bitumen, followed by cationic asphalt emulsion. Cold-laid asphalt pavements are not as resistant to studded tyres as are hot mix pavements. Thin wearing courses are not resistant to the action of studded tyres and therefore are no longer used on pavements for motor traffic. / Author /

Presented at the XIVth World Road Congress, Prague, Czechoslovakia, 1971.

Niemi, A (State Institute for Technical Research, Finland)
Permanent International Association of Road Congr Book II-6, 1971, 10 pp, 1 Fig., 1 Phot.

2A 265691 FLEXIBLE PAVEMENTS, GREAT BRITAIN

In an effort to make a realistic assessment of the theoretical approach to pavement design (both in its own right and as a means of evaluating field concentrated on the fatigue and deformation characteristics of road materials, including the soil foundation. Investigations into the properties of binders are reported. Epoxy bitumen used in conjunction with artificial aggregates of high PSV, is now being increasingly used to treat pavements in areas of specific traffic hazard, where the high cost can be justified. Attention has been given to continuous methods of test to ensure the compliance of bituminous materials with specification. The increasing use of coated materials has led to developments in mixing and laying plants, particularly in the direction of automation and wire-guidance. Procedures are being developed to help the engineer to decide when maintenance is required and its necessary extent.

Presented at the XIVth World Road Congress, Prague, Czechoslovakia, 1971.

Law, WM (Asphalt and Coated Macadam Association, London)
Permanent International Association of Road Congr Book II-10, 1971, 22 pp, 9 Fig.

2A 265693 FLEXIBLE PAVEMENTS, IRELAND

This paper describes the methods evolved for input of non-linear stress-strain relationships in finite element analysis of multilayer systems. Functional relationships for behaviour of pavement materials subjected to transient stresses are formulated. Parameters in these relationships are interpreted from the standpoint of repeated load triaxial compression tests. The displacement field for a typical pavement configuration is determined on the basis of the non-linear materials' responses. The computer program is based on direct stiffness matrix, axially symmetric stress distribution and continuity of strains across layer interfaces. In addition to handling stress dependent moduli, there is provision for dealing with non-tensile layers and axle load repetitions. Separation of the displacement field into recoverable and permanent components is achieved in the program. The digital computer program, DYNASTCO, was developed at The Computer Laboratory, C.S.R., University of Dublin. / Author /

Presented at the XIVth World Road Congress, Prague, Czechoslovakia, 1971.

Glynn, TE
Permanent International Association of Road Congr Book II-12, 1971, 18 pp, Figs., Refs.

2A 265694 FLEXIBLE PAVEMENTS, SWEDEN

The problems of design and choice of materials within the framework of a highway and motorways network are discussed, as well as problems relating to the maintenance and strengthening of the surfaces of the road network. The construction of flexible pavement of an average or heavy type with surface layers of bituminous concrete is described. The interpretation of pavement behavior under traffic and atmospheric conditions is also reviewed. Possible solutions are suggested to the phenomenon of fatigue in coated bituminous materials. Calculations and checks, deflections and strengthening are other aspects considered. The characteristics of bituminous binders in respect of methods of manufacture are considered. The revising of standards and research programs, the use of additives to improve binders, and properties of bituminous binders are reviewed. A discussion of pavement structure covers such aspects as cement-gravel, the control testing of gravel, and the control testing of the compaction of bituminous courses. Physical and rheological characteristics of bituminous concrete, the choice of aggregates, and spreading and compaction processes are also considered. The maintenance of pavement courses is briefly reviewed.

Presented at the XIVth World Road Congress, Prague, Czechoslovakia, 1971.

Anderson, O Rosengren, A Lilja, B (National Swedish Road & Traffic Research Institute)
Permanent International Association of Road Congr Book II-22, 1971, 19 pp, 11 Fig., 1 Tab.

2A 265709 CONCRETE PAVEMENTS, BELGIUM

Innovations are described in the field of concrete surfacing, particularly in the field of design, reinforced and non-reinforced pavement, materials and

manufacture, and maintenance. The principal pavement designs used in Belgium are outlined, and the results are presented of theoretical and experimental research in regard to design which relate to quality criteria, vehicles and traffic, theory of multi-layer systems behavior, mechanical properties of the materials, and the influence of seasonal weather conditions. Jointing problems in reinforced and non-reinforced pavements are discussed, as well as the composition of concrete for slip form pavers and rural roads. The surface treatment of cement concrete pavements for improvement of the coefficient of skid resistance is also discussed. A review of maintenance covers such aspects as the repair of cement concrete road surfaces, restoring the rugosity of cement concrete roads, surface damage caused by chemical solutions, and the measurement of scaling.

Presented at the XIVth World Road Congress, Prague, Czechoslovakia, 1971.

Doyen, A (Ministry of Public Works, Belgium)
Permanent International Association of Road Congr Book III-2, 1971, 39 pp, 13 Fig., Tabs.

**2A 272008
PAVEMENT DESIGN: THE FATIGUE SUBSYSTEM**

This paper develops the framework for the symposium on the technology necessary to design airfield and highway pavements to minimize fatigue distress. The paper summarizes the steps required to determine whether a particular pavement section will be subject to fatigue from a series of traffic loads (applied during some specified time period). The diagram of a fatigue subsystem is presented in which each aspect is considered in a stepwise progression. An example is included to illustrate the application of the procedure to determine the potential for fatigue cracking in an existing pavement consisting of an asphalt concrete layer and a base and subbase composed of untreated granular material. The traffic information necessary for highway pavements and airfield pavements is outlined and the methodology for estimating traffic is discussed. The lateral distribution of aircraft on both taxiways and runways should be considered to ensure an economical design. The distribution of temperature within layers containing asphalt-bound materials should be determined, as well as the influence of environment as it influences the water contents (or effective stresses) of materials constituting pavement sections. The construction requirements and effects are outlined and the design of the structural section is discussed. Materials consideration is reported and the structure analysis and fatigue property determination are reviewed. The aspect of fatigue life estimation is covered. An example is presented here (of a pavement designed for a 10-year life) which demonstrates the feasibility of design to preclude fatigue, and illustrates many of the concepts described in detail in the symposium papers.

Appeared in Structural Design of Asphalt Concrete Pavements to Prevent Fatigue Cracking. Proceedings of a Symposium held January 22, 1973.

Monismith, CL (California University, Berkeley) *Highway Research Board Special Reports* No. 140, 1973, pp 1-19, 11 Fig., 6 Tab., 6 Ref.

PURCHASE FROM: TRB Repr. PC

**2A 272049
ANALYSIS OF QUESTIONNAIRE ON AGGREGATE DEGRADATION**

A tabulated summary is presented of the results of a questionnaire survey which was conducted to evaluate the extent and seriousness of the problem of aggregate degradation in highway construction in the U.S. and Canada. The results of the survey are analyzed and the interrelationships between these questions are considered. It was determined that certain conclusions may be drawn regarding the relationship between such factors as (1) the type of aggregate and the seriousness of degradation (2) the various combinations of quality control tests utilized and the degree of protection provided against acceptance of poor quality material. It is concluded from the findings that when comparing physical degradation versus chemical, the physical degradation problem is the more troublesome. The relative seriousness of the various forms of degradation is influenced by the type of aggregate. Sixty-two percent of those states reporting problems with volcanic aggregate attributed difficulties to both chemical and physical degradation. Replies also indicated that uncoated aggregate is the major problem in respect to degradation. Data indicates that an abrasion test should be combined with either a soundness or wet abrasion if confidence in the testing program is to be achieved. Aggregate users indicate that the greatest need is in the area of methods of aggregate evaluation and secondly in assessing the severity of a particular use.

Hendrickson, LG Shumway, RD *Highway Research Circular* No. 144, July 1973, 9 pp, 5 Fig., 1 Tab., 1 App.

PURCHASE FROM: TRB Orig. PC

**2A 272092
LANDSLIDE INSTRUMENTATION FOR THE MINNEAPOLIS FREEWAY**

In 1967 a landslide developed along a section of freeway under construction in Minneapolis. The following procedure was undertaken to ensure the stabilization of the landslide and completion of the project: Instruments were installed to detect the depth and rate of movement, and exploration was undertaken to determine the properties of the material in the failure zone; a temporary buttress was placed to control the movements while corrective treatment was being designed; additional instruments were installed to monitor movements during construction of the permanent treatment; and, after completion, all instruments were maintained and additional instruments were installed to monitor post-construction movements, if any. The corrective treatment consisted of a series of slit-trench concrete buttresses anchored into limestone below the failure plane. Details of exploration, instrumentation, testing, and design are included in the paper.

Wilson, SD (Shannon and Wilson, Incorporated) *Transportation Research Record* No. 482, 1974, pp 30-42, 9 Fig., 1 Tab.

PURCHASE FROM: TRB Orig. PC

**2A 272108
MINIMIZING PREMATURE CRACKING IN ASPHALTIC CONCRETE PAVEMENT**

Based on an extensive review of available information from research and field experience, a series of recommendations have been prepared related to material specifications, mix design, structural materials selection and construction requirements that are intended to reduce the possibility of premature cracking of asphaltic concrete pavement. The recommendations assume that the pavement designer is using a suitable design method for selecting the thickness of various pavement layers to provide structural adequacy for the traffic, subgrade support, and climatic conditions. Possible procedures are reviewed for verification of the recommendations for minimizing premature cracking and suggestions are made for an approach to a more extensive future verification program. The recommendations which are suitable for immediate implementation, have been subjected to limited case history and analytical verification, and appear to confirm and quantify recent trends in the field of asphaltic concrete pavement design. The project findings are listed and discussed by type of cracking: fatigue cracking, low temperature cracking, and reflection cracking. Suggestions are made regarding implementation of the recommendations for minimizing premature cracking of asphaltic concrete pavement. Individual highway agencies can evaluate the recommendations against current practice and adopt any changes that are judged to be adequately verified in the report. Future observations of performance would indicate the effect of the changes. Individual modify, or expand specific recommendations. It is also suggested that a nationwide verification investigation be initiated based on Bayesian decision statistics. Two approaches to verifications are discussed: that involving the design of a factorial experimentation program and monitoring of performance using statistical analysis for evaluation of variables; and verification of an analytical model using a small experimental program and case histories of in-service pavements. The recommendations dealing with (a) asphalt content and void content of asphaltic concrete, (b) density of untreated aggregate base courses, and (c) subsurface drainage where accumulation of water is a problem, appear to be well documented and suitable for immediate implementation.

An NCHRP staff digest of the essential findings from the final report on NCHRP Project 9-4, "Minimizing Premature Cracking of Asphaltic Concrete Pavements" by F.N. Finn, K. Nair, and J. Hilliard, Materials Research & Development, Oakland, Calif.

Highway Research Board NCHRP Digest No. 58, Mar. 1974, 8 pp, 1 Fig., 4 Tab.

PURCHASE FROM: TRB Orig. PC

**2A 276022
LOW COST ROAD CONSTRUCTION**

The publication contains the following reports: Low Cost Roads in the Service of Agriculture, by Frowein, WA; Experiences in the Planning of the

Agricultural Road Network in Hungary, by Gaspar, L; Design of the Longitudinal Section of Agricultural Roads, by Hernandez, JL; Notes on Farm Roads, by Hruza, J; The Recent Planning and Traffic Loading of Agricultural Roads with Reference to Modern Agricultural Machines, by Klempert, B; The Quality of Agricultural Roads, by Kyritsis, S; Specification and Construction Method for Agricultural Roads Treated with Calcium Chloride, by Laporte, JG; Study of the Design of the Agricultural Road Network, by Leclerque, J and Therasse, R; The Stress on Agricultural Roads, by Moeser, H; Rationalization of Agricultural Road Construction, by Ott, R; Low Cost Road Construction--Diagnosis, Forecast, Therapy, by Seidel, J; Erosion at the Edges of Roads and in Fine-Grained Subsoil with Particular Reference to Victoria, Australia, by Turner, AK; and The Contribution Made by Agricultural Roads in a Catchment Area, by Wilson, TV and Lignon, JT. /TRRL/

Schriftenreihe d Dt Nationalen Komitees d Inter No. 4, 134 pp, Figs., Tabs.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 300442)

3A 025673

PREFABRICATION IN HARBOUR CONSTRUCTION WORKS--WITH SPECIAL REFERENCE TO CONDITIONS IN GREENLAND

Up to now most harbour works have been planned using prefabrication to a large extent but mostly with manufacturing of the elements in a plant in connection with the harbour site. The use of this method in arctic areas would require a much longer period for the construction than normal in warmer regions. To reduce the construction period it would be natural to move as much of the works as possible to factories in more industrialized regions so that the procedure on site would be a pure assembling of prefabricated elements. Prefabrication in this way combined with a really good planning of the constructing procedure would make works in the arctic less complicated and lower the costs. Due to short summer the construction period even small jobs last 2 or 3 years. The service functions in the villages are bad. The workers available are still not developed enough to make complicated craft. The materials all have to be transported from other parts except for the aggregates for the concrete. All those points invite the use of prefabricated elements from industrialized countries in the work, because the transport is more or less the same whether the elements are made or going to be made on site, the need for imported skilled workers is much less and the construction period shorter, so that the jobs can be completed in one summer. A problem with prefabricated constructions is always the joining of the elements and the fixing in the seabed. Under arctic conditions this problem however is even bigger due to the ice-pressures which can occur and because of the very often occurring lack of soft sediments overlying the rock, so that it is difficult to fix the structures in the bottom. All those problems have to be taken into account, but it is possible to solve them. Our moderate experiences in the field of harbour engineering in the arctic area are for Danish engineers limited to harbour works in Greenland. The paper presents some examples of prefabricated harbour structures which during the latest years have been applied in Greenland. Also presented are some examples of standard prefabricated elements which already exist on the market and which can be used in the harbour construction in arctic areas.

Abstract of paper delivered at the First International Conference on "Port and Ocean Engineering under Arctic Conditions" held at Trondheim, Norway, August 23-30, 1971

Steenfos, HP Rodevang, B (Bigum and Steenfos)
POAC Conference Aug. 1971

ACKNOWLEDGMENT: Arctic Institute of North America
PURCHASE FROM: Technical University of Norway Conference Chairman, Trondheim, Norway Orig PC

3A 037198

CHEMICAL GROUTING FOR PARIS RAPID TRANSIT TUNNELS

Special problems in the construction of subsurface structures for a new rapid transit railroad line in Paris, France. Consolidation of soils was provided by chemical grouting. Grouting technique was also used to consolidate the foundations of a bridge, over the tunnel. Silicate and resin grouting provided the consolidation without recourse to compressed air or dewatering. A classification of modern chemical grouts is given with their limits of injectability. Elaborate grouting procedures prove their efficiency in supplementing or replacing modern tunneling methods.

Janin, JJ LeSciellour, GF *ASCE Journal of the Construction Division* Vol. 96 No. C01, Paper 7382, June 1970, pp 61-74

ACKNOWLEDGMENT: EI (EI 70 38532)
PURCHASE FROM: ESL Repr PC, Microfilm

3A 039240

A SYSTEMS STUDY OF SOFT GROUND TUNNELING

A fundamental investigation of soft-ground tunneling operations was made to identify and assess the potential technical and economic feasibility of new tunneling system concepts. Quantitative estimates were made of costs and rate of advance of different candidate system concepts relative to an assumed set of tunneling conditions. The magnitude of R and D effort required to achieve cost reductions and performance improvements over the 1970 to 1985 time period was estimated. The study concludes that the major restraints to reducing costs and increasing performance in soft ground tunneling over the 1970 to 1985 time period will result from the lack of any effective method for handling bouldery ground and from the lack of a

method for rapid installation of the permanent tunnel liner continuously and concurrently with the advance of the face. With a 15-year R and D effort of \$35 to \$70 million, these problems could be substantially overcome and current tunneling costs could be expected to decrease by 40-65% and advance rates could be expected to increase by a factor of from 4 to 8. Cost differences among the more promising alternative system concepts were found to be small relative to the range of uncertainty associated with the cost forecasts. (Author)

Prepared in cooperation with Little (Arthur D.), Inc., Cambridge, Mass.

Brandt, CT Stone, RB Smith, AR Willis, BH Pastuhof, A
Fenix and Scisson Incorporated Final Rpt DOT-FRA-OHSGT-231, May 1970, 439 pp

Contract DOT-FR-9-0034

ACKNOWLEDGMENT: NTIS (PB-194769)
PURCHASE FROM: NTIS Repr PC, Microfiche

PB-194769, DOTL NTIS

3A 041554

CONSTRUCTION OF SAN-YO SHINKANSEN

On March 15, 1972 a section of the San-Yo Shinkansen, the high-speed railway network of Japan, was completed linking the cities of Shin-Osaka and Okayama. Trains now travel the 165-km distance in exactly one hour. Many aspects of the construction of this section which took 4 1/2 years to complete are described including: the techniques used to break through the faults and fractured zones and moistured soil at the 16.25-km long Rokko tunnel, the boring machine at the Saisho tunnel, the big john for the whole section boring at the Takatsuyama tunnel, the elevated track structure designed to reduce noise and vibration, the Kakogawa bridge where the cantilever block method was resorted to for construction, and the slab track that has drawn world-wide attention as an epoch-making track structure.

Kinbara, H Kamada, S *Rail International* No. 6, June 1972, pp 349-360, 5 Tab

PURCHASE FROM: International Railway Congress Association 17-21 rue de Louvain, 1000 Brussels, Belgium Repr PC

3A 041827

SHIP TRANSFER SYSTEM REDUCES BUILDING COSTS

Sea Transport Engineering has produced a ship transport system devolving on a Takraf Land-Transport system. It permits the movement of block sections or complete ships in a vertical plane without the use of gantry cranes. This transportation system is mainly by rail in a longitudinal and transverse direction, thus optimizing material flow while reducing equipment usage per ton of steel ratio. This system is mainly for ships up to 10,000 tons, providing a longitudinal slip for 1,000 tons, and a transverse slip of 3,500 tons. Sea Transport Engineering confirms that at least a 25% saving in man hours is possible, and considerable flexibility in contrast to a fixed production line is achieved.

Shipbuilding and Shipping Record Vol. 119 No. 18, May 1972, pp 23,25

ACKNOWLEDGMENT: United States Merchant Marine Academy (N-521)
PURCHASE FROM: Engineering, Chemical and Marine Press Limited 33-39 Bowling Green Lane, London EC1P 1AH, England Repr PC

3A 048064

SHIPBUILDING. VOLUME 15, NUMBERS 5-6 1970

The problem of building ships by assembling them from parts in a dry or floating dock arose in the mid-fifties with the increased demand for large ships. The majority of ships built this way are constructed in two 'halves' on longitudinal stocks. After the foreship has been launched as the second part of the two, both parts are joined in a dry dock. Dry docks can also be used for building hulls of ships with parameters exceeding those of the dry dock. In such cases the hull of a ship is built either without the bow part, or without the bow part and side tanks.

Trans. of Budownictwo Okretowe (Poland) v15 n5/6 p140-215 1970, by L. Przeradzki. The above journal is translated on a regular basis. Sponsored in part by National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.

National Marine Fisheries Service 1973, 84 pp

ACKNOWLEDGMENT: NTIS (IT-70-55126/5-6)
PURCHASE FROM: NTIS Repr PC

TT-70-55126/5-6

3A 057990

NEW "WORK UNIT" SYSTEM IN SHIPBUILDING

In order to retain efficient shipbuilding operations, from the point of view of both the safety of the workers and efficiency in the execution of the works, a new system was developed called the "work unit". In this article a general explanation of the "work unit" is made, followed by an explanation of the new shipbuilding system using the device under study. The development of this system, as well as example of the system including construction of the "work units" and the new working cycle, are also included in the article.

Minamizaki, K. Kurose, H (Ishikawajima-Harima Heavy Industries Company, Ltd) *Japan Shipbuilding and Marine Engineering* Vol. 7 No. 4, 1973, pp 28-35

ACKNOWLEDGMENT: National Maritime Research Center, Kings Point (N-870)

PURCHASE FROM: Japan Association for Technical Information 4-7-107, Yamazaki-cho, Machida City, Tokyo 194-01, Japan Repr. PC

3A 090570

ADVANCING FORMWORK

THE ARTICLE DESCRIBES A SYSTEM OF ADVANCING GIRDERS AND FORMWORK DEVELOPED IN EUROPE FOR MULTI-SPAN BRIDGE CONSTRUCTION. THE SYSTEM IS SUITABLE WHERE INTERMEDIATE SPANS AND CROSS-SECTION PROFILE ARE CONSTANT. GROUPS OF HEAVY-DUTY STEEL GIRDERS BRACED TOGETHER SUPPORT ONE SPAN, ONE END, CONTROLLED BY HYDRAULIC JACKS, BEING SUSPENDED FROM THE UNDERSIDE OF THE PREVIOUS SPAN, AND THE FORWARD END CANTILEVERED QUARTER SPAN PAST THE NEXT SUPPORT COLUMN. THE POSITIONING OF HYDRAULIC JACKS, ROLLERS AND MACHINE SKATES AT THE SUPPORTS IS DESCRIBED. CLOSE JOINTED BOARDING IS SUITABLE FOR FORMWORK AND CAN BE HINGED TO ALLOW CLEARANCE AT THE SUPPORT COLUMNS WHEN GIRDER GROUPS ARE REPOSITIONED. CONCRETE IS PLACED IN ONE CONTINUOUS POUR TO FULL WEIGHT, STARTING AT THE LEADING CANTILEVER NOSE. VARYING AMOUNTS OF RETARDER ARE INCORPORATED INTO THE MIX TO ALLOW THE GIRDERS TO CHANGE SHAPE DURING POURING AND TO INSURE UNIFORM INITIAL SET. STRESSING IS APPLIED AS SOON AS THE CONCRETE STRENGTH PERMITS. AFTER JACKING DOWN ONTO THE ROLLERS AND MOVING SIDEWAYS FOR CLEARANCE, THE GIRDERS AND FORMWORK ARE WINCHED FORWARDS AND REPOSITIONED FOR THE NEXT SPAN. THE CONSTRUCTION OF THE ROMBERGSHOLZ VIADUCT IS DESCRIBED TO ILLUSTRATE THE USE OF THE SYSTEM.

Turner, CF Knight, JF *Civil Engineering* No. 814, Apr. 1974, pp 22-25, 2 Fig.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 209951)

3A 080701

TWO TECHNIQUES FOR THE CONSTRUCTION OF CONTINUOUS PRESTRESSED CONCRETE BRIDGE DECKS ON TALL SUPPORTS

THE PAPER DESCRIBES TWO TECHNIQUES FOR THE CONSTRUCTION OF CONTINUOUS PRESTRESSED CONCRETE BRIDGE DECKS RESTING ON TALL SUPPORTS. ONE OF THEM INVOLVES PRECAST SEGMENTAL CONSTRUCTION USING A SERVICE GIRDER, AND THE OTHER A THREE-UNIT CAST IN SITU METHOD USING TEMPORARY TRESTLES AND ERECTION-SPANS.

Raina, VK *Indian Concrete Journal* Vol. 48 No. 1, Jan. 1974, pp 26-27, 2 Fig.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 210216)

3A 080702

PIPE JACKING-A TECHNIQUE FOR SOFT GROUND TUNNELLING

THE PAPER DEALS WITH PIPE JACKING, A TECHNIQUE WHICH IS DESIGNED FOR THE CONSTRUCTION OF SEWER LINES, PEDESTRIAN SUBWAYS, IRRIGATION CONDUITS, ETC, BELOW GROUND WITHOUT DISRUPTING THE SURFACE AMENITIES. THE METHOD IS PARTICULARLY APPLICABLE TO SOFT GROUND WHERE TRADITIONAL MINING AND TUNNELLING PROCESSES MAY BE DIFFICULT. THE PAPER ALSO CITES BRIEFLY SOME PROJECTS WHERE THIS TECHNIQUE HAS BEEN EMPLOYED SUCCESSFULLY.

Basu, NK (Cementation Company Limited) *Indian Concrete Journal* Vol. 47 No. 9, Sept. 1973, 8 pp, 2 Fig., 6 Phot., 9 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 210210)

3A 080814

THE TRANS-ALASKA PIPELINE PROJECT

Innovative methods and equipment are described which are utilized or being developed for utilization in the Trans-Alaskan project. These include special trenching machines, chain saw rock cutters, pipe bedding and padding compactors, protection systems for workmen, tie-in positioning clamps, lift platforms, and warming equipment for pipes. Backhoes that dig pipe trench, bridge wings that support pipeline and installation methods that adapt to site requirements are reviewed. Thirty eight innovative drills and vertical support members set by coordinated machine lineup are also described. The following unusual features are outlined: installation unit, cement placement unit, sand slurry placement unit, sand-cement transport, sand transport and water transport.

Lee, RE Smith, L Donnelly, CW *Construction Methods and Equipment* Vol. 56 No. 12, Dec. 1974, pp 32-38, Figs., Photos.

3A 080826

SYSTEMS APPROACH TO FLEXIBLE PAVEMENT DESIGN AND MANAGEMENT

A project is reported which resulted in the improvement of the computer program, SAMP5, to an operational program, SAMP6, which provides a basis for selecting flexible pavement design and management strategies with the lowest predicted total cost over a prescribed analysis period when considering such cost elements as initial construction, routine maintenance, periodic rehabilitation, interest on investment, salvage value, and roadway user costs. The SAMP6 program uses the AASHTO Interim Guides as its structural subsystem and the predicted decreases in serviceability with time and traffic as developed at the AASHTO Road Test. The SAMP6 is capable of considering all aspects of the systems approach to pavement design and management except those of the cost of seal coats and the cost of skidding accidents. The program requires 12 classes of input variables: program control and miscellaneous variables, environmental serviceability, traffic and reliability; constraint; traffic delay; maintenance; cross-section, cost-model, shoulder; track coat, prime coat, bituminous materials; wearing surface; overlay; pavement material; and shoulder material variables. The output of the SAMP6 program is provided in three parts: Summary of the input data; summary of the best design strategy for each material and layer combination; and a summary of the 80 best design strategies in order of increasing total cost per square yard of traffic lane. The results are given of a limited sensitivity analysis conducted to provide an indication of the influence of the individual variables on the output. As an illustration of the application of SAMP6, a comparison is described of the economics of staged construction and planned rehabilitation versus the "no-overlay", or a strong initial construction approach. Another illustration involved the effect of fluctuating material costs on optimum design.

An NCHRP staff digest of the essential findings from the final report on NCHRP Project 1-10A, "Systems Approach to Pavement Design Implementation Phase," by R. C. Lytton and W. F. McFarland, Texas Transportation Institute, College Station, Texas.

Transportation Research Board NCHRP Digest No. 62, July 1974, 8 pp, 1 Fig., 1 Tab.

PURCHASE FROM: TRB Publications Off Repr. PC

3A 080873

BOSPHORUS BRIDGE, ISTANBUL

THIS ARTICLE DESCRIBES THE BUILDING OF THE BOSPHORUS BRIDGE AND THE USE OF HIGH-PRESSURE SODIUM LAMPS FOR ITS LIGHTING. THE HISTORICAL BACKGROUND OF THE 1074M LONG SUSPENSION BRIDGE IS GIVEN. THE BRIDGE FLOOR IS OF BOX-GIRDER CONSTRUCTION AND IS SUSPENDED FROM FOUR 165M STEEL TOWERS. THE ROAD SURFACE COMPRISES A MIXTURE OF CONCRETE & ASPHALT. DIMENSIONS OF THE BRIDGE, WHICH HAS 6 MOTOR LANES AND A LOWER FOOTPATH, ARE INCLUDED. THE BRIDGE HAS TAPERED SIDES TO REDUCE WIND PRESSURE TO A MINIMUM. LIGHTING IS PROVIDED BY 400W SODIUM LAMPS MOUNTED ON 92M HIGH MASTS PLACED ON THE MEDIAN STRIP. THE 66 LIGHTING COLUMNS ARE SPACED AT 27M. LUMINANCE AND ILLUMINANCE ON THE ROAD SURFACE ARE 3.5 CD/M² AND 45 LUX RESPECTIVELY. HIGH-PRESSURE SODIUM LAMPS PROVIDE LIGHTING FOR THE APPROACH ROADS AND THE TOLL WAITING AREA. THE TOWERS ARE FLOODLIT BY 2000W MERCURY LAMPS. PHOTOGRAPHS ILLUSTRATE THE LIGHTING SYSTEM.

International Lighting Review Vol. 24 No. 4, 1973, pp 138-143, 3 Fig., 10 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 210220)

3A 080916

DIAPHRAGM WALLS AND ANCHORAGES. A REVIEW OF THE ICE CONFERENCE PAPERS: PART 1

In this article--the first of a two-part summary--a review is given of 13 of the 26 Papers presented at an international conference on diaphragm walls and anchorages. These are the Papers presented during the first three sessions of the conference and are all related to diaphragm walling. Paper 1 listed the wide range of applications of the diaphragm wall technique, and then went on to describe the practical limitations of the method in highly permeable strata, in very soft soils, in hard strata or where there is a high water table. Paper 2 described four cases in the UK where diaphragm walls have been used to construct self stable structures. Various shaped load bearing diaphragm wall elements were considered in Paper 3, where their use was compared with concrete cast-in-place piles formed in temporary casings. Paper 4 described the advantages of slurry trench diaphragms as cut-off walls and for remedial measures in dams. Paper 5 considered the properties of bentonite slurries used in diaphragm walling. Paper 6 presented a method of designing multi-tied diaphragm type walls. Paper 7 described the design and construction of diaphragm walls as temporary and permanent retaining walls for the basements of a complex structure. Paper 8 discussed the studies carried out on load bearing diaphragm walls at Kensington and Chelsea Town Hall. Paper 9 discussed the proposed design for a multi-story underground car park in Amsterdam incorporating a circular diaphragm wall 0.8 m thick. The principles of the diaphragm wall technique and the different types of equipment which may be employed, highlighting their effect on vertical and horizontal tolerances, were described in Paper 10. The Prefasif system of diaphragm wall construction in which the slurry trench is excavated by normal diaphragm wall technique using bentonite suspension for support of the sides was described in Paper 11. Paper 12 described the construction of diaphragm walls and slab piles for the A13 motorway in Paris. Paper 13 reviewed the method used for the support of a basement excavation 16.5-20.5 m deep and having a plan dimension 154 m by 122 m, at the Centre Beaubourg, Paris.

Hanna, TH (Sheffield University, England); West, AS (Federation of Piling Specialists) *Ground Engineering* Vol. 7 No. 6, Nov. 1974, pp 27-30, 3 Fig., 3 Tab., 1 Phot.

3A 080979

SLIP-FORM CONSTRUCTION OF HIGHWAY APPURTENANCES

This paper describes slip-form construction techniques for widening and resurfacing, curb and gutter building, single-lane concrete paving with integral curb, and concrete safety barrier. Formerly, most of this type of construction was done by using forms and hand tools. Labor requirements were high, and production rates were low. In recent years development of specialized slip-form equipment by contractors and equipment manufacturers has revolutionized this type of concrete construction. The authors

describe some of the equipment available and the wide variety of equipment that provides for interchangeable mules or forms to shape concrete to almost any cross section. The paper presents some recommendations on suitable concrete mixes and finishing techniques for this type of work.

Presented at the 6th Summer Meeting of the Transportation Research Board in cooperation with the Washington Department of Highways, August 6-8, 1973, Olympia, Washington.

Ray, GK Lokken, EC Robbins, EG (Portland Cement Association) *Transportation Research Board Special Reports* No. 148, 1974, pp 50-56, 2 Tab., 13 Ref.

PURCHASE FROM: TRB Publications Off Repr. PC

3A 080980

POSTTENSIONED CONCRETE PAVEMENT

This report covers the initial main-line installation of a posttensioned concrete pavement in Pennsylvania. A pavement thickness of only 6 inches was possible through the use of posttensioned strands in the slab. The installation was a single slab 500 feet in length and 24 feet wide. It rests on 3-in. bituminous concrete base and a 9-in. subbase, with a slip plane provided between the base and slab. There are 10 longitudinal strands in the slab as well as transverse reinforcement. The construction methods used and details of placement and materials are discussed. Concrete was placed over the strands by conventional slip-form paving equipment. Hydraulic jacking was used to apply tension in two increments during the curing period. Posttensioning promises to provide a crack-free pavement structure, thereby eliminating a source of deterioration and need for maintenance. It is too soon to make conclusions on the performance of this installation, although cracks have not appeared. The future of posttensioned pavement will depend mainly on cost of construction and benefits in relation to other pavement types.

Presented at the 6th Summer Meeting of the Transportation Research Board in cooperation with the Washington Department of Highways, August 6-8, 1973, Olympia, Washington.

Gramling, WL Brunner, RJ (Pennsylvania Department of Transportation) *Transportation Research Board Special Reports* No. 148, 1974, pp 57-64, 6 Fig., 7 tab., 4 Ref.

PURCHASE FROM: TRB Publications Off Repr. PC

3A 080981

NEW CONSTRUCTION EQUIPMENT AND TECHNIQUES FOR AIRPORTS

This paper discusses some of the new techniques and equipment used to construct the mammoth Dallas/Fort Worth Airport. As a background to this discussion, the author gives some of the advantages and disadvantages in using new equipment. To give an indication of the magnitude of the Dallas/Fort Worth Airport project, the author relates some of the quantities of materials used on the project. He goes on to mention some of the problems in meeting the contract specifications and tells how they were resolved.

Presented at the 6th Summer Meeting of the Transportation Research Board in cooperation with the Washington Department of Highways, August 6-8, 1973, Olympia, Washington.

Cloud, BB (Zachry (HB) Company) *Transportation Research Board Special Reports* No. 148, 1974, pp 65-68

PURCHASE FROM: TRB Publications Off Repr. PC

3A 080982

A REVIEW OF FIELD APPLICATIONS OF FIBROUS CONCRETE

The use of fibrous concrete as an overlay or resurfacing material has been tested in many field research projects. These projects have been designed to test thickness requirements, fiber requirements, mix design, jointing requirements, placement conditions, and construction procedures. Several tests have been conducted of fibrous concrete resurfacing on airport taxiways, urban expressways, arterials, residential streets, and bridges, and the results of some of these tests are discussed.

Presented at the 6th Summer Meeting of the Transportation Research Board in cooperation with the Washington Department of Highways, August 6-8, 1973, Olympia, Washington.

Yrjanson, WA (American Concrete Paving Association) *Transportation Research Board Special Reports* No. 148, 1974, pp 69-79, 13 Fig., 3 Tab.,

Photos., 2 Ref.

PURCHASE FROM: TRB Publications Off Repr. PC

3A 080986

COOLING OF HOT-MIXED ASPHALT LAID ON AN INSULATED BASE

The cooling of hot-mixed asphalt laid on an insulated base was studied to determine the feasibility of using thin insulation to permit cold-weather paving of thin mats on an existing pavement. A computer program was developed to predict the temperature distribution in the mat, insulation, and base. Bench-scale laboratory tests were conducted to verify the validity of the computer program. The computer program was then used to simulate cold-weather paving for field conditions. The results were analyzed statistically to determine the variables that significantly affect the time available for compaction. A step-wise multiple linear regression program was used to develop equations that would give the time available for compaction as a function of these significant variables and their interactions. In addition, a nomogram was constructed to predict the time available for compaction graphically. The results of this study indicated the possibility of using thin insulation for cold-weather paving.

Presented at the 6th Summer Meeting of the Transportation Research Board in cooperation with the Washington Department of Highways, August 6-8, 1973, Olympia, Washington.

Shah, ND Dickson, PF (Colorado School of Mines) *Transportation Research Board Special Reports* No. 148, 1974, pp 106-112, 7 Fig., 1 Tab., 5 Ref.

PURCHASE FROM: TRB Publications Off Repr. PC

3A 080987

PREFABRICATED SANDWICH PANELS FOR BRIDGE DECKS

Based on the generally recognized superior strength-weight characteristics of sandwich panels, a study program was carried out to test a new type of compositely acting steel-concrete sandwich panel for use in bridge decks. Basically, the sandwich panel consists of two thin-faced plates of steel joined by a series of round shear-spacer studs welded to their inner surfaces. The core between the plates is made of lightweight concrete using expanding cement to induce a small prestress into the system. Laboratory tests were made on 10 small-scale panels, some loaded with a concentrated load and others with a uniformly distributed load. Mathematical theories developed for this type of panel show a generally satisfactory correlation between tests and theory. A number of solutions that take into account practical fabrication and erection problems are offered to illustrate how such panels can be bolted or welded, either longitudinally or transversely, across standard steel bridge girders. A comparative investigation indicated that these panels are substantially stronger and stiffer than normal reinforced concrete slabs that use the same quantity of concrete and steel.

Presented at the 6th Summer Meeting of the Transportation Research Board in cooperation with the Washington Department of Highways, August 6-8, 1973, Olympia, Washington.

Zuk, W (Virginia Highway Research Council) *Transportation Research Board Special Reports* No. 148, 1974, pp 115-121, 16 Fig., 1 Tab., Photos., 6 Ref.

PURCHASE FROM: TRB Publications Off Repr. PC

3A 080988

USE OF PRESTRESSED, PRECAST CONCRETE PANELS IN HIGHWAY BRIDGE CONSTRUCTION

A beam and slab bridge that makes use of precast, prestressed panels was investigated. For this type of bridge, both the panels and the beams are precast and prestressed in the casting yard. In the bridge structure, the panels span the transverse distance between beams and serve as forms for the cast-in-place portion of the deck. They remain in place to become an integral part of the continuous structural slab. Composite action is obtained when the deck elements and the beams are bonded together by the cast-in-place concrete. Tests were made to determine the ability of this type of bridge to distribute wheel loads in a satisfactory manner and to behave as a composite unit. A full-scale, simple span, prestressed panel concrete bridge was constructed and structurally tested in the laboratory. The bridge was subjected to cyclic applications of design loads and finally to static failure loads. It performed satisfactorily under all load conditions. Several bridges of this type have been in service in Texas for 10 years and have performed well.

Presented at the 6th Summer Meeting of the Transportation Research Board in cooperation with the Washington Department of Highways, August 6-8, 1973, Olympia, Washington.

Buth, E Furr, HL Jones, HL (Texas Transportation Institute); Butler, HD (Texas Highway Department); Toprac, AA (Louisiana Department of Highways) *Transportation Research Board Special Reports* No. 148, 1974, pp 122-135, 13 Fig., 7 Tab., Photos., 8 Ref.

PURCHASE FROM: TRB Publications Off Repr. PC

3A 080989

BRIDGE REPLACEMENTS WITH PRECAST CONCRETE PANELS

Methods of replacing existing distressed bridge deck slabs with precast concrete panels are presented. The general nature of the problem is explored, and the nature of force transfer in a bridge deck system is examined. The various methods of connection between adjacent slab panels and between the slab and stringer are then developed on a rational basis. Eight types of slab-stringer connections are detailed. Many of these would developed composite action. Some connections are welded, and others are bolted. Several types of shear connectors are used. A construction method is suggested that (a) presents a rehabilitated structure that is compatible in strength to the original, (b) provides rapid construction that causes minimal interference to normal traffic, and (c) allows full traffic capacity to be maintained during peak periods.

Presented at the 6th Summer Meeting of the Transportation Research Board in cooperation with the Washington Department of Highways, August 6-8, 1973, Olympia, Washington.

Biswas, M Iffland, JSB Schofield, RE (URS/Madigan-Praeger, Incorporated); Gregory, AE (New York State Thruway Authority) *Transportation Research Board Special Reports* No. 148, 1974, pp 136-148, 29 Fig., 9 Ref.

PURCHASE FROM: TRB Publications Off Repr. PC

3A 081051

THE "NEW MIDLANDS ROAD" TO SOUTH WALES. MACHINE LAID UNREINFORCED CONCRETE CARRIAGEWAYS

Details are given of the design and construction of the third section of the New Midlands Road. This five-mile-long section starts just north of Raglan and ends east of Usk. The line of the road follows an abandoned railway track. Dual two-lane unreinforced concrete carriageways are provided to near motorway standard and vehicular access is limited to the two-level interchanges at Usk and Raglan. Attention is drawn to the construction methods and equipment used.

Roads and Road Construction Vol. 48 No. 575, Nov. 1970, pp 339-370, 15 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 58032)

3A 081064

UTILISATION OF PLANT ON A ROADWORKS CONTRACT

The author discusses three methods commonly used for programming roadworks: the bar chart, the critical path network, and the time/location chart, and points out the advantages and disadvantages of each. Various operations involved in a roadworks contract, i.e. site clearance, earthworks, drainage, sub-base, road base and surfacing construction, kerbing, bridge construction, are briefly described together with the construction equipment needed for each operation. Brief mention is made of the maintenance of plant.

Perkins, JT *Institution of Municipal Engineers, Journal of* Vol. 98 No. 2, Feb. 1971, pp 39-34, 1 Tab.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 59665)

3A 081108

DETAILING FOR STANDARD PRESTRESSED CONCRETE BRIDGE BEAMS

THIS BOOKLET GIVES INFORMATION ON THE DETAILING OF REINFORCED CONCRETE BEAMS THAT ARE MADE TO A

SERIES OF STANDARD SECTION SHAPES FOR BRIDGE CONSTRUCTION. ITS OBJECT IS TO GIVE METHODS WHICH AVOID DETAILS HAVING AN UNDESIRABLE EFFECT ON PRODUCTION, EFFICIENCY OR SUBSEQUENT PERFORMANCE. SEPARATE SECTIONS OF THE BOOKLET GIVE INFORMATION ON THE VARIOUS FEATURES OF BEAM CONSTRUCTION. THE FIRST DEALS WITH THE CONCRETE USED AND INCLUDES NOTES ON STRENGTH REQUIREMENTS, COMPACTION, DEFECTS INCLUDING CRACKING, AND CURING METHODS. THIS IS FOLLOWED BY THE DETAILING OF PRE-TENSIONED STEEL, INCLUDING DATA ON STRAND PATTERN DEBONDING AND DEFLECTING, AND THE EFFECT OF STIRRUP GEOMETRY, SECONDARY REINFORCEMENT IS THE SUBJECT OF THE NEXT SECTION INCLUDING NOTES ON VERTICAL STEEL AT BEAM ENDS AND STIRRUP LOCATION AND FIXING. PALLETES AND SOFFIT AND SIDE FORMWORK ARE DEALT WITH, TOGETHER WITH THE DETAILING OF SKEW; A TABLE GIVES INFORMATION ON RATIONALIZED SKEW ANGLES. THE USE OF CAMBER TO OFFSET LONG TERM DEFLECTION, THE REDUCTIONS OF BOWING AND THE EFFECT OF DEBONDING SKEW BEAMS ARE DISCUSSED. THIS IS FOLLOWED BY NOTES ON LIFTING POINTS AND EDGE BEAMS. THE BOOKLET CONCLUDES WITH NOTES ON THE SITE ERECTION PROCEDURES WHICH HAVE A BEARING ON DETAILING.

Green, JK
Cement and Concrete Association Standard Publication 46.018, Dec. 1973, 22 pp, 18 Fig., 1 Tab., 10 Phot., 14 Ref.

ACKNOWLEDGMENT:

3A 081115
CONSTRUCTION PUMPS [Baupumpen]

Piston and semi-rotary pumps are not yet used very much in construction operations. The membrane pump has retained its place on the construction site as it is safer and less sensitive. Rotary pumps are hardly used in construction operations. Centrifugal pumps nowadays play a significant part on the construction site. They are formed as one, two or multi-channel wheel pumps, and their importance was increased particularly by the development of the self-priming centrifugal pump. The submersible sewage handling pump is also used a great deal because of its low maintenance requirements. Most submersible pumps are formed as one and two channel wheel pumps. Various designs and makes are described in the article which also deals with deep-well pumps (under water pumps). Vacuum pumps and jetting pumps. [German]

Theiner, J *Strassenbau-Technik* pp 37-49, 21 Fig.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 300915)

3A 081143
TRENDS IN DEVELOPMENT IN CIVIL ENGINEERING AND UNDERGROUND CONSTRUCTION [Entwicklungstendenzen im Erd- und Tiefbau]

The author surveys the development of mechanized earthworks and underground construction the world over and describes new equipment shown at the 1972 Hannover Trade Fair. Emphasis is placed not on the constructional details, but on the possible uses of the equipment and its economic efficiency, together with its operational safety and ease of maintenance, transport and assembly. [German]

Kuehn, G *Baumaschine und Bautechnik* Vol. 19 N 1972, pp 327-362, 6 Fig.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 300862)

3A 081148
THE GLION TUNNELS ON THE LEMAN MOTORWAY [Les tunnels de glion sur l'autoroute du leman]

The project is outlined and details given of the ventilation, lighting, equipment, and entrance works. geological and hydrological conditions are outlined together with construction methods used, work progress, incidents on site during construction, strengthening by means of metal centering and cement injection. [French]

Guisan, F (Bonnard et Gardel) *Travaux* Vol. N No. 39, Oct. 1971, pp 17-27, 8 Fig., Photos.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 100120)

3A 081174
SCALE MODELS FOUND GOOD ROUTE TO SOIL

The use of scale models is discussed, and it is observed that they are well suited to basic studies of soil-machine relationships, and to comparative tests of configurations and operating conditions. Scale-model testing can afford greater control over test conditions, and experience proves it is feasible to make scale models of earth-moving equipment to yield reliable data for application to practical earth-moving. Correctly set up and operated model earthmoving machines have proved superior to full-scale equipment for observing basic soil phenomena. Scale-model testing for the scraper is outlined.

Sullivan, RJ (Caterpillar Tractor Company)
Society of Automotive Engineers Nov. 1964, 1 Fig.

3A 081220
SUBSURFACE INVESTIGATIONS FOR HIGHWAYS AND STRUCTURES

Definitions are set forth and the procedure is described which must be followed on subsurface investigations for highways and structures. Pilot borings (cut sections, fill sections) and design borings are covered. A discussion of the specifications for subsurface explorations covers such aspects as scope, affidavit of non-collusion, certificate of authorization, laws to be observed, permits and licenses, insurance requirements, boring samples and reports, wage rates, lines and grades, duration of contract, and protection of property. Observations are also made on supervision and foreman qualification. General remarks are made on construction methods. Construction methods for payment items are detailed and covers drive sample borings, core preparatory borings, core borings, thin wall steel tube drive samples, undisturbed-sample preparatory borings, undisturbed samples, vane shear test preparatory borings, vane shear test, anger borings, anger boring samples, mobilization and dismantling. Compensation is also discussed.

Mohr, HA
Boston Society of Civil Engineers Oct. 1964, 25 pp, 2 Fig.

3A 081248
PUMPING OF CONCRETE [Le pomage des betons]

A detailed description is given of pumping techniques for concrete. The factors influencing the pumping of concrete are reviewed: laitance, grading composition, consistency, water/cement ratio, admixtures, mixing, pipes, blowing, influence of atmospheric conditions, and prevention of blockages in the equipment. [French]

Schwing, MFW *Revue Technique du Batiment & des Constr Industr* No. 17, Mar. 1970, pp 23-48, 6 Fig., 12 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (JRRD 53812)

3A 081375
SPECS FOR YOUR FILES. EARTHMOVING PART II

A comparative earthmoving equipment specification chart is presented covering off-highway haulers, off-highway dump trailers, motor graders, rubber-tired rollers, steel rollers and vibratory rollers (self-propelled and towed). Data are presented of general features (maximum carrying capacity, overall length, ground clearance, shipping weight etc.), weight distribution, body, engine, transmission, and tires. Different models are considered of the various makes which include Athey, Caterpillar, Euclid, International Harvester, Isco Cline/Eject-All, Mack, Terex, Unit, V-Con, Wabco, Challenge-Cook, Fruehauf, Garwood, Hobbs, J.H. Holland, and Hyster.

Construction Methods and Equipment Vol. 56 No. 12, Dec. 1974, 16 pp, 6 Tab.

3A 081477

AMSTERDAM IS FIRST IN CONSTRUCTING A CONTINUOUSLY REINFORCED CONCRETE PAVEMENT WITH A SLIP-FORM PAVER [Amsterdam Legt-Als Eerste-Een Doorgaand-Gewapende Betonverharding aan met een Slipformpaver]

A continually reinforced concrete pavement, total area 21,000 sq. m, thickness 18cm, was constructed on a section of a dual-carriageway road. The width of each carriageway is 7.50m. On a roadbase of sand cement, thickness 20cm, a 5cm basecourse of gravel-sand asphalt was laid in order to improve the evenness of the base and to obtain a uniform thickness of the concrete layer. The reinforcement, composed of B50 steel bars, diameter 16mm, was assembled on the site. The transverse bars were placed at an angle of 60deg. with the alignment. The percentage of reinforcement is 0.75. The concrete was laid by means of a slip-form paver. Details of the construction method are described and some related aspects of concrete technology are discussed. It is concluded that the experimental use of a slip-form paver for this purpose has been successful. [Dutch]

Hille, GJA Vries, DJA Luitwieler, JA *Wegen* Dec. 1973, pp 371-381, 3 Fig., 4 Tab., 8 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 209818)

3A 081556

AFTER THE CONSTRUCTION OF THE OLERON AND NOIRMOUTIER VIADUCTS, ANOTHER VIADUCT 957M LONG IS BEING BUILT BETWEEN THE TREMBLADE AND MAREENES IN THE DEPARTMENT OF CHARENTE-MARITIME [Après cex d'oleron et de noirmoutier, un viade de 957M de long est en cours de construction entre la tremblade et mareennes en charente-maritime]

Details are given of a toll viaduct being built over the river La Seudre in the Department of Charente-Maritime. The structure, which should be opened to traffic at the end of the 1972 tourist season, is 957M long with access roads 3.5KM and 1.6KM long. The prefabricated curved deck consists of a tubular girder of trapezoidal shape which supports two cantilevers. The segments are transported on a truck running on rails and positioned by means of a launching beam. They are glued together and held with prestressing cables. The structure rests on 12 piers four of which are on footings, and eight on piles. The pavements of the access roads consist of a 20CM sand-bitumen layers, 8CM bituminous layer and 4CM asphaltic concrete layer. Observations are made on framework for the segments and on the difficulties arising from variations in height. Mention is made of a study conducted to accelerate setting and speed up handling. Costs are quoted. [French]

Pouget, E *Moniteur des Travaux Publics et du Batiment* Vol. 69 No. 1, Jan. 1972, pp 116-122, 5 Fig., 6 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 100117)

3A 081640

CONCRETE SLURRY GUNS [Bomba de Hormigon-(Canon Para la Proyeccion del Hormigon).]

AFTER DESCRIBING THE STATE OF THE ART OF CONCRETE IN CIVIL ENGINEERING, THE AUTHOR CLASSIFIES THE VARIOUS CONCRETE INGREDIENTS: CEMENT AND AGGREGATES, AND VARIOUS TYPES OF CONCRETE. THE CORRECT METHOD OF PLACING CONCRETE IS DISCUSSED AND A DETAILED STUDY MADE OF THE DIFFERENT TYPES OF CONCRETE PUMPS: PISTON PUMPS, ARCHIMEDEAN-TYPE PUMPS, HYDRAULIC PUMPS, COMPRESSED-AIR PUMPS. THE MAIN TECHNIQUES OF CONCRETE APPLICATION ARE OUTLINED TOGETHER WITH SEVERAL TYPES OF EQUIPMENT. THE FRENCH PUMP "MOINEAU", IS STUDIED IN DETAIL AS AN EXAMPLE. /TRRL/ [Spanish]

Cardoso, JL *Materiales Maguinaria Y Metodos Para la Constrac* No. 67, Dec. 1969, pp 877-87, 10 Fig., 14 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 100397)

3A 081654

EXPERIMENTAL STRETCHES OF ROAD [Les Sections D'Essai De Chaussees.]

A number of experimental stretches of road, approximately thirty in all was built in all regions in France. This article describes the conditions under which the experimental programme was established, the various construction techniques represented in the experiment and the main results obtained. The necessity of having a thorough knowledge of the pavement before strengthening and of the manufacturing conditions for materials and in-situ operational conditions was shown to be a first requirement. Measurements were taken of deformability, and the deformation of longitudinal and transverse profiles; the light-weight vibrator was used together with core boring for evaluating the pavement structure and its evolution. The importance and effects of heavy traffic were studied. [French]

Sauterey, R Siffert, M *Bulletin de Liaison des Lab des Ponts et Chaussees* No. 63, Jan. 1973, pp 83-91, 4 Fig., 1 Tab.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 101045)

3A 081693

USE OF DUALITY IN ELASTICITY. ADDITIONAL DATA ON THE REISSNER ENERGIES. EQUILIBRIUM OF A LAYERED ELASTIC SLAB RESTING ON A LAYERED STRUCTURE

[Utilisation de la Dualite en Elasticite-Complements sur les Energies de Reissner-Equilibre d'une Dalle Elastique Reposant sur une Structure Stratifiee.]

BY USING DUALITY IT IS POSSIBLE TO REDUCE TO A NUMBER OF FORMULAE PROBLEMS OF VARIATION FOUND IN ELASTICITY. SOME OF THESE FORMULAE ARE WELL ADAPTED TO NUMERICAL CALCULATION. FOR EXAMPLE, IT IS DIFFICULT TO NUMERICALLY MINIMISE BY COMPLEMENTARY ENERGY AS DIFFICULTIES OCCUR WHEN THE FINITE ELEMENT METHOD IS USED TO MAKE DISCRETE THE STRESSES WHICH VERIFY EQUILIBRIUM CONDITIONS. THE USE OF DUALITY ENABLES THIS DIFFICULTY TO BE SOLVED. THE EQUILIBRIUM OF A CONCRETE SLAB RESTING ON THE SOIL WAS STUDIED BY MEANS OF ANALYTIC FUNCTIONS. THE SLAB CAN SOME AWAY FROM THE SOIL UNDER THE ACTION OF APPLIED STRESSES (IN PARTICULAR STRESSES CAUSED BY TEMPERATURE). WITH DUALITY THIS PROBLEM CAN BE SOLVED NUMERICALLY. THE DATA USED IN THE CALCULATIONS ARE ON THE ONE HAND THE GEOMETRIC AND MECHANICAL PARAMETERS OF THE SLAB AND THE SOIL, ON THE OTHER THE APPLIED STRESSES. THE RESULTS ARE THE DISPLACEMENTS, THE STRESSES IN THE SLAB AND THE SLAB/SOIL CONTACT AREA ARE AN UNKNOWN. PRIOR NUMERICAL RESULTS AGREE WITH EXPERIMENTAL MEASUREMENTS. SOME EXAMPLES ARE PRESENTED. /TRRL/ [French]

Fremond, M *Annales de l'Institut Tech du Batiment Travaux Pub* No. 294, June 1972, pp 53-66, Figs., 20 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 100529)

3A 081742

CONSTRUCTION OF BITUMINOUS PAVEMENTS WITH A DEGREE OF EVENNESS AND A MINIMUM QUANTITY OF MATERIAL

Owing to the requirement that paved surfaces should be smooth and even, and still have a specified minimum thickness, new plans are constantly being devised to improve the surface quality of newly constructed surfacing. In this paper the problem is discussed with reference to the construction of bituminous overlays on existing airport pavements. It is shown how to deviate from a theoretically perfect plane to a plane deformed within certain tolerances without decreasing the serviceability. Thus the quantity of material required may be considerably reduced with corresponding financial benefits. Particulars of the method with respect to surveying, tolerances, the computer program, plant and construction techniques are given. /TRRL/ Conference held on July 28-Aug. 1, 1969.

Rauth, PL Hugo, F *Conference on Asphalt Pavements for So Africa Proc* Vol. 1 Session X, July 1969, 13 pp, 5 Fig., 8 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 58381)

3A 081743

ASPHALT CONSTRUCTION TECHNIQUES

A detailed description is given of the techniques required for asphalt construction with particular reference to Durban's Southern Freeway. The advantages of this type of construction for South African conditions are also considered and the contractor's problems discussed. /TRRL/

Conference held on July 28-Aug. 1, 1969.

Perry, J *Conference on Asphalt Pavements for So Africa Proc* Vol. 1 Session X, July 1969, 8 pp, 2 Phot., 3 Ref.

ACKNOWLEDGMENT:

3A 081759

BITUMINOUS PAVEMENT PRACTICE IN QUEENSLAND

This paper describes bituminous pavement design and construction practices both for lightly trafficked rural roads and for motorways and heavily trafficked urban roads in Queensland. Brief reference is made to pavement performance studies being currently carried out. /IRRD/

Murphy, HW *Asphalt Pavements for So Africa Conference (1st) Proceeding* 1969, 10 pp, 4 Fig., 2 Phot., 10 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 58387)

3A 081762

THE CONSTRUCTION OF DURBAN'S SOUTHERN FREEWAY

This paper is an account of a freeway constructed under difficult conditions. A deep strength asphalt design was adopted since the method of construction offered many advantages for design engineer and contractor alike and has been used extensively both in Europe and in the U.S.A. Details are given of the pavement and asphalt mix designs, the methods used for quality control at the plant and in the field, and the construction techniques employed. /IRRD/

Board, JR *Asphalt Pavements for So Africa Conference (1st) Proceeding* 1969, 14 pp, 5 Fig., 3 Tab., 2 Phot., 4 Ref.

3A 081766

WHERE DO CONCRETE ROADS STAND?

The author gives details of concrete road contracts in Great Britain for 1970 and reviews rigid pavement construction methods. /IRRD/

Beadle, D *Contract Journal* Vol. 241 No. 4790, June 1971, 5 pp, 5 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 61726)

3A 081770

MOTORWAYS IN NORTHERN IRELAND

There are at the present time 56 miles of motorway completed and opened to traffic in Northern Ireland, a further 7 miles under construction and a further 47 miles at the project stage. These motorways are similar to those in Great Britain except for the mound barrier on the central reservation, special curbing along each side of the pavement, and a continuous 4.5 ft-wide paved strip next to the fast lane of the pavement in the central reservation. Mention is made of the predominance of boulder clay and peat and construction methods used. Details are given of aggregates and materials utilized, concrete bridge design and construction, motorway lighting systems, and preliminary survey works. Costs are quoted. /IRRD/

This article is based on a paper presented at the Institution of Highway Engineers National Conference- Northern Ireland, July 5-7, 1971.

Allen, GWH *Roads and Road Construction* Vol. 49 No. 584, Aug. 1971, pp 278-281, 1 Fig., 1 Tab., 1 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 61955)

3A 081775

PUMPED CONCRETE THE KEY ON M5 BRIDGE BUILDING

Details are given of the methods and equipment used for the construction of 41 prestressed and reinforced concrete bridges on the 26.5 km stretch of the M5 motorway in Gloucestershire. /IRRD/

Contract Journal Vol. 242 No. 797, 1971, pp 616-617, 3 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 42447)

3A 081809

ROAD CONSTRUCTION IN THE CARIBBEAN

Details are given of the 14.1-mile main highway under construction between Chaguanas and San Fernando in Trinidad. It will provide two 24-ft pavements, 15 steel and reinforced concrete bridges and four underpasses, and seven miles of frontage roads. The works include earthworks, drainage, sub-base, bridges and culverts for both pavements, and the gravel base and asphaltic concrete for one pavements only. Mention is made of the soil along the route, earthmoving and compaction equipment. /IRRD/

Bowden, KS *Roads and Road Construction* Vol. 49 No. 585, Sept. 1971, pp 319-320, 3 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 42489)

3A 081917

BITUMINOUS STRUCTURAL SEALS WHICH RESIST WATER PRESSURE

Developments in methods of protecting engineering structures from the effects of ground water are discussed, with particular reference to bituminous seals and the necessary adaptation of specifications. Mention is made of experience gained in the protection of alpine tunnels in Switzerland, particularly the use of machines to place the seals, and the advantages and disadvantages of the different machines are explained. Details are given of various other projects in Germany where sealing was carried out. /TRRL/

Technical University of Munich, West Germany 55 pp, 98 Fig.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 300551)

3A 081918

MASTIC SURFACINGS STABILIZED WITH CHIPPINGS AND PLACED ON OKTA ADHESIVES AS SURFACINGS FOR ORTHOTROPIC BRIDGE SLABS

Practical experience has shown that the durability of surfacings on orthotropic decks can only be guaranteed if the surfacings are firmly bonded to the metallic base. They must also withstand thermal and traffic stresses and have sufficient stability at high temperatures. A satisfactory method of construction consists in placing an adhesive on the bridge deck and covering it with a mastic layer and a further protective layer. A new method which has been developed combines the advantages of a mastic layer and the protective action of gussasphalt in one layer. The mastic layer contains chippings which are twice crushed and screened and rolled in with a static roller and also has an admixture of highpolymers to improve the adhesion strength. Gussasphalt, fine asphaltic concrete or asphalt can be used as a top course. An important role is played by the Okta adhesive which also gives protection against corrosion. /TRRL/

Werding, J *Teerbau Veroeffentlichungen* No. 18, 1974, pp 99-105, 8 Fig., 10 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 300548)

3A 081919

SELECTION OF THE BEST SURFACE PROTECTION LAYER TO GO ON TOP OF BITUMINOUS WEARING COURSES

The author briefly considers the need for surface protection courses and describes methods of constructing these courses and their advantages and disadvantages. An evaluation of the courses under present day conditions shows that: 1- Treatment of a surface with a binder which has maximum adhesion and strength is sufficient for light and average traffic; 2-Speeds limits for two to three days and laying during warm weather are recommended; 3-Bituminous slurry may be used for roads carrying light to average traffic; And 4-binders currently available in the German Democratic Republic are such that traffic should not be allowed on the road immediately after the slurry has been laid. /TRRL/

Linemann, K *Strasse* Vol. 12 No. 3, Mar. 1972, pp 121-124, 6 Fig.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 300539)

3A 081922

USE OF AN ELECTRONICALLY CONTROLLED, TRACKED, GUSSASPHALT LAYING TRAIN DURING THE RECONSTRUCTION OF A SECTION OF MOTORWAY IN BAVARIA

One machine, which was developed especially for laying gussasphalt, has four tracked units carrying a frame which may be hydraulically raised and lowered, and may be electronically positioned by means of guiding sensors. Widths of material varying from 5 to 15.25 m can be laid. A special roller was developed for grooving the material after it had been laid; this also runs on tracks and is controlled electronically. Both machines came up to expectations on a motorway construction site; advantages include the fact that they are not rail-bound, and that they can be used on cement-stabilized gravel. /TRRL/

Kurek'Sa, VJRRK *Teerbau Veroeffentlichungen* No. 18, 1971, pp 38-41, 2 Fig.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 300522)

3A 081932

COMPOSITE STEEL AND CONCRETE CONSTRUCTION
THE DEVELOPMENT AND ECONOMICS OF COMPOSITE STEEL AND CONCRETE CONSTRUCTION ARE DISCUSSED. ITS ENGINEERING APPLICATIONS ARE DEALT WITH UNDER THE FOLLOWING CHAPTER HEADINGS: FUNDAMENTALS OF COMPOSITE ACTION; CONSTRUCTION METHODS; SHEAR CONNECTION; OTHER TYPES OF COMPOSITE CONSTRUCTION; COMPOSITE CONSTRUCTION IN BUILDINGS; COMPOSITE BRIDGES.

Knowles, PR
Surrey University, England Textbook 1973, 200 pp, Figs., Tabs., Refs.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 208787)

3A 081933

THE REGULARITY OF CONCRETE FLOOR SURFACES: A SURVEY OF CURRENT KNOWLEDGE

AN EXAMINATION OF ARTICLES, ADVISORY PUBLICATIONS, CODES OF PRACTICE, STANDARDS, TRADE LITERATURE AND RESEARCH REPORTS YIELDED VERY LITTLE INFORMATION ON THE SURFACE REGULARITY OF CONCRETE FLOORS. A VALUABLE ASSESSMENT OF CURRENT VIEWS WAS, HOWEVER, PROVIDED BY A SEMINAR OF PEOPLE CONCERNED WITH FLOOR CONSTRUCTION, AND USEFUL DATA WERE OBTAINED FROM A SURVEY OF SURFACE REGULARITY CARRIED OUT ON 13 CONCRETE FLOORS USING A BEAM PROFILOMETER DEVELOPED BY THE CEMENT AND CONCRETE ASSOCIATION. VARIOUS METHODS OF SPECIFYING AND CHECKING SURFACE REGULARITY ARE EXPLAINED. THE STANDARDS OF SURFACE REGULARITY AT PRESENT ATTAINED ON DIFFERENT TYPES OF FLOOR ARE SELDOM KNOWN BUT RECENT EVIDENCE SUGGESTS THAT THE TOLERANCES RECOMMENDED IN CP 204 MAY BE THE CLOSEST WHICH CAN REASONABLY BE EXPECTED ON MOST FLOORS. THE MOST COMMON TYPES OF IRREGULARITY OCCURRING ON CONCRETE FLOORS ARE DISCUSSED. RECOMMENDATIONS ARE MADE FOR IMPROVING SPECIFICATIONS FOR FLATNESS, FOR THE PROVISION OF LEVELLING DEVICES ON EQUIPMENT, AND FOR THE USE OF CONSTRUCTION TECHNIQUES WHICH MINIMISE SURFACE IRREGULARITIES. IT IS ALSO RECOMMENDED THAT FURTHER WORK SHOULD BE CARRIED OUT TO ESTABLISH THE DEGREE OF SURFACE REGULARITY REQUIRED ON DIFFERENT TYPES OF FLOOR AND TO DETERMINE THE EFFECTS OF VARIOUS CONSTRUCTION AND FINISHING TECHNIQUES. THERE IS A NEED FOR IMPROVED METHODS OF SPECIFICATION AND FOR ADVISORY LITERATURE IN ACCORD WITH CURRENT OPINIONS AND PRACTICES. /AUTHOR/

Chaplin, RG
Construction Industry Research & Information Assoc Series No. 48, Jan. 1974, 33 pp, 9 Fig., 5 Tab., 2 Phot., 23 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 208775)

3A 081934

MOBILE PLANT COSTING

THE PAPER CONSIDERS IN DETAIL THE VARIOUS COST FACTORS ASSOCIATED WITH MOBILE PLANT USED BY THE SURFACE EXTRACTIVE INDUSTRY. IT IS STATED THAT THE AIM SHOULD BE TO ACHIEVE LOWEST UNIT COST OF OPERATION AT THE OPTIMUM REQUIRED OUTPUT; IF THE OUTPUT POTENTIAL IS FIXED, THE OPTIMUM ECONOMIC WORKING LIFE CAN BE ESTIMATED BY CAREFUL CONSIDERATION OF THE FACTORS INVOLVED. THE FOLLOWING FACTORS ARE DISCUSSED IN DETAIL: COST OF OWNERSHIP, INCLUDING CAPITAL COST, INTEREST CHARGES AND DEPRECIATION; RESIDUAL VALUE AFTER USE WHICH VARIES WITH THE WAY IN WHICH IT IS SOLD; COST OF MECHANICAL MAINTENANCE AND OVERHAUL WHICH SHOULD BE LESS THAN THE OWNERSHIP COSTS BUT IF MISMANAGED CAN BE THE GREATEST SINGLE COST FACTOR (NOTES ARE GIVEN ON WAYS OF REDUCING MAINTENANCE COSTS); COST OF REPLACING WEARING PARTS SUCH AS EXCAVATOR BUCKETS AND WIRE ROPES; COST OF FUEL AND LUBRICANTS-ATTENTION IS DRAWN TO THE INCREASED COST WHEN PAYING DUTY ON FUELS WHEN THE EQUIPMENT IS USED ON A PUBLIC HIGHWAY; COST OF LABOUR; COST OF THE MAINTENANCE DEPARTMENT INCLUDING STORES AND WORKSHOPS; AND FINALLY, COMPANY, OVERHEAD CHARGES WHICH VARY WITH DIFFERENT COMPANIES. THREE APPENDICES GIVE DETAILED EXAMPLES FOR TWO SIZES OF DRAGLINE AND A LOADING SHOVEL.

Crane, J (Hoveringham Gravels Limited) *Quarry Managers' Journal* Dec. 1970, pp 441-458, 7 Tab., 5 Phot., 1 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 208726)

3A 082752

THE DESIGN AND CONSTRUCTION OF JOINTS IN CONCRETE PAVEMENTS

This report reviews the various types of joints used in concrete pavements in Great Britain, and gives recommendations on their design, which is related to the method of pavement construction employed. The recommendations are based on the results obtained from a comprehensive programme of laboratory tests and site studies carried out jointly by the Transport and Road Research Laboratory and the Cement and Concrete Association. Standards for the rigidity of transverse joint assemblies are discussed, and a relaxation in the tolerances for alignment of dowel bars is suggested. The report also discusses simple procedures for site tests on joint assemblies before concreting to ensure satisfactory performance both during the construction and the subsequent life of the road. /Author/TRRL/

Parmenter, BS
Transport and Road Research Laboratory TRRL Rpt. No. LR 512, 1973, 33 pp, 17 Fig., 5 Tab., 3 Phot., 12 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 208228)

PURCHASE FROM: Transport and Road Research Laboratory Crowthorne, Berkshire RG11 6AU, England Orig. PC

3A 082758

TSING YI BRIDGE

This brief article gives an outline of the planning and construction of the bridge which will link Ising Yi Island to the Chinese mainland at the Kowloon peninsula, Hong Kong. This bridge will serve motor traffic and accommodate electricity cables and oil and other service pipes. A post tensioned reinforced concrete bridge design on the principle of balanced cantilevers was chosen in preference to a suspension bridge because of the prevalence of typhoons, five 200 ft. cantilevers giving four spans of 400 ft and two of 200 ft. After describing the negotiations that preceded

construction, the author gives some details of the construction of the piers and of the structure itself. He also describes the precautions that were necessitated by the prevalence of tyhoons. The bridge is the second longest of its type in the world. The consultants, contractors, engineers and others who participated in the project are cited.

Zinn, WV (Zinn (WV) and Associates) *Civil Engineering and Public Works Review* Vol. 68 No. 804, July 1973, pp 628-629, 3 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 207996)

3A 082760

SECOND PHASE CONSTRUCTION OF THE TOKYO EXPRESSION ROUTE NO. 3

This article gives an account of the design and construction of the Tokyo Expressway route no. 3 which links the Tokyo-Nagoya Expresshighway to the city's business center. After giving a brief introduction which includes a diagram of the Tokyo Expressway network the author describes the general scope of the project, which involved the simultaneous construction of an elevated highway and a subrailway tunnel. The tunnel was constructed by the cut and cover method and the piers for carrying the highway were mostly constructed with the tunnel. Steel box-girder construction was used for the elevated highway. Details are given of the design of the structure including the methods of stress analysis that were used. This is followed by an account of the actual construction work, particular reference being made to measures that were adopted to overcome environmental problems. These include an Auger method for sinking the piles to eliminate noise and vibration, and timing the operations to reduce disturbance to traffic flow. After an account of the ways in which engineering difficulties were overcome, the author concludes with details of the construction costs. /TRRL/

Konura, T (Tokyo Expressway Public Corporation) *Civil Engineering in Japan* Vol. 11 1973, pp 51-60, 8 Fig., 3 Tab., 4 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 207919)

3A 082778

A GLANCE AT THE CONSTRUCTION OF MANY KINDS OF BRIDGES IN JAPAN

After a general introduction outlining the scale of bridge construction during recent years, the author discusses the materials that have been used. He refers particularly to high tensile steels, weather-proof steels and the increasing use of lightweight aggregates in concrete. Reference is also made to the increasing use of computers to automate the design and drawing of plans of structures and to assist in workshop processes. The advantages conferred by pre-fabrication are discussed and reference made to the attention being paid to the block method of constructing pre-stressed concrete bridges; a number of examples of its use are given. The Author makes particular reference to measures that have been adopted to reduce the noises caused by bridge construction, such as the use of high tensile steel bolts instead of rivets and the increase in the proportion of concrete bridges, which although more prone to problems resulting from earthquakes, are quieter. The remainder of the article gives details of a number of specific bridges which have been constructed recently. These have included girder steel bridges, truss bridges, arch bridges, suspension bridges, cable-stayed bridges and concrete bridges.

Tomonaga, K (Yokogawa Bridge Works, Limited) *Civil Engineering in Japan* Vol. 11 1972, pp 1-5, 2 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 207914)

3A 082779

PAVING MATERIALS FOR MOTORWAYS AND TRUNK ROADS

The article describes the progress made in the concrete paving of motorways and major trunk roads—a ten fold increase in the proportion of road length built in concrete. The Department of Environment now prepares alternative designs for both flexible and concrete paving. Concrete roads are now 10 to 15 percent cheaper than before. This is due to the recommendation of the then Road Research Laboratory that unreinforced concrete be used as an alternative construction material on motorways and trunk roads at the same thickness as was specified for reinforced concrete on these roads. The article

also compares the advantages and disadvantages of concrete paving and flexible paving and suggests that the competition between the two types might lead to a drop in the cost of roads.

Millbank, P *Civil Engineering and Public Works Review* Nov. 1973, pp 971-975, 5 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 208003S)

3A 082787

PLYMOUTH CAR PARK STRADLES RAILWAY LINE

This article briefly describes a multi-story car park for 310 cars built over a section of the London-Plymouth Main-line Railway. The three-story car park is built on a bridge of precast prestressed concrete beams that span 16m between in-situ columns and beams on either side of a cutting on the railway line. Details are given of the costs, design, concrete mix and construction methods. /TRRL/

Contract Journal Vol. 252 No. 4884, Apr. 1973, p 38, 1 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 205787)

3A 082788

QUICKER BY TUBE TO THE JETS?

Details are given of the 5.6km long extension of the Piccadilly line tube from Hounslow west to the center of Heathrow airport, scheduled to be opened in 1976. The construction work in progress in in three parts: the cut-and-cover section from Hounslow west to a new station at Hatton Cross on the airport perimeter, the mainly deep tube section from Hatton Cross to Heathrow central, and the terminal station at Heathrow central. Construction is mainly of secant pile wall type with some reinforced concrete boxes, and open cut where the line rises to cross the river Crane over a reinforced concrete bridge. Mention is made of the special track deck used in the covered way between Hounslow west and Parkway, which is mounted on 102mm thick rubber bearings. Costs are quoted. /TRRL/

Contract Journal Vol. 252 No. 4881, Mar. 1973, pp 22-24, 1 Fig., 5 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 205788)

3A 082794

GUNITING ADDS STRENGTH UNDERNEATH THE ARCHES

To match the load capacity of the newly opened London bridge, a program of guniting has been carried out to strengthen the arches that support its southern approach roads. Details are given of the placing of the gunite on the wall faces and arch soppits, the reinforcement used, and equipment utilized. To further improve the load-bearing properties of the soil beneath the foundation, injections of sodium silicate and calcium chloride were used. Costs of the guniting operations are quoted. /TRRL/

Contract Journal Vol. 252 No. 4883, Apr. 1973, p 43, 1 Fig., 1 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 205764)

3A 082800

SYNTHETIC RESINS FOR CONCRETE REPAIR [Kunstharsen Bij Betonreparatie]

A survey is presented of the various types of synthetic resin used for concrete repair. The properties of the resins, resinous compounds and mortars are discussed. The application methods and reparation techniques are described, and several problems, especially with respect to the adhesion of fresh concrete to old concrete and repair of cracks, are outlined. /TRRL/

Bassie, W *Cement* No. 25, Jan. 1973, pp 1-2, 12 Fig., 3 Tab., 8 Phot., 14 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 206059)

3A 082804

LEAN CONCRETE USED AS A BASECOURSE MATERIAL

[Magerbetong som Baerelag i Veier]

The construction of a test section using a 12 cm layer of lean concrete as a basecourse is described. The test section is incorporated in a new road

constructed in 1972 by the city of Oslo, Department of Roads and Streets. Details of the water/cement ratio and the aggregate size distribution are given together with methods of placing, compacting and curing the concrete. Results of tests on concrete core samples are presented, and the economic advantages of using lean concrete are briefly discussed. /TRRL/ [Norwegian]

Wistroem, T *Bygg* Vol. 20 No. 8, Oct. 1972, p 26, 1 Fig., 2 Phot., 1 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 206073)

3A 082805

PROBLEMS IN THE CONSTRUCTION OF WESTERN AVENUE EXTENSION

The paper deals with some of the practical aspects of the construction of the elevated sections of Western Avenue extension. Throughout its length it runs over and alongside railways, electrified lines of the London Transport Board, water ways and local urban roads. The paper concentrates on some of the special problems which entailed variations to the standard construction techniques. /Author/TRRL/

Nundy, FS (Laing (John) Construction, Limited) *Institution of Civil Engineers, Proceedings* Vol. 51 Feb. 1972, pp 219-250, 13 Fig., 13 Phot., 3 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 206020)

3A 082809

ROADHEADERS PROGRESS STEADILY UNDER LIVERPOOL

The underground railway system being constructed in Liverpool is outlined, and details are given of the construction of the tunnels for which a rotary boom roadheader, chosen because of its flexibility, was used. /TRRL/

New Civil Engineer No. 39, May 1973, pp 32-35, 2 Fig., 6 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 206031)

3A 082810

THE USE OF BITUMEN EMULSIONS IN THE CONSTRUCTION AND MAINTENANCE OF ROADS

The types and grades of bitumen emulsion available to road authorities in South Africa and their properties are described. Recommendations are made on the correct handling and application of bitumen emulsion in road construction practice. This document gives details of the types of construction where bitumen emulsion was found to give satisfactory performance, together with some of the most common road construction and maintenance specifications. /Author/TRRL/

South African Council for Scientific & Indus Res *Standard* June 1972, 36 pp, 1 Fig., 10 Tab.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 205982)

3A 082839

HOW TO BUY, RENT OR LEASE THE TOOLS OF CONSTRUCTION

A contractor has many equipment acquisition choices. Cash purchases, various installment plans, rental plans, and a number of different leases and loans are available to contractors who want to get equipment. In total dollars spent, the least costly equipment financing method is the cash purchase; the most expensive is renting. In addition to outlining these choices, this article presents other costs to consider; costs imposed by missed tax deferrals and deductions, costs of lost profits from work missed due to lack of funds or bonding capacity, and costs of lost dollar value because of inflation. Cash-flow analysis is the best procedure for evaluating long term costs of alternative methods. Tables included here show a present value analysis (PVA) of cash flows for four hypothetical alternatives for acquiring equipment: a cash purchase, an installment purchase, a bank term loan, and a true lease.

Construction Methods and Equipment Vol. 57 No. 2, Feb. 1975, 12 pp

3A 082870

STAGE POST-TENSIONING--A VERSATILE AND ECONOMIC CONSTRUCTION TECHNIQUE

The author, whose company has been a prime developer of stage post-tensioning, describes the mechanics and structural advantages of this new and powerful prestressing technique and discusses its application to several major high rise structures. Some of the structures include large girders (of minimum depth) over subways and supporting high rise buildings, girders in nuclear facilities, girder ties in buildings with sloping columns, and in the foundation of the world's tallest free-standing tower. It is concluded that stage post-tensioning will play an important role in the future growth of the prestressed concrete industry.

Slater, WM (Conenco International Limited) *Prestressed Concrete Institute, Journal of* Vol. 20 No. 1, Jan. 1975, pp 14-27, 14 Fig.

3A 082871

TEN YEARS OF EXPERIENCE IN PRECAST SEGMENTAL CONSTRUCTION

The author, whose company pioneered in the development of precast prestressed segmental construction, reports on the state-of-the-art of this versatile and fast-growing construction technique. The report confines itself to the discussion of segmental construction with match-cast segments with an epoxy resin. Following a historical review of the development of segmental construction, design considerations are given for a typical segment and glued joint, choice of structural system and erection technique, selection of transverse cross section, design of longitudinal members, design of piers and stability during construction, control of deflections, precasting methods, and hoisting equipment needed for erecting the segments. The last part of the report describes the application of segmental construction to freeway overpasses and the latest technique of progressive segment placing. It is concluded that precast segmental construction is an efficient and economical construction method for medium to long-span structures.

Muller, J (Bernard (Compenon) Design & Construction Engineers) *Prestressed Concrete Institute, Journal of* Vol. 20 No. 1, Jan. 1975, pp 28-61, 25 Fig.

3A 082898

AN INTEGRATED PAVEMENT DESIGN PROCESSOR

An integrated pavement design processor has been developed as a strategic approach to the design and management of construction and rehabilitation of pavements. The modular processor is a comprehensive decision framework with a capacity to drive different optimization routines at the user's command through interactive queries between the computer and the design engineer. The multi-option arrangements enable the design engineer to consider both rigid and flexible pavement systems simultaneously. The processor can be used for new pavement construction or existing pavement rehabilitation. In addition, three options for flexible pavement design are included to describe the structural subsystem desired: one based on AASHTO structural number, another based on Dynaflect deflection, and the third based on linear elastic theory.

Research Study sponsored by Texas Highway Department and FHWA.

Lu, DY Shih, CS Scrivner, FH Lytton, RL
Texas Transportation Institute, Texas University, Austin, Texas State
Department of Highways & Public Transp Intrm Rpt. Res. Rpt. No.
123-22, May 1974, 173 pp, Figs., Tabs., 53 Ref., 6 App.

1-8-69-123

3A 083162

DIMENSIONING OF TUNNEL LININGS WITH REGARD TO CONSTRUCTIONAL PROCEDURES

It is shown that by using a combination of the characteristic curves for rock, rock core and installed structures, the point of equilibrium, i.e. the effective rock pressure, may be calculated. The influence of the method of working and of the distance between heading and point of installation of support structure is demonstrated, and a procedure for the evaluation of these influences is suggested. The method of calculation may be applied to the control of rock pressure and deformation properties of tunnel linings. /TRRL/

Lombardi, G *Tunnels and Tunnelling* Vol. 5 No. 4, 1973, pp 340-351, 13 Fig.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 206697)

3A 083166

CONCRETE ROADS-DEVELOPMENT OF NEW TECHNIQUES

This article describes the new techniques which have been developed during the past three years, following the publication of Technical Memorandum H5/69 which approved the use of unreinforced concrete slab construction without expansion joints provided the work was carried out between April 21 and October 21. The techniques were used in three road construction projects: (1) The A-12 4Rm-long Margaretting By-pass in Essex in which the principal innovation in slip-forming was the successful positioning of dowel bars in the transverse contraction joints, which are spaced at 5M centers without the need for prefabricated joint assemblies set ahead of the paver; (2) The A449 New Midlands Road, an unreinforced concrete structure with dowelled contraction joints at 20 ft intervals; and (3) the Gerrards Cross Motorway Bypass, for which the Errut CXCA plastic grooving machine for producing anti-skid texture on new concrete roads was used for the first time. Details are given of the slip form pavers used, formation of transverse contraction joints and longitudinal joints, concrete mix design and laying, and grooving techniques and equipment. /TRRL/

Highways and Road Construction Vol. 41 No. 1762, 1973, pp 13-17, 1 Fig., 11 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 206674)

3A 083204

PREFABRICATING SMALL CROSS SECTION TUNNELS THE DUTCH WAY

The article discusses methods developed in the Netherlands for the construction of underwater tunnels from prefabricated concrete sections. The tunnel sections, which are usually from 60-120m long, are sunk in dredged trenches and provided with concrete ballast. To ensure that joints are watertight, "Gina" compressible rubber profile seals are used, while the problem of shrinkage cracks is usually overcome by applying a bituminous lining. Details are given of a number of methods developed to minimize the number of constructional joints and shrinkage cracks. /TRRL/

Glerum, A *Tunnels and Tunnelling* Vol. 5 No. 4, 1973, pp 366-371, 4 Fig., 3 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 206695)

3A 083318

CRACKING AND SPALLING OF THE CONCRETE COVER OVER STEEL IN REINFORCED CONCRETE IN MARINE ATMOSPHERES

This information sheet presents some operational guidelines intended to reduce the risk of cracking and spalling in reinforced concrete structures exposed to marine atmospheres. The recommendations concern (a) the design and siting of the structure; (b) materials; (c) composition of the concrete mix; (d) compaction; (e) curing; and (f) placing of the reinforcement. /TRRL/

Council for Scientific and Industrial Res, S Afrca 1972, 2 p

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 207440)

3A 083320

SOME CONSIDERATIONS ON THE PLANNING OF ENGINEERING STRUCTURES IN RELATION TO THE VARIOUS PHASES OF CONSTRUCTION AND TO THE STRUCTURE WHEN IN SERVICE [Qualche Considerazione Sulla Progettazione di Operedi Ingegneria Civile in Rapporto alle Varie Fasi di Esecuzione e a Quella Finale di Esercizio]

In addition to its operational function, the planning of a civil engineering structure is determined by the technical means used for its construction. This gives rise to a preference for certain constructional solutions in relation to particular economic conditions. The prevalence of cantilever over arch bridges, due to the prohibitive cost of centering and scaffolding, is cited as an example, and the planning of constructional stages is discussed with a view to minimizing the effects of secondary stresses and delayed deformation in cantilever structures. /TRRL/ [Italian]

Morandi, R *Strade* No. 8, 1973, pp 455-466, 3 Fig., 7 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 207351)

3A 083321

BUDAPEST: A NEW TYPE OF CONSTRUCTION ADOPTED FOR UNDERGROUND RAILWAY STATIONS [Un Nuovo Tipo di Costruzione Adottato per le Stazioni Nelle Ferrovie Sotteranee]

Details are given of the design and construction of a new type of underground station, built on the first Budapest underground line. The station (at Astoria) consists of twin tunnels or a combination of several tunnels with a supporting structure of top and bottom girders, in turn supported by concrete filled steel columns, spaced 4m apart. Since the station and the line tunnels are of the same diameter, the design ensures the continuous operation of the driving shield, without the need for dismantling and reassembly. The type of construction described will also be adopted for the Kossuth and Batthyony stations. /TRRL/ [Italian]

Rosza, L Bernvalner, J *Strade* No. 5, 1973, pp 269-299, 15 Fig.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 207350)

3A 083327

DIFFICULTIES ENCOUNTERED IN THE CONSTRUCTION OF THE BRIDGE ACCROSS BASSEIN CREEK

Details are given of the difficulties encountered during construction of the 555 meter long prestressed concrete, box-girder bridge across Bassein Creek near Ghodbunder, Bombay. Beside describing the usual difficulties of tilts and shifts in the foundation caissons, and the methods of their rectification, the article outlines the solutions adopted to solve special problems of very heavy tilts and leakage joints in concrete well steinings. In order to get over the difficulty of non-availability of roller bearings in time, the special arrangements made for constructing the decking of the bridge at a higher level than designed and subsequently lowering it on the roller bearings when they were received are also detailed. Difficulties usually encountered in the cantilever method of construction are discussed. /TRRL/

Phadke, RP Shenolikar, GM *Indian Roads Congress, Journal of* Vol. 35 No. 1, Paper No. 293, 1973, pp 87-137, 4 Fig., 2 Tab., 14 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 207313)

3A 083330

JACK-UP PLATFORM SINKS UK'S BIGGEST DRIVEN PILES

Brief details are given of the piling operations during the construction of the 29-span, composite plate girder ouse bridge, near Goole, Yorkshire, part of the m62 motorway. The ground conditions of the flood plain favored the use of reinforced concrete step taper-type driver piles for the 26 approach spans of the bridge. The end-bearing piles were driven using a steel mandril; they are designed to take high lateral forces, contain reinforcing bars, and use high slump concrete which does not need vibration. Large diameter piles are being driven under water for the 3-span river section. 1.53m diameter steel tubed piles are being driven to a depth of 20m. The first 10m of soil inside the casing is removed by high pressure jetting and pumping and is replaced by high slump concrete containing 40mm diameter reinforcing bars. 50x50mm shear rings are welded into the casing, and are used to transfer the vertical load from the concrete to the pile casing. /TRRL/

New Civil Engineer No. 55, 2 Fig., 8 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 207334)

3A 083361

UNISSEN PILES CUT CONSTRUCTION TIME

THIS BRIEF ARTICLE GIVES AN ACCOUNT OF THE USE OF UNISSEN PILING IN THE CONSTRUCTION OF A BRIDGE AT SHRIVENHAM TO ALLOW THE ROAD TO PASS UNDER THE RAILWAY AT A FORMER LEVEL CROSSING. THE USE OF THE PILING ELIMINATED ALMOST ALL OF THE TEMPORARY WORKS WHICH ARE REQUIRED IN A CONVENTIONAL REINFORCED CONCRETE CONSTRUCTION AND THE WORK WAS ALSO SPEEDED UP BECAUSE THE UNISSEN SECTION PERFORMED THE DUAL FUNCTION OF SHEET PILE AND BEARING

NESS OF FINISHED SURFACE) THAT HAS BEEN ATTAINED UNDER DIFFERENT SOIL CONDITIONS. PARTICULAR REFERENCE IS MADE TO THE RELATIONSHIP BETWEEN EXCAVATION TIME AND GROUND CONDITIONS. THE NEXT PART OF THE ARTICLE IS CONCERNED WITH THE DIFFERENT APPLICATIONS OF THE METHOD. PARTICULAR REFERENCE IS MADE TO THE TBW PROCESS WHICH HAS BEEN USED IN JAPAN BECAUSE OF THE ADDITIONAL NEED FOR A DIAPHRAGM WALL TO FUNCTION AS A SEISMIC WALL. ASPECTS OF DIAPHRAGM WALL TECHNOLOGY ARE NEXT DISCUSSED. THESE INCLUDE THE USE OF A NEW STABILIZING AGENT "TELMACH" & RESEARCH ON DIAPHRAGM WALL MEASURING APPARATUS. THIS IS FOLLOWED BY FURTHER DETAILS OF THE USE OF THE TBW PROCESS. THE AUTHOR CONCLUDES BY MAKING REFERENCE TO AREAS WHERE FURTHER INVESTIGATIONS ARE NECESSARY.

Ikuta, Y (Takenaka Technical Research Laboratory) *Ground Engineering* Vol. 7 No. 5, Sept. 1974, 2 pp, 10 Fig., 1 Tab., 12 Phot., 4 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 211515)

3A 083883

INTERIM REPORT ON COMPACTION OF SOIL IN ARID AREAS, PART I LITERATURE SURVEY

This interim report draws on information obtained from literature on compaction generally, but special reference is made to the problems of compaction in arid areas. A bibliography of 178 references is included. A brief review is given of the theory behind the need for compaction to increase the load carrying capacity of the soil as well as to reduce the future deformation which might occur under the effects of repeated loading. The possible advantage of vibrating compactors in requiring very little water to give maximum density is pointed out, and the factors affecting loss of water from the soil layers are considered. It is concluded that the object of further research should be to investigate or find methods which will ensure high strength and resistance to deformation with as little water as possible, to apply the necessary water in the most effective manner, and to use procedures and construction methods which will reduce evaporation losses to a minimum.

Via Vol. JG6 No. 1, Mar. 1966, pp 5-6

3A 083901

FULL-DEPTH CONSTRUCTION TYPE [Asphaltoberbau]

THE AUTHOR DESCRIBES THE INCREASING USE OF A NEW FLEXIBLE PAVEMENT CONSTRUCTION METHOD: FULL-DEPTH CONSTRUCTION, IN WHICH THE STANDARD ROAD-BASES (PART OF WHICH CONSISTS OF A THICK LAYER OF UNBOUND MATERIALS) IS REPLACED WITH A THINNER BITUMINOUS LAYER. ACCORDING TO THE AUTHOR THIS NEW TYPE OF CONSTRUCTION SHOULD NOT BE INDISCRIMINATELY SELECTED. THE MAIN ADVANTAGE, WHICH IS REDUCED THICKNESS, IS CANCELLED BY THE FACT THAT HIGH-QUALITY, VERY COSTLY AGGREGATES MUST BE USED TO ENSURE THE STRENGTH OF THE THINNER LAYER. FURTHERMORE, BECAUSE A ONE-COURSE SYSTEM RESTS DIRECTLY ON THE SUBGRADE, THE RIGIDITY OF THE PAVEMENT STRUCTURE IS NOT GUARANTEED AND THE SUBGRADE MUST HAVE ADEQUATE BEARING CAPACITY. [German]

Luecke, H *Naturstein-Ind* No. 5, May 1972, pp 5-6

ACKNOWLEDGMENT: Laboratoire Central des Ponts et Chaussées (LCPC11026E), Transport and Road Research Laboratory (IRRD 100625)

3A 084088

THE FOUNDATIONS OF THE PORT MANN BRIDGE. PART 2: CONSTRUCTION

This paper deals with the various phases of the construction of the foundations and describes, in varying detail, the work to be performed and the construction methods used. Well known types of construction are referred to briefly and the more uncommon are dealt with at length. Work described in detail includes (a) the preboring of holes up to 200 ft. deep in

sensitive material, the placing and driving of piles in these holes and the grouting of the annular space between the driven pile and the sides of the hole; (b) the construction, bracing and dewatering of cofferdams; (c) underwater excavation and compaction by Vibroflotation; (d) underwater injection concrete work and (e) the manufacture, locating and sinking of brush mattresses for scour protection.

Davie, WG *Engineering Journal (Canada)* Vol. 47 No. 3, Mar. 1964, p 51

3A 084532

DESIGN FOR CHANGE: THE IMPACT OF CHANGING THREATS AND MISSIONS ON SYSTEM DESIGN PHILOSOPHY
Our highly formalized acquisition process has caused the Naval Architecture Community to evolve to a 14 year development cycle. In this cycle the combat system is proved in the first seven years, prior to the last seven of platform definition and construction. Inflation and accelerating rates of change of both threat and technology force the Navy to alter platform characteristics during these final years, causing a complex and costly "integration after" problem in every new combatant. This paper discusses the naval ship system peculiarities; ship modernization/ conversion cost; modularity feasibility; current Navy weapons systems acquisition; modularity cost review; recommendations for modularity and the future of naval architecture.

One of 24 papers contained in the April 1975 issue of the ASNE Journal available at \$5.00 from ASNE. Reprints of single articles \$1.50 for members and \$2.00 for non-members.

Simmons, JL *Naval Engineers Journal* Vol. 87 No. 2, Apr. 1975, pp 120-125

ACKNOWLEDGMENT: American Society of Naval Engineers
PURCHASE FROM: American Society of Naval Engineers 1012 4th Street, NW, Washington, D.C., 20005

3A 084686

FIFTY-YEAR DEVELOPMENT: CONSTRUCTION OF STEEL ARCH BRIDGES

During the past 50 years there have been major changes in the engineering, fabrication, and construction of steel arch bridges. The laser surveying instruments, high-strength steels, numerically controlled drilling, welding, and high-strength bolts have all had tremendous impact on field construction. The methods of erecting have also vastly improved the efficiency, time, and safety of bridge construction. Erection methods vary from supporting the arch by falsework or wire rope tiebacks to jacking large heavy spans several hundred feet above river level. Fifty years ago, falsework was made of square timber formed into bents supported by wooden pile. Today, it is made from light reusable steel sections. Large floating derricks are used to lift heavy pieces, often eliminating the need for travelers mounted on the bridge.

Hollingsworth, WF *ASCE Journal of the Construction Division Proc Paper* Vol. 101 No. C01, ASCE 11187, Mar. 1975, pp 85-103, 10 F, 10 Phot., Refs., 1 App.

3A 084687

FIFTY-YEAR DEVELOPMENT: CONSTRUCTION OF STEEL SUSPENSION BRIDGES

During the past 50 years there have been changes in the construction of steel suspension bridges. The design of bridges with longer spans has had an impact on the methods used for construction. The methods used for tower erection have changed with the use of heavier and taller towers. Longer spans have resulted in larger diameter cables. This has affected the design and erection of catwalks and the methods and equipment used for cable spinning, stiffening truss erection, and cable wrapping. The development of the methods used to erect the towers, main cables, and suspended steelwork of suspension bridges is traced by reviewing the construction of notable suspension bridges built in the United States.

Dwyer, JD *ASCE Journal of the Construction Division Proc Paper* Vol. 101 No. C01, ASCE 11176, Mar. 1975, pp 105-125, 11 Fig., Refs., 1 App.

3A 090075

PRESTRESSED CONCRETE PAVEMENTS. VOLUME II. DESIGN AND CONSTRUCTION PROCEDURES FOR CIVIL AIRPORTS

The volume of this report recommends practices and procedures for design and construction of prestressed concrete pavements for civil airports. For the

design procedure, the basic load-stress relationships were developed from small-scale model tests employing static loadings. Stresses computed from Westergaard's theory for elastic behavior were adjusted by moment correction factors to reflect the redistribution of moments resulting from partial hinges that develop under the load. Effects of repetitive moving loads were examined both in small-scale models and in full-scale prototype test pavements. The design procedure permits interrelating magnitude of loading, load repetitions, flexural strength, subgrade conditions, pavement thicknesses, slab dimensions, and magnitude of prestress. Consideration also is given to the effects of elastic shortening, creep, and shrinkage of concrete, relaxation in steel tendons, anchorage systems, tendon friction, subgrade restraint, and temperature changes. Construction procedures and alternatives are examined based on a study of prototype test pavements and operational prestressed facilities constructed in the US and abroad.

See also Volume 1, AD/A-000 456.

Odom, EC Carlton, PF
Waterways Experiment Station, Federal Aviation Administration Final Rpt. Nov. 1974, 77 pp

Contract DOT-FA71WAI-218

ACKNOWLEDGMENT: NTIS
PURCHASE FROM: NTIS Repr. PC, Microfiche

AD/A-003477/7ST

3A 090676

THE FLATHEAD TUNNEL. A GEOLOGIC, OPERATIONS, AND GROUND-SUPPORT STUDY, BURLINGTON NORTHERN RAILROAD, SALISH MOUNTAINS, MONTANA

The 7-mile Flathead Tunnel located in the central Salish Mountains of northwestern Montana was constructed between 1966 and 1969. With the contract awarded April 19, 1966, tunnel excavation began September 30, 1966, and was completed June 21, 1968, in 488 tunnel driving days. Peak advance was 66 feet per day. On June 27, 1969, 53 weeks following 'holing through', all tunnel concrete lining was completed. Average wall and arch concrete placing rates exceeded 1700 cubic yards daily. Much of this outstanding tunneling progress can be directly attributed to specialized construction equipment. Operations were distinctly conducive to seasonal construction and decidedly influenced job schedules. The Flathead Tunnel was successfully completed within contract time, with major cost savings in concrete tunnel lining achieved through a value engineering clause in the contract.

Skinner, EH
Bureau of Mines Bumines-IC-8662, Feb. 1975, 114 pp

ACKNOWLEDGMENT: NTIS
PURCHASE FROM: NTIS Repr. PC, Microfiche

PB-240682/5ST

3A 090680

CONSTRUCTION EQUIPMENT (A BIBLIOGRAPHY WITH ABSTRACTS)

Construction equipment used in roadbuilding, mining, earth handling and general construction are described and analyzed in these Government-sponsored research reports. Translations of foreign literature are not included. (Contains 174 abstracts).

Supersedes COM-73-11378.

Habercom, GEJ
National Technical Information Service Bibliog May 1975, 179 pp

ACKNOWLEDGMENT: NTIS
PURCHASE FROM: NTIS Repr. PC, Microfiche
NTIS/PS-75/391/3ST, DOTL NTIS

3A 090759

THE D-645-2 COMPLEX OF EQUIPMENT FOR PREPARING ASPHALT CONCRETE MIXES

The D-645-2 complex is intended for preparing asphalt concrete and bitumen-mineral mixes which are used in road building and for other types of construction. It is designed so that when necessary the formula for the mix can be changed easily. The article gives the order of preparation of the mixes and describes the various units of the complex. The equipment was tested under unfavorable weather conditions and proved to be entirely satisfactory. Its adoption in industry will effect large economic savings.

Trans. of Stroitelnye i Dorozhnye Mashiny (USSR) n7 p8-11 1972.
Bardaev, SV Zabolotnyi, VM Mendeleev, AI Gurbanov, IM
Army Foreign Science and Technology Center FSTC-HT-23-11092-73,
Apr. 1973, 9 pp

ACKNOWLEDGMENT: NTIS
PURCHASE FROM: NTIS Repr. PC, Microfiche

AD/A-005952/7ST

3A 090789

DS-70 AGGREGATE FOR CRUSHING SOIL

The DS-70 aggregate is additional equipment for the D-709 soil-mixing installation and is intended for crushing weak (kaolinite) clays with moisture of up to 12%. The aggregate contains a bar screen, a mill, and a conveyor. When changing to different soils, the aggregate need not be removed from the D-709 installation.

Trans. of Stroitelnye i Dorozhnye Mashiny (USSR) n8 p2-3 1972.

Kaganovskii, Y
Army Foreign Science and Technology Center FSTC-HT-23-1394-73,
July 1974, 7p

ACKNOWLEDGMENT: NTIS
PURCHASE FROM: NTIS Repr. PC, Microfiche

AD/A-005477/5ST

3A 090801

REVIEW OF CONSTRUCTION EQUIPMENT AND METHODS FOR PAVEMENTS

The investigation reported herein was conducted to review methods and equipment being used by industry in the construction of pavements and to recommend changes to Corps of Engineers guide specifications to incorporate new methods and equipment. Literature reviews were conducted, and visits were made to construction sites and equipment manufacturers. Observations and measurements were taken on pavements constructed with slip-form pavers, and a separate report was written on the results. As a result of the overall investigation, the pertinent guide specifications will be revised to allow the use of slip-form pavers for portland cement concrete pavements in airfield construction and to add methods of testing for quality of mixture and for determining mixing times.

Rone, CL
Assistant Secretary of the Navy, (DA-4-A-162121-A-891) Final Rpt.
AEWS-Misc-Paper-S751, Jan. 1975, 15p

ACKNOWLEDGMENT: NTIS
PURCHASE FROM: NTIS Repr. PC, Microfiche

AD/A-005007/0ST

3A 091757

TUNNEL COST ESTIMATING UNDER CONDITIONS OF UNCERTAINTY

Of all areas of heavy construction, tunnel projects are subject to perhaps the greatest degree of uncertainty from the standpoint of predicting cost and progress. Sources of uncertainty include the unknown nature of geologic conditions along the tunnel alignment, and the difficulty of estimating the performance of men and equipment within the narrow confines of the tunnel. In this report a method is presented for explicitly reflecting these uncertainties in estimates of the time and cost of tunnel construction.

Also pub. as Tunnel Construction-5.

Wyatt, RD
Massachusetts Institute of Technology, National Science Foundation Tech. Rpt. R75-13, Sept. 1974, 211 pp

Grant NSF-GI-34029

ACKNOWLEDGMENT: NTIS
PURCHASE FROM: NTIS Repr. PC, Microfiche

PB-242428/1ST, DOTL NTIS

3A 091758

THE PROBABILISTIC ESTIMATION OF CONSTRUCTION PERFORMANCE IN HARD ROCK TUNNELS

This report concerns the development of a computer-based simulation model which can be used to evaluate costs and risks associated with hard rock tunneling. This report is the 4th in a series of reports dealing with this

subject. The report examines conventional cost estimating procedures and concludes that there are two major inadequacies which exist: (1) the inability to account for the uncertainty in suspected geologic conditions at the tunnel depth; and (2) the inability to quantify the effect of uncertain geology and the effect of the additional uncertainty in productivity of men and equipment on the performance of a construction strategy. The model employs techniques of probability and simulation to avoid these two shortcomings.

Also pub. as Tunnel Construction-4.

Minott, CH
Massachusetts Institute of Technology, National Science Foundation Tech. Rpt. R74-47, July 1974, 198 pp

Grant NSF-GI-34029

ACKNOWLEDGMENT: NTIS
PURCHASE FROM: NTIS Repr. PC, Microfiche
PB-242427/3ST, DOTL NTIS

3A 092551

TUNNEL COST MODEL: PROFESSIONAL PAPERS, 1974

This collection of four papers describes the completed first phase of the research project--the organization and scope of the model; its technical content, assumptions, capabilities; and directions for its future development and use. These papers draw upon several reports and theses produced over the last year, and highlight the important characteristics of the model and its potential applications.

Report no. 3 in a series on 'Tunnel Construction.' See also report dated Jun 74, PB-242 598.

Moavenzadeh, F Einstein, HH Markow, MJ Wyatt, RD Vick, SG
Massachusetts Institute of Technology, National Science Foundation Tech. Rpt. P74-4, P74-5, July 1974, 121 pp

Grant NSF-GI-34029

ACKNOWLEDGMENT: NTIS
PURCHASE FROM: NTIS Repr. PC, Microfiche
PB-243253/2ST, DOTL NTIS

3A 092552

TUNNEL COST MODEL: A STOCHASTIC SIMULATION MODEL OF HARD ROCK TUNNELING. VOLUME 1. SUMMARY REPORT

This report describes the completed 1st phase in a project to develop a tunnel cost model--the organization and scope of the model; its technical content, assumptions, and capabilities; and the relation of the model to various exploratory and tunneling practices. The report consists of three volumes; a Summary Report, a Technical Report, and the Appendices. The tunnel cost model was developed in an attempt to improve the assessment of uncertainty in tunnel cost estimates, with enough detail and accuracy to aid in preparing estimates or bids. The scope of the model is limited to hard rock tunneling. A working version of the model has been obtained and trial runs of selected example problems have been run and are discussed in this report. This report is the 1st in a series relating to the tunnel cost model to document the work continuing under the research project mentioned.

Report no. 1 in a series on 'Tunnel Construction'. See also report dated Jun 74, PB-242 598.

Moavenzadeh, F Einstein, HH Markow, MJ Lindner, EN Minott, CH
Massachusetts Institute of Technology, National Science Foundation Tech. Rpt. R74-22, NSF/RA/T-74-080, May 1974, 124 pp

Grant NSF-GI-34029

ACKNOWLEDGMENT: NTIS
PURCHASE FROM: NTIS Repr. PC, Microfiche
PB-243252/4ST, DOTL NTIS

3A 092588

AIRFIELD PAVEMENT CONSTRUCTION: SLIPFORM PAVING METHOD [Final rept. Jul 71-Jun 73]

This report presents the results of a study conducted to evaluate the use of slipform paving equipment for the construction of airfield pavements. Nine construction projects were observed and smoothness measurements made on

eight of these projects. Currently used equipment and construction practices are presented and analyzed; problem areas and corrective measures are discussed. Results from the smoothness measurements are presented and considered in terms of current construction requirements and the effect of the surface smoothness on the functional performance of the pavement. Although the elimination of fixed side forms is the most appealing feature of the slipform method, it also causes the most complications.

Parker, FJ
Army Engineer Waterways Experiment Station, Vicksburg Miss 5-18
AEWES-Misc-Paper-S-7, 18, June 1975, 76p

ACKNOWLEDGMENT: NTIS
PURCHASE FROM: NTIS NTIS Price, /MF\$2.25

AD-A012769/6ST

3A 092596

RESEARCH PROGRAM PLAN FOR MEETING TOMORROW'S NEEDS IN TUNNELING AND EXCAVATION

This report presents the results of a study performed by Bechtel Corporation for the National Science Foundation, Research Applied to National Needs (RANN). The purpose of the study is to develop a recommended long range research program plan in tunneling and excavation for RANN. The objective of the RANN tunneling and underground excavation research program is to achieve technological improvements that would enhance the quality of life in urban areas through more economic and effective utilization of the underground space.

See also PB-242 742.

Bechtel Corporation, National Science Foundation Final Rpt.
NSF/RA/T-74-087, Aug. 1974, 357 pp

Grant NSF-C841

ACKNOWLEDGMENT: NTIS
PURCHASE FROM: NTIS Repr. PC, Microfiche
PB-242777/1ST, DOTL NTIS

3A 092597

RESEARCH PROGRAM PLAN FOR MEETING TOMORROW'S NEEDS IN TUNNELING AND EXCAVATION. EXECUTIVE SUMMARY

This report presents the summary of a study performed by Bechtel Corporation for the National Science Foundation, Research Applied to National Needs (RANN). The purpose of the study is to develop a recommended long range research program plan in tunneling and excavation. The results of the study, which are delineated in the main report and accompanying appendices, contain supporting evaluations.

See also PB-242 777.

Bechtel Corporation, National Science Foundation NSF/RA/T-74-086,
Feb. 1974, 34 pp

Grant NSF-C841

ACKNOWLEDGMENT: NTIS
PURCHASE FROM: NTIS Repr. PC, Microfiche
PB-242742/5ST, DOTL NTIS

3A 093223

SLURRY SEAL SURFACE TREATMENTS

This report was prepared to aid the facilities engineer in prescribing and constructing slurry seals. The report identifies the potential areas of slurry seals application and discusses material requirements, field construction processes, and techniques to assist the facilities engineer in placing good quality slurry seals. A summary of a recommended laboratory design method for proportioning the materials of the slurry seal mixture and a modified version of construction guide specification CE-807.23 for emulsified asphalt slurry seal surface treatments are also presented herein.

Godwin, LN
Waterways Experiment Station Final Rpt. AEWES-Instr-S-75-1, June 1975, 64 pp

ACKNOWLEDGMENT: NTIS
PURCHASE FROM: NTIS Repr. PC, Microfiche

AD-A014164/8ST

3A 093434

SPlicing OF PRECAST-PRESTRESSED CONCRETE PILES

A broad range of splices for precast-prestressed concrete piles were evaluated, based largely upon information furnished by fabricators, designers, and proponents of the various splices. Basic considerations included size range, field time for splicing, approximate cost, availability, and construction usage. Data on the strength of the splices was obtained from tests during the study, from experience and tests conducted by others, and from theoretical and analytical studies. The cement-dowel splice was tested under hard and soft driving conditions. Study results indicate that the Herkules splice, the Anderson sleeve splice, and the cement-dowel splice would be most effective in fulfilling the needs of practical applications for highway and bridge construction in Louisiana.

Prepared in cooperation with Louisiana Dept. of Highways, Baton Rouge. Research and Development Section, Rept. no. 71-5C.

Tulane University, Federal Highway Administration, Louisiana
Department of Highways, (LA-736-01-66) Final Rpt. TR-106, July 1974,
123 pp

ACKNOWLEDGMENT: NTIS

PURCHASE FROM: NTIS Repr. PC, Microfiche

PB-245605/1ST, DOTL NTIS

3A 093742

TUNNEL COST MODEL: USERS' MANUAL [Technical rept. no. 6, Apr 74-Jun 75]

This User's Manual provides the guidelines required to implement the Tunnel Cost Model (TCM) and its file structure, to prepare input data, and to operate the system. It also aids in identifying several interrelationships among data structures and program flow that affect the TCM results.

See also report dated Jul 74, PB-243 253.

Reynoso, SS Gray, DJ
Massachusetts Inst. of Tech., Cambridge. Dept. of, Civil
Engineering.*National Science Foundation,, Washington, D.C. Research
Applied to National, Needs. R75-29, NSF/RA/T-75/022, June 1975,
287p

Grant NSF-GI-34029

ACKNOWLEDGMENT: NTIS

PURCHASE FROM: NTIS NTIS Price, /MF\$2.25

PB-245835/4ST

3A 093817

ENERGY USE IN THE CONTRACT CONSTRUCTION INDUSTRY. APPENDIX A. STUDY METHODOLOGY

This report contains data describing the activity of the contract construction industry expressed in terms of the dollar value of construction. A prime requirement of the methodology employed was the development of a traceable relationship between the dollar value of construction activity and the type of construction, geographical area of construction, and the energy consumed during construction. The basic methodology used to estimate fuel and energy use for representative construction projects involved the following: postulating representative construction projects of at least three sizes for each division of the industry; identifying energy-consuming equipment required for each project and determining fuel and energy consumption rates for each equipment type; estimating hours of operation for each type of equipment; and estimating fuel and energy use for each project by combining the results of the above two steps. Portions of this document are not fully legible.

See also Appendix B, PB-245 424 and Final rept., PB-245 422.

Tetra Tech, Inc., Arlington, Va.*Federal Energy, Administration,
Washington, D.C. Office of, Economic Impact. APP-A TET-
RAT-A-412-75-011-, FEA/EI-1664-A, Feb. 1975, 179p

Contract DI-14-01-0001-1664

ACKNOWLEDGMENT: NTIS

PURCHASE FROM: NTIS NTIS Price, /MF\$2.25

PB-245423/9ST

3A 095278

PRE-FORMED LININGS IN TUNNELLING PRACTICE

Based on a detailed description of the applications for preformed metallic and concrete segmental lining in Europe and North America paper

concludes that the use of pre-formed segmental linings instead of in situ placed linings in tunnels will predominate where the physical characteristics of the ground require the placing of a support system quickly after excavation and where economic considerations show that a permanent lining can be achieved in a single process. These linings are more usefully employed in soft ground, possibly water bearing, varying from sands and gravel through cohesive clays, mudstones and chalks rather than hard rock conditions although even in regard to the latter the choice must depend on the degree of competence of the rock. A reduction in lining thickness in some grounds may be achieved by allowing the newly excavated cavity at a tunnel face to redistribute ground stresses before placing the permanent lining. Because of the time element, and the need to protect the tunnel, either a temporary flexible support is required or pre-formed linings must be devised which will partially collapse through frangible packings to take up the initial deformations of the ground. In the former case a permanent lining would eventually be formed to encompass the temporary work, while the latter in a single construction perhaps provides the more economic solution.

Tough, SC (Transit and Tunnel Consultant, Incorporated);

Noskiewicz, TM *Rapid Excavation and Tunneling Conf, 2nd Proc* Vol. 1 June 1974, pp 643-668, 16 Ref.

ACKNOWLEDGMENT: EI

PURCHASE FROM: American Inst of Mining, Metallurg & Petrol Engrs 345 East 47th Street, New York, New York, 10017 Repr. PC

3A 095786

MAINTENANCE OF HYDRAULIC COMPONENTS ON ARMY CONSTRUCTION EQUIPMENT

This paper presents the current status of the Mobility Equipment Research and Development Center's new Hydraulic System Test and Repair Unit (HSTRU). In addition to describing the configuration of the prototype, it discusses the military requirements which led to its development and the analysis of the engineering tradeoffs involved in the selection of its components. Throughout the paper, analogies are drawn between military and commercial needs for the repair and maintenance of hydraulic systems in field mobile construction equipment.

Coyne, WP (Mobility Equipment Research and Development Center)

Society of Automotive Engineers, (SASI 74-2723) SAE No. 740657, 11 pp

3A 095794

VEHICLE AND MACHINE OPERATOR SOUND DATA ACQUISITION AND REDUCTION SYSTEM

The unaltered, commercially available instrumentation described in this paper provides an accurate (close to Type 1 sound level meter tolerances) and lightweight (total system--5.25 lb) sound recording system. In conjunction with commercially available programmable calculators, this instrumentation enables accurate determination of dosage to various criteria. The applications included construction equipment, lift trucks, farm or yard tractors, private airplanes, military vehicles, highway trucks, motor boats, snowmobiles, etc.

Flint, WH (Caterpillar Tractor Company)

Society of Automotive Engineers, (SASI 74-2712) SAE No 740685, 1974, 9 pp

3A 095839

THE ABC'S OF RADIAL OFF-THE-ROAD EARTHMOVER TIRES

The advantages and disadvantages of radial off-the-road earthmover tires are discussed with comparisons to the bias ply tire. The radial tire advantage of "Cooler Running Higher Ton-Mile-Per-Hour" is elaborated. Radial tire design trends and applications are covered with preference given to the sidewall protective Rock Lug designs at all non-skid levels.

Vermie, HR (Goodyear Tire and Rubber Company)

Society of Automotive Engineers, (SASI 74-2716) SAE #740679, 1974, 5 pp

3A 095841

NOISE REDUCTION PROGRAM FOR U.S. ARMY CONSTRUCTION EQUIPMENT

The initial program was to analyze the source of noise, reduce noise at the source, and provide overall noise reduction treatment to reach lowest practical levels. Similar efforts were then accomplished on several special

military vehicles to provide noise reduction retrofit kits. The initial work revealed special needs in the area of hydraulic system noise, and acoustical materials and in-depth studies were initiated to analyze techniques of hydraulic noise measurement and to evaluate material suitability for military use.

Hopler, PD Wehr, SE (Institute of Modern Languages Incorporated)
Society of Automotive Engineers, (SASI 74-2697) SAE #740714, 1974,
12 pp

3A 095845

RELIABILITY OF CONSTRUCTION EQUIPMENT VEHICLES

Customer demands for reliability in construction equipment are increasing. Reliability results first from adequate design and second from the capability of manufacturing in executing this design. The ultimate measure of reliability is performance for the customer. Information concerning good or bad performance must be communicated and used to improve new designs and correct existing machines. This can be accomplished effectively with the use of a reliability organization and with final approval of all products shipped.

Czarnecki, J (International Harvester Company)
Society of Automotive Engineers, (SASI 74-2721) SAE #740659, 1974,
5 pp

3A 096020

EXPERIENCE WITH CEMENT-BOUND HEAT-INSULATING COURSES [Erfahrungen mit Zementgebundenen Waermedaemm-schichten]

Instead of a frost blanket made of gravelly sand, a styropor concrete heat-insulating roadbase can be laid directly on the subsoil. The material for the styropor is brought to the construction site in a compact form and foamed on site into light-weight aggregate by means of steam. Mixing, transporting and laying of the concrete is carried out with conventional equipment. Recognized methods exist for design for heat insulation and bearing capacity. Large-scale technical manufacture was tried out in 1971 on a 1 km long section of the Turracher Road in Carinthia, Austria. The method is ready for application. /TRRL/ [German]

Sommer, H *Zement und Beton* No. 70/7, July 1973, pp 5-10, 6 Fig., 5 Phot., 12 Ref.

ACKNOWLEDGMENT: Road Safety Board, Austria, Federal Institute of Road Research, Inzel, W Ger, Transport and Road Research Laboratory (IRRD 301334)

3A 096026

MEASUREMENT OF GROUND MOVEMENTS DURING A BENTONITE TUNNELLING EXPERIMENT

The report describes the ground movement and pore-pressure measurements carried out during the construction of an experimental tunnel at new cross, London using the bentonite tunnelling process. The measurements confirmed the ability of this process to limit ground settlements in reasonably dense cohesionless soils to values similar to those produced by conventional tunnelling methods in London clay. /Author/TRRL/

Boden, JB McCaul, C
Transport and Road Research Laboratory TRRL LR 653, 1974, 20 pp,
9 Fig., 2 Phot., 4 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 211784)

PURCHASE FROM: Transport and Road Research Laboratory Crowthorne, Berkshire RG11 6AU, England Orig. PC

3A 096027

PIPE LAYING PRINCIPLES

The report indicates the methods of construction that are imposed by design principles and contribute essentially to the strength and efficiency of pipelines. The report is presented under the following headings: (1) trench work- excavation and timbering, construction of bedding, handling, laying and jointing pipes, temporary protection and initial testing, and filling; (2) performance testing; (3) construction in headings; (4) thrust and auger boring; (5) construction under embankments; (6) special cases; (7) safety precautions. /TRRL/

Clarke, NWB

Building Research Establishment R&D Rept. No. 35, 1964, 28 pp, 7 Fig., 7 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 211815)

3A 096073

BITUMINOUS SURFACE TREATMENT IN COLD AREAS

[Tratamientos Superficiales Bituminosos en Zonas Muy Frias]

A study is presented of the causes of surface treatment failures which occurred along national highway 3 and provincial highway 520-recommendations are put forward for the selection of the right aggregates and bituminous materials, mix design, binder content with a view to obtaining higher resistance to weathering. The types of failure observed are illustrated and explained. /TRRL/

Lanne, A

Comision Permanente del Asfalto Nov. 1973, pp 17-38, 1 Fig., 14 Phot., 5 Ref.

ACKNOWLEDGMENT: Transportation & Soil Mechanics Laboratory, Spain, Transport and Road Research Laboratory (IRRD 211823)

3A 096078

MOVEMENT OF MATERIALS [El Movimiento de los Materiales]

Machines for handling materials on site can be divided into two groups. The first group, dealing with the short-distance continuous transport, comprises fixed conveyors, articulated bucket line chains, screw feeders, pneumatic conveyors and vibratory equipment. The second group comprises earthmoving equipment and vehicles such as trailer-type lorries and dumpers. If the movement is vertical or nearly vertical, lifting machines are used; for example; lifts, hoists, cranes, etc. The operation of the various types of equipment listed is described. /TRRL/ [Spanish]

Garcia, HE *ATEMCOP* No. 28, May 1972, pp 11-21, 8 Fig., 7 Phot.

ACKNOWLEDGMENT: Transportation & Soil Mechanics Laboratory, Spain, Laboratoire Central des Ponts et Chaussees, Transport and Road Research Laboratory (IRRD 100899)

3A 096163

SAND CEMENT [Zandcement]

After having defined some concepts relating to sand cement roadbases the author introduces his subject with a historical review, a description of the present use of sand cement or soil cement in various countries, an explanation of the aim of stabilization and a discussion of the various types and the execution of roadbase stabilization. In the subsequent chapters the properties of sand cement, materials, laboratory tests, construction, quality control and applications are discussed. Some rules for practical use concerning compressive strength and calculation examples are given. /TRRL/ [Dutch]

Grevelt, ERE

Stichting Studie Centrum Wegenbouw R&D Rpt. Sept. 1974, 121 pp, 30 Fig., 23 Tab., 16 Phot., 57 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 211687)

PURCHASE FROM: State Road Laboratory, Netherlands Van Mourik Broekmanweg, Delft, Netherlands Orig. PC

3A 096259

THE CONTRACTOR-LAST LINE OF DEFENSE

Construction procedures produce disruptive effects on human and natural environments. Adverse impacts can be minimized the best of environmentally sensitive planning & responsive designs. Construction project personnel are the last line of defense for environmental engineering. Demonstrated concern and open communication with the public alleviates apprehension for inconvenience and damage resulting from construction. Uniform national standards for environmental protection would enable the construction equipment industry to produce universally acceptable machines and contractors to bid work with confidence.

Emery, AH (New York State Department of Transportation) *ASCE Civil Engineering* Vol. 45 No. 3, Mar. 1975, pp 87-90, 4 Phot.

3A 096407

ASPHALT PAVING IN 1974

This discussion of the prudent use of asphalt, reviews engineering design considerations, engineering construction methods, techniques and specifications, as well as the engineering of maintenance. Full depth asphalt pavements, planned stage construction, and soil-asphalt mixes are economical design factors. The placement of asphalt mixes in thick lifts will achieve both greater density and fewer lifts. Lower mix temperatures coupled with greater density, can produce high performance pavements. The review of specifications (to pug out mix at 250 deg F and haul it in insulated trucks) and the substitution of other asphalt products for cutback asphalts also require attention. The utilization of the correct maintenance techniques are advocated, and the areas of surface preparation treatment, surface preparation, rejuvenation and heater planning are also considered.

This paper was presented at the Twenty-Third Annual Arizona Conference on Roads and Streets.

Boring, JE (The Asphalt Institute, Phoenix)
Arizona University Proceeding Apr. 1974, pp 102-106

PURCHASE FROM: Arizona University Transportation and Traffic Institute, Tucson, Arizona, 740418 Repr. PC

3A 096412

FIELD TESTS FOR COMPACTED ROCKFILL

The limitations of vibratory rolling are reviewed and field tests that are required for the design of rock fills, including test quarries, test fills, field density tests, grain-size analysis and relative density tests are described. The chief limitation of the vibratory roller is that the vibrations are applied to the top surface of the layer being rolled, giving the roller a limited ability to compact at depth. Also, it must travel in a forward direction to achieve best compaction. The importance is emphasized of the test quarry in a test program. The separation of spalls and sand-size material from the coarser rock by a grizzly operation, has advantaged during construction. The equipment required for construction of rockfill test sections includes a front end loader or power shovel, trucks, a caterpillar tractor with a bulldozer blade, and rollers. The layout of test fills is detailed. Rockfill compaction is evaluated in terms of the percentage decrease in thickness of a layer under repeated roller passes. The procedure for conducting tests is described, as well as the evaluation of data. It is highly desirable to make comparative tests of the merits of the different types of vibratory rollers available, and a method is described that was devised for making direct comparison between a 10-and 12.5-ton roller. Construction control tests, field density tests, maximum density determination, and grain size determination are detailed and typical results are discussed. Specifications for construction control are also discussed.

Bertram, GE
Wiley (John) and Sons, Incorporated 1973, pp 1-19, 17 Fig., 4 Ref.

3A 096455

WIDE WIDTH PAVING

The introduction of full width paving took place in 1968 with the initial job being done on F. A. I. Interstate 90 By-Pass around Ellensburg, Washington. Following the success of this and other initial projects utilizing full width paving techniques, the first production units of the Blaw-Knox PF-220 paver were delivered to Ohio contractors. These jobs were the subject of intense testing and evaluation by the Ohio State Department of Highways. Subsequently, Blaw-Knox has introduced two full width pavers in addition to the PF-220. The machines are the PF-180H for paving up to 26 ft. (7.93 m) wide, and the PF-500 which will handle widths up to 25 ft. (7.63 m) wide. In addition to this, two other manufacturers have introduced machines capable of paving full width and full depth. The most important aspect of full width paving is considered to be more efficient placing of material, resulting in reduced costs and a better job.

Wright, JM (Blaw-Knox Construction Equipment, Incorporated) *Canadian Technical Asphalt Association, Proc* Vol. 17 1972, pp 139-140

3A 096478

POLYMER CONCRETES-REPORT OF A CONCRETE SOCIETY WORKING PARTY

The review of the uses of polymer concrete covers polymer impregnation, additions of solid, water-soluble or dispersed polymers and resin-bonded aggregates in concrete with or without hydraulic cement. The effects of

polymers on the rheology of the plastic mix are discussed, as well as the development of strength and properties of hardened concrete. Terminology used in the text is defined. The polymerization process and the impregnation process are outlined, and premixed polymer concrete and polymer-bound aggregates are described. The applications reviewed include desalination plants, bridge decking and motorways structures, underwater structures, housing applications and concrete piles. Expanded polystyrene aggregate, reinforcement with plastics fibers, woven polymer fabrics and architectural facing mixtures are described. Categories of water soluble polymers are discussed, as well as the use of vinyl acetate and copolymers, and the use of rubbers. Polyester, epoxide and isocyanate resins are considered in a discussion of resin-bound aggregates. Synthetic resins with outstanding properties which have been commercially exploited in the U.K. are epoxides, polyesters and polyurethanes. An extensive bibliography is included.

Cement and Concrete Association Tech. Rpt. No. 9, Jan. 1975, 47 pp, Figs., Tabs.

PURCHASE FROM: Cement and Concrete Association 52 Grosvenor Gardens, London SW1W 0AQ, England Repr. PC

3A 096513

A SURVEY TO DETERMINE THE IMPACT OF CHANGES IN SPECIFICATIONS AND CONSTRUCTION PRACTICES ON THE PERFORMANCE OF CONCRETE IN BRIDGE DECKS

In response to its own research and observations in the early 1960's, the Virginia Department of Highways mounted an intensive and extensive effort to improve the performance of concrete in bridge decks. Major elements of this effort included 1) a training and certification program for Department and industry personnel and 2) improved and upgraded specifications for both materials and construction practices. In 1972 a survey was made of 129 randomly selected bridges constructed after 1966, when all the improvements had been formally instituted. The performance of these bridges was compared with that of a similar sample that had been surveyed in 1961. In addition to the visual observation of performance measurements of electrical corrosion potentials and depth of concrete cover were made in the 1972 survey. Based upon this survey, several conclusions and recommendations were made.

This report was sponsored jointly by the Virginia Department of Highways and the University of Virginia, in cooperation with the U.S. Department of Transportation Federal Highway Administration.

Newlon, Jr., HH
Virginia Highway & Transportation Research Council VHRC 73-R59, June 1974, 50 pp, 15 Fig., 6 Tab., 12 Ref., 4 App.

3A 096683

THE BRUSSELS UNDERGROUND RAILWAY, CONSTRUCTION METHODS USED FOR ENGINEERING STRUCTURES [Le metro de Bruxelles, procedes d'execution des ouvrages de genie civil]

The advantage and disadvantages of the various construction methods used are discussed: metal sheet piles, lined excavation building pits, slurry trench walls, secant piles, shield, semi-elliptic shield, freezing of the ground, false deep wells, etc. A study was also made of the use of the space above the tunnel for an underground parking garage. This paper was presented at the 5th International Congress of Underground Techniques and Town Planning, Madrid, 5-11 October 1969. /TRRL/ [French]

Woitichik, M
Societe des Transports Intercommunaux de Bruxelles R&D Rpt. Oct. 1971, 47 pp, Figs.

ACKNOWLEDGMENT: National Scientific & Tech Res Ctr of Cement Indus, Road Safety Study and Research Fund, Belgium, Laboratoire Central des Ponts et Chaussées, Transport and Road Research Laboratory (IRRD 100535)

PURCHASE FROM: Societe des Transports Intercommunaux de Bruxelles 15 Avenue de la Toison d'Or, 1050 Bruxelles, Belgium Repr. PC

3A 096685

PILING PRACTICE

This book is divided into two parts. The first describes the main types of piles, construction methods, manufacture, and advantages and disadvantages of each type. The second part reviews the various stages of construction of piled foundations, from the initial survey of the terrain to the completion

of the work and control tests. The aim of the book is to present data on the selection of techniques for different conditions and details of the organization of piling foundation operations. /TRRL/

West, AS
Butterworths & Company, Limited 1972, 114 pp, Figs., Tabs., Photos., Refs.

ACKNOWLEDGMENT: Laboratoire Central des Ponts et Chaussées, Transport and Road Research Laboratory (IRRD 100354)

PURCHASE FROM: Butterworth and Company, Limited 88 Kingsway, London WC2B 6AB, England Repr. PC

3A 096782

JACKING IN AT BRENT CROSS

The article discusses the installation of two concrete box unit tunnel sections under existing embankments at the Brent Cross flyover, London. The two tunnels are claimed to be the world's largest such units to be installed using pipe-jacking or thrust boring techniques. Each of the precast concrete units are 32 ft wide, 22 ft high and have lengths of 33 ft and 45 ft. The rear jacking capability is provided by a bank of 28 110 ton capacity hydraulic rams. /TRRL/

Concrete Vol. 8 No. 12, Dec. 1974, pp 32-33, 4 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 212034)

PURCHASE FROM: ESL Repr. PC, Microfilm

3A 096786

THE PROBLEMS OF CHOOSING MACHINERY FOR CONSTRUCTION OF ALL-BITUMEN (HB) PAVEMENTS

[Maskinvalet Problem vid Bygge av HB-Vaeg]

The National Road Administration constructed a test road in order to study the problems in using all-bitumen (HB) pavements, such as strengthening of the subgrade, choice of plant for spreading the pavement, and suitable course thickness. The test road is approx. 1 km long, the subgrade being clay mixed with sand. It was divided into 10 sections, each of which had a different subgrade preparation, pavement thickness and construction method. It has been found that lime stabilisation of the subgrade is suitable if this is reasonably uniform and well compacted clay. If composition is variable, then bituminous gravel (BG) must be spread in such a way that the formation is not broken up. If the clay is very wet, the surface must be lime stabilised. It is best to lay BG by a spreader if the subgrade is strong enough, otherwise a grader must be used. The first course must then be at least 15 cm. The pavement is more even when laid by spreader; 20 cm can however be spread by grader and remainder by spreader. If the subgrade is strong enough then it is best to lay 25 cm course with a spreader, while on weak subgrades 2-3 courses are more suitable. /TRRL/ [Swedish]

Lindahl, T *Byggnadsindustrin* No. 34, 1974, p 4, 1 Fig., 2 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 212472)

PURCHASE FROM: National Swedish Road & Traffic Research Institute S-11428 Stockholm, Sweden Repr. PC

3A 096788

WARWICKSHIRE SKEW TWIN BOX GIRDER BRIDGE

This article gives an outline of the design and construction of the Warwickshire skew twin box girder bridge on the Kenilworth By Pass. It is the central bridge in the 3-level interchange connecting the by pass and the A45 truck road. The authors briefly discuss the factors that led to the choice of a single-span skew bridge at this site, rather than three-span structures or by over-spanning with a single-span structure. They follow this with details of the bridge itself which involved a displacement of the box girder units by 3.68M each due to the 30 degree skew. An account is given of the method of analysis used in designing the structure, which was broken down into four parts to facilitate the writing and checking of the computer programs used, and to make it easier to re-run the program until a satisfactory solution was obtained. The article concludes by giving constructional details. These mainly relate to the freyssinet concrete hinges that support the legs, the design of which was complicated by the need to resist torsion about the longitudinal axis perpendicular to the line of the hinges, in addition to the normal loads. /TRRL/

Knowles, A Rusbridge, DV (Midland Road Construction University, England) *Concrete* Vol. 8 No. 11, Nov. 1974, pp 38-39, 2 Fig., 3 Phot., 5 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 212031)

3A 096799

A VIADUCT FOR THE ENVIRONMENT

The article discusses the design of and method of construction used for the E Dale Road Viaduct, Derbyshire, built to replace an existing rail bridge built in 1930 to carry railway traffic from the Associated Portland Cement Manufacturer's Hope Works. Increased rail traffic made it necessary to not only replace the existing bridge but also to strengthen the Peaks Hole Culvert and to construct a pedestrian footbridge. The constructions required special attention to their design due to environmental considerations of the local countryside. The reinforced concrete, box-girder type viaduct was built directly alongside the old bridge, the new abutments being located on the existing embankments. Large longitudinal forces due to traction, braking and wind loads are carried by reinforced concrete raking struts at the north end, while the longitudinal reaction is carried by a horizontal plate anchor at the south end. The transverse reaction is carried by reinforced concrete foundations in conjunction with a retaining wall. /TRRL/

Butler, AW (Oscar Faber and Partners) *Concrete* Vol. 8 No. 9, Oct. 1974, pp 34-35, 3 Fig., 2 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 212026)

PURCHASE FROM: ESL Repr. PC, Microfilm

3A 096876

NEW RAILWAY BRIDGES OVER LONDON'S EAST CROSS ROUTE

The east cross route, or London Inner Ring Road System, affects the eastern region of British Railways at Victoria Park and Old Ford. Two under-line bridges are required at Hackney Depot, and three in the Victoria Park area including a 7 span box girder viaduct. A major under-line bridge is required at Old Ford. Site problems required differing forms of structure and different modes of erection. Problems with respect to the demolition of the old railway arch arose at the bridge over Wick Road. Special consideration was given to temperature effects on the Victoria Park viaduct which is on a curve. Old Ford bridge was a particularly difficult problem due to the high density electrified rail traffic and the presence of London transport tunnels and sub-station. This governed the choice of thrust bored abutments under the seven tracks. Superstructure design of all bridges was based on steel box girders, some strong enough to support a single track and others used as a beam group. Plated or concrete decks were used, and some of the parapet girders were clad. Waterproofing was by membrane or epoxy resin. Abutments were generally of reinforced concrete, sometimes on bored piles. /TRRL/

Jenkins, AH Holloway, BGR *Institution of Civil Engineers, Proceedings* Vol. 56 Nov. 1974, pp 537-557, 9 Fig., 8 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 212094)

PURCHASE FROM: Institution of Civil Engineers 26-34 Old Street, London EC1V 9AD, England Orig. PC

3A 096883

BIRMINGHAM INNER RING ROAD

The authors deal with the development of the Birmingham Inner Ring Road from its conception in 1917 to its completion as a traffic route in 1971. The detailed design of the road together with estimates was prepared in the early 1940s and parliamentary powers to carry out the land acquisition and the construction of the road were obtained in 1945-46. Work started on site in 1957 and the paper deals with the changes that were made to the original design consequent on new projections of traffic growth. These primarily consisted of the introduction of grade separation at the junctions. These changes, however, did not alter the original concept of the road as an all-purpose dual carriageway with frontage development. One of the changes was to introduce a 600 M long tunnel and the paper gives details of the design of this together with information on the ventilation methods used. The paper, in addition to giving details of the specifications and construction

methods used, deals with the problems associated with carrying out a major civil engineering work in a highly developed city centre area with the consequent disruption to existing mains services and to pedestrian and vehicular traffic movement. Information is given on traffic design capacities of the various sections of the road together with some details of the actual flows on completion. Finally the authors give their opinion on the effect of the construction of the inner ring road on the development of the city centre and conclude with some thoughts on the possible future development of the city centre area as affected by the ring road. /TRRL/

Cowles, BR Piggott, SG *Institution of Civil Engineers, Proceedings* Vol. 56 Nov. 1974, pp 513-534, 3 Fig., 6 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 212093)

3A 096968

TRENDS IN PRESTRESSED CONCRETE BRIDGE BUILDING [Entwicklungstendenzen im Spannbetonbrückenbau]

The design of multiple span prestressed concrete bridges in the Dresden area is described chronologically (1961-1971) and examples given of completed and projected structures. Principles, elements and technologies which have changed during this period are highlighted and the reasons for the changes are given. Many technical aids such as for example steel scaffolding systems have been tested. As regards production it is suggested that variable building height should not be chosen except for special reasons. Coloration of the concrete and processing are now rarer and natural stone walling is confined to special cases because of the cost. /TRRL/ [German]

Fischer, KH *Strasse* Vol. 12 No. 10, Oct. 1972, pp 424-28, 7 Fig., 9 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 300956)

PURCHASE FROM: VEB Entwurfs-und Ingenieurbuero des Strassenwesen BT Berlin, Bruederstrasse 26, 102 Berlin, East Germany Repr. PC

3A 096991

FIFTY-YEAR DEVELOPMENT-CONSTRUCTION OF STEEL TRUSS BRIDGES

Construction methods for steel truss bridges, though much refined, have not changed appreciably. Bridge construction gradually shifted priority from the railroad requirements to the highway requirements. This shift was accompanied by replacement of temporary timber trestles and rail-mounted derrick cars or locomotive cranes with steel falsework and derricks mounted on travelers or tower barges. Truss construction is divided into three types-simple, cantilever, and continuous. Procedures for each type are presented by describing major representative structures.

Bigelow, LN (US Steel Corporation) *ASCE Journal of the Construction Division Proc Paper* Vol. 101 No. C02, ASCE 11381, June 1975, pp 239-258, 16 Fig., 17 Ref.

3A 096994

PAST AND FUTURE OF CONSTRUCTION EQUIPMENT--PART I

The Industrial Revolution in the 19th Century brought about an expanding economy in a rapidly expanding world. Manual labor was changing to mechanized. Man had to enlarge his physical effort by creating new machines to keep up with his ever-growing needs. This paper traces the various changes in construction tool development from ancient man, through the pre-World War I period, the rapid development prior to the Great Depression of the 1930's, the slowdown during the depression, the tremendous requirements placed on the Construction Industry at the start of WW II, the war itself and immediate post-war periods. Culmination of the paper is the release of the pent up demand which brought on the post-war inflation and boom that laid the ground work for changes in the construction equipment industry during the 1960's and 1970's the like of which the world had never seen.

Larkin, -FJ (Dravo Corporation); Wook, S, Jr (Rocky Mountain Area Engineers) *ASCE Journal of the Construction Division Proceeding* Vol. 101 No. C02, ASCE 11391, June 1975, pp 309-315

3A 097055

GENERAL CONSIDERATIONS ON THE PREFABRICATION OF CONCRETE STRUCTURES [Consideraciones Generales Sobre la Prefabricacion de Estructuras de Concreto]

The problem of the prefabrication of concrete structures is studied, especially the advantages and disadvantages of in-situ construction. The field of prefabrication, in which Mexico has the greatest experience, is that of bridge construction, where concreting tables located near the construction site are used for manufacturing prestressed beams while the superstructure of the bridge is being built. /TRRL/ [Spanish]

Robles, F *Ingeniera* No. 2, Apr. 1972, pp 155-176, 5 Fig., 17 Phot., 27 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 100876)

3A 097062

NEW TYPE OF PREFABRICATED BRIDGE [NUEVO TIPO DE PUENTE PREFABRICADO]

Details are given of a type of prefabricated bridge for spanning railway lines. Thanks to prefabrication and maximum lightness, installation is reduced to the simple in-situ excavation of the foundations and erection of the precast units. The project described consists of three semi-continuous spans (elimination of transverse joints) 7.70, 12.60 and 7.70 m respectively. The structure comprises three components: pier, box girder and deck slab. The flexibility of the system facilitates the construction of a wide variety of spans and the erection of one-, two- or three-lane structures. The erection process, equipment needed and calculation assumptions are described. /TRRL/ [Spanish]

Aquilo, M Ordonez, JA Martinez, J *Hormigon Y Acero* No. 102, Jan. 1972, pp 101-108, 8 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 100813)

PURCHASE FROM: Ultimas Noticias de Hormigon Pretensado Instituto Eduardo Torroja, Madrid 16, Spain Repr. PC

3A 097186

IMPROVEMENT IN THE ADHESION OF BITUMINOUS RUNWAYS BY MEANS OF GROOVING. TESTS ON THE LYON-BRON AIRPORT [Amelioration par Striage de l'Adherence des Pistes en Enrobés. Essais sur l'Aerodrome de Lyon-Bron]

This article describes grooving tests on a 5400 M squared surface of asphaltic concrete containing siliceous-limestone 0/16 aggregate and 6% bitumen. Grooving was carried out by means of diamond discs under water spraying. The costs of the various operations are quoted together with the coefficients of friction measured before and after grooving. /TRRL/ [French]

Quint, D Lacharme, M *Revue Generale des Routes* Vol. 42 No. 478, July 1972, pp 31-34, 7 Fig., 1 Tab., 3 Phot.

ACKNOWLEDGMENT: Laboratoire Central des Ponts et Chaussees, Transport and Road Research Laboratory (IRRD 100697)

3A 097336

UNDERPASS THRUST AT BRENT CROSS FLYOVER

The thrusting of precast concrete tunnel boxes beneath the three-level flyover approaches at Brent cross is reported and claimed to be the largest thrust in the UK to date. The need for thrust boring was found to be essential, in order to meet the condition that access to the shopping centre should not interfere with the heavy traffic flow at the existing interchange. Details of the excavations required, materials used and methods employed in construction are given, together with diagrams and photographs, and the overcoming of the problem of pockets of soft material located in the line of thrust is described. The work was coordinated by Cementation Projects Ltd., and the other companies that were involved are listed. /TRRL/

Highways and Road Construction Vol. 43 No. 1781, Jan. 1975, pp 10-12, 2 Fig., 3 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 212067)

3A 097339

FILE ON CONSTRUCTION METHODS [Fichero de Procedimientos para la construcción]

The author examines the reasons for low output in the construction industry and concludes that 75% of them stem from a lack of knowledge of suitable construction methods. A file is proposed for construction methods, the aim of which is (1) to present the experience gained up to date in the field of the application of construction methods, (2) to give clear data for the selection of suitable methods for each case. The file comprises a very large number of sheets classified into (a) normal construction work, (b) specific construction work, and (c) specific civil engineering work. /TRRL/ [Spanish]

Perezal, F. *Materiales Maquinaria y Metodos para la Construc* No. 86, Nov. 1971, pp 841-846, 3 Fig., 6 Tab.

ACKNOWLEDGMENT: Transportation & Soil Mechanics Laboratory, Spain, Laboratoire Central des Ponts et Chaussees, Transport and Road Research Laboratory (IRRD 100757)

3A 097342

TECHNOLOGICAL SOLUTIONS TO THE CONSTRUCTION OF CONDUITS [Solucion de canales tecnologicas]

Details are given of the use of precast reinforced concrete slabs for building conduits in various types of industrial installations. Construction techniques for each type are described, and the advantages of the system from the point of view of material and labour saving, are described. /TRRL/ [Spanish]

Roque, R. *Ingenieria Civil* No. 1, Jan. 1972, pp 33-42, 4 Fig., 1 Phot.

ACKNOWLEDGMENT: Transportation & Soil Mechanics Laboratory, Spain, Laboratoire Central des Ponts et Chaussees, Transport and Road Research Laboratory (IRRD 100754)

3A 097345

ROAD PAVEMENTS, WATERBOUND MACADAM [Pavimentos rodoviarios. Macadame hidraulico]

This specification establishes the characteristics and the construction procedure for waterbound macadam pavements. /TRRL/ [Portuguese, French]

National Civil Engineering Laboratory, Portugal Standard E296, Mar. 1974, 3 pp

ACKNOWLEDGMENT: National Civil Engineering Laboratory, Portugal, Transport and Road Research Laboratory (IRRD 211888)

PURCHASE FROM: National Civil Engineering Laboratory, Portugal Avenida do Brazil, Lisbon 5, Portugal Orig. PC

3A 097349

THE STABILIZATION OF COHESIVE SOILS WITH LIME [Verfestigung Bindiger Boeden Mit Kalk]

At the Fourteenth World Road Congress in Prague the experiences of several European countries with lime stabilisation were described. It is reported that there is extensive cohesive soil between Belgium and the USSR and that lime treatment is cheaper than exposure. Observations of test sections with various lime additives show good results. Even after many years comparative values of land with and without lime show marked increases of strength. In the Federal German Republic it is proposed that all sections which have been lying for years should be systematically tested for lime stabilisation and practical evaluation made. /TRRL/ [German]

Buergen, W. *Strassenbau-Technik* Vol. 25 No. 18, Sept. 1972, pp 45-52, 7 Fig., 6 Tab., 23 Ref.

ACKNOWLEDGMENT: Research Association for Road Communications, W Gr (BAST21065E), Transport and Road Research Laboratory (IRRD 300965)

PURCHASE FROM: Verlagsgesellschaft Rudolf Mueller Stolberger Strasse 84, D-5000 Koeln-41, West Germany Repr. PC

3A 097370

WINTER CONSTRUCTION [Winterbau]

The publication is a collection of 12 articles presented at a meeting in Magdeburg in 1971 entitled "Methods for Carrying Out Road and Bridge Works in Winter". The articles describe practical experience in earthworks, massive bridge construction and road construction, and two deal in

particular with the methodology of planning construction in winter. /TRRL/ [German]

Beitraege zur Forschung & Praxis im Strass & Brueck 1971, 28 pp

ACKNOWLEDGMENT: Research Association for Road Communications, W Gr, Transport and Road Research Laboratory (IRRD 300992)

3A 097422

TO SELECT A NEW SCRAPER-GO BACK TO BASICS

Production volume requirements, material characteristics, and haul conditions are identified as the three major variables to consider in scraper selection. The amount of material to be moved and the time available to do the job will determine an "optimum" scraper size. The various aspects are considered of loading, hauling, the disadvantages of large scrapers, and amortization of machines. The best means of determining optimum scraper capacity is either a side-by-side on-the-job comparison, or comparison via a computerized study simulating the earthmoving conditions on project. The effect of loading conditions on scraper scraper selection is illustrated. Tandem-powered 4-wheel drive scrapers, the elevating scraper and push-pull scrapers are discussed. Hauling conditions such as length, grades and rolling resistance will affect selection and have an effect on cycle time and cost per yard. The economics of various scraper usage are briefly discussed. Job conditions have an effect on earth moving tire expense. Tires normally represent 30 percent of the total owning and operating cost of scrapers. On tandem-powered scrapers, wear can be reduced by deadstick loading to eliminate wheel spinning.

Roads and Streets Vol. 118 No. 3, Mar. 1975, pp 120-122, 1 Fig., 2 Phot.

3A 097600

A STUDY ON PRE-ERECTION SYSTEM IN HULL CONSTRUCTION

The Shipyard lay-out and facilities have been modernized in line with the adoption of the block construction process. In these days the most modernized shipyards have been newly constructed both in Japan and abroad to cope with the increased demand of superlarge type ships. In the first stage of these new shipyards simply a single building dock each was constructed in view of the then prospect of newship tonnage to be built and the cost of the deck construction. After that due to the ever increasing demand for super-large ships, it became necessary either to lengthen the dock or to add another new dock in which the after block of the hull containing the machinery space to be pre-erected. Even in this case, it was necessary to float and shift the pre-erected after-ship block, and this process was not so easy due to the problems for the adjusting of its draft and trim. As the next stage the pre-erection process of the aft part of the ship including machinery space and some oil tanks was adopted. But even in this process it was necessary to float and shift the portion, and though the draft problem was solved, the labor manhour balancing problem remained unsettled. To solve this problem new shipyards with dual entrance dock or two building docks have emerged. In these docks, the pre-erected hull portion are constructed without shifting. At the same time, in some docks the pre-erected hull portions are shifted mechanically in lieu of the floating procedure. In this essay, the authors intend to explain these aforesaid various construction methods. At first the theoretical explanation of the construction process is made and then calculation of the length of the necessary pre-erection dock to peak-shaving the labor manhours is shown. As a result, it is concluded that the mechanical shifting of the pre-erected portion from the pre-erection dock with a suitable length shall be very advantageous to solve the problems. Finally the authors describe the fundamental design of the mechanical moving system.

Selected paper from the Journal of the Society of Naval Architects of Japan, Vol. 133, June 1973.

Takezawa, I Muto, M Kanazaki, A (Mitsubishi Heavy Industries, Limited) *Selected Papers, J of Soc of Naval Arch of Japan* Vol. 12 1974, pp 135-147, 6 Ref.

ACKNOWLEDGMENT: Society of Naval Architects of Japan

PURCHASE FROM: Society of Naval Architects of Japan 35 Shiba-Kotohira-cho, Minato-ku, Tokyo 135, Japan Repr. PC

3A 097606

CHINNOR TUNNELLING TRIALS-BACKGROUND & PROGRESS

This article gives the background to the Chinnor tunnelling trials and an outline of the progress that has been made. Because the rate of tunnelling

is a critical factor affecting costs, TRRL's tunnelling research has concentrated on excavation and primary mucking systems. The Chinnor trials represent the first full-scale studies that back up laboratory and pilot scale studies. After discussing the choice of the site (in the lower chalk) the authors outline the scope of the work which is primarily aimed at obtaining data relating to the performance of tunnelling machines and how it is affected by various factors; secondary objectives are the development of instrumentation and data processing systems, the study of debris clearance and performance of the machine, the study of the relation between site investigation and actual conditions, and the study of ground movements caused by tunnelling. The authors give details of the cutting head and tunnelling machine used at Chinnor and briefly discuss the initial trials. This is followed by a discussion of the principal factors being studied; rock cutting tool forces, head rotation speed, rate of advance and alignment of the head, hydraulic delivery pressure to the head, machine thrust, energy consumption and hydraulic oil pressure supplied to the reaction ring. Data acquisition is next discussed followed by an outline of the programme of tunnelling to be employed. This includes a diagram showing the proposed stages of the rock cutting experiments which are designed to provide data useful in the selection of tools appropriate to different rock formations. /TRRL/

Higne, HJ Boden, JB (Transport and Road Research Laboratory) *Tunnels and Tunnelling* Vol. 6 No. 6, Nov. 1974, pp 65-70, 5 Fig., 1 Tab., 1 Phot., 3 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 212139)

PURCHASE FROM: ESL Repr. PC, Microfilm

3A 097652

PRESPLITTING

This report is a synthesis of three interim reports on presplitting of high cut slopes. Observations are presented on the economics, construction, and maintenance aspects of presplitting in addition to the general conclusions and recommendations of the authors, and the specifications developed as a result of the study. /FHWA/

McCauley, ML Hoover, TP Forsyth, RA
California Department of Transportation, (19203-762503-632955) Final Rpt. Sept. 1974, 32 pp

F-8-7

ACKNOWLEDGMENT: Federal Highway Administration (P-0072)

PURCHASE FROM: NTIS Repr. PC, Microfiche

PB-240627/AS

3A 097673

RENFREW MOTORWAY SEWER

This article is concerned with the design and construction of the Renfrew motorway sewer, which was built to avoid overloading Glasgow's existing sewerage system. Particular reference is made to the problems created by the presence of underground railway tunnels, poor ground, the depressed motorway profile and the need to minimize tidal effect. After a general introduction the author discusses design criteria and the choice of a suitable route which passed under the underground railway. This includes a discussion of the factors which led to the type and method of construction used. The next part of the article is concerned with the actual construction work, and includes details of the equipment used which included a stielmo shield in the soft ground tunnel and of the tunnel lining. It also includes information relating to the blasting methods that were used and the laying and backfilling of the pipes which involved the use of an aliva 300 concrete placing machine. Reference is made to the caulking of joints which was carried out to overcome the problem of containing the compressed air used in the construction in the sheet pile shafts and at the junction with the air deck. /TRRL/

McLean, RD (Scott, Wilson, Kirkpatrick and Partners) *Tunnels and Tunnelling* Vol. 6 No. 6, Nov. 1974, pp 57-59, 3 Fig., 2 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 212138)

3A 097679

PRACTICAL ASPECTS OF THE COMPACTION OF BITUMINOUS MATERIALS

After a general introduction the authors consider the costs of compaction and conclude that constraints are more likely to be physical than economic. Current equipment and practice are mentioned and the principle of the compaction process is discussed. The practical consequences of applying these principles are examined and the planning of the site operations, which requires consideration of the number and characteristics of the rollers employed, the rate at which the material is laid, the laydown temperature and the rate of cooling. The question of the number of roller passes necessary is studied and the authors put forward the opinion that it is best to aim at as many as possible. The effectiveness of different types of roller is also analysed. The next part of the paper, concerned with the evaluation of compaction, makes special reference to gamma-ray transmission techniques and discusses the relative merits of "method" and "end product" specifications. The authors conclude that whilst compaction practice relies heavily on experience, it rarely fails to result in poor performance. They believe that improved compaction technology may be required in the future for mixes which make more economical use of materials, but that in the meantime there is a case for using as many rollers as possible with light rollers immediately behind the paver. For the covering abstract of the seminar, see IRRD abstract no 212145. /TRRL/

Finey, JT Hills, JF (Wimpey Laboratories Limited)
Asphalt and Coated Macadam Association Conf Paper 1974, 25 pp, 10 Fig., 21 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 212147)

3A 097760

GUIDELINES FOR THE APPRAISAL OF STRUCTURAL COMPONENTS IN HIGH ALUMINIA CEMENT CONCRETE

This memorandum is primarily concerned with suspended floor and roof structures which are constructed from precast prestressed concrete components made from high alumina cement (hac), where the units are used generally in a simple non-composite form with breeze block or composition non-structural decking. Current field experience is used to outline a rational inspection and appraisal procedure. The process of assessment of the structural condition is described in detail: visual inspection, background information (one-day cube strength of the concrete, water/cement ratio, composition and strength of the cement, method of compaction and curing), non-destructive tests, structural analysis and judgment and recommendations for action. /TRRL/

Institution of Structural Engineers Standard HAC/1/1974, Oct. 1974, 18 pp, 3 Fig., 1 Tab.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 211909)

3A 097836

TESTS ON A HEAVY SINGLE-WHEELED VIBRATING ROLLER FOR THE COMPACTION OF A GRAVEL-SLAG ROADBASE

[Essais d'un rouleau vibrant monobille lourd pour le compactage d'une couche de base en grave-laiter]

Results are given of compaction tests on gravel-slag carried out with a single-wheeled vibrating roller at the road testing centre in rouen. The object of this study was not to compare the performance of this type of roller with that of the types currently used, but only to define the operational parameters of the roller. Results show that the efficiency of the roller in depth is better at resonance frequency than at the maximum permitted frequency. High densities can be obtained if the number of passes is between 6 and 14. /TRRL/ [French]

Morel, G Valeux, JC Chaigne, D *Revue Generale des Routes et des Aerodromes* No. 481, Nov. 1972, pp 93-96, 7 Fig., 5 Tab., 1 Phot.

ACKNOWLEDGMENT: Laboratoire Central des Ponts et Chaussees, Transport and Road Research Laboratory (IRRD 100706)

3A 097844

CONSTRUCTION OF RIGID PAVEMENTS [Execution des Chaussees en Beton de Ciment]

The author reviews changes in the construction techniques for rigid pavements, in particular the techniques used recently on construction sites

in France. A study is made of the ingredients (cement, aggregates, admixtures) and of mix-design, manufacture and laying techniques from the point of view of the behaviour of the edges of the pavement, cracking and screeding and from that of long-term behaviour of the pavement (mechanical strength and resistance to wear). Maintenance and strengthening problems, and rigid pavement design, methods in use in other countries are briefly discussed. /TRRL/ [French]

Parey, C (Laboratoire Central des Ponts et Chaussées) *Revue Generale des Routes et des Aerodromes* Vol. 42 No. 479, Sept. 1972, 14 pp, 1 Fig., Photos., Refs.

ACKNOWLEDGMENT: Laboratoire Central des Ponts et Chaussées, Transport and Road Research Laboratory (IRRD 100910)

3A 097971

DUSK TO DAWN LIFT FOR 1100 TONNE DECK AT MILFORD HAVEN

This article gives an account of the construction and positioning of the final section of the new steel box girder bridge at Milford Haven. It is the biggest lifting operation of its kind (1100 tonnes) to be undertaken in Britain. The author first outlines the collapse of a 70 M cantilever on the south bank in 1970 and the events that led to the adoption of the Swiss losinger system to complete the bridge. Four slu 330-tonne jacks were mounted on each of the 38M cantilevers and the section lifted by means of 8 cables formed from 18 stabilized 15.2mm steel strands. The 40 metre high lift was completed in 18 hours at rates up to 5 metres an hour. Details are given of the construction of the 118M long section in a near-by dry dock, it consisted of 17M long box lengths and was floated into position for lifting. This method avoided the joining of two 100M cantilevers which would have drooped over 3M before being connected. Mention is made of the high cost (.5M) of strengthening the bridge which led to an increase in the weight of steel used of 5,000 to 6,000 tonnes. Notes are included on the completion of the structural work together with several illustrations of the project. /TRRL/

Cottrill, A *New Civil Engineer* No. 120, Nov. 1974, pp 36-39, 1 Fig., 9 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 212084)

3A 097973

FABRICS FOR ROADS

Monarflex of Denmark, Ici, and Chemie Linz of Austria showed new or recently developed artificial fibre, fine mesh fabrics suitable for separating different layers in road building and for drainage. These polypropylene-based materials can be used to contain tipped material while still permitting drainage. Or, laid beneath aggregate on marshy ground, they can prevent the aggregate sinking into the subsoil, thus producing roads strong enough to carry heavy construction vehicles. Other uses include site stabilisation for car parks and playgrounds, filtration membranes in erosion control, and reinforcement of asphalt in road repair works. /Author/TRRL/

New Scientist Vol. 64 No. 928, Dec. 1974, p 875

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 212086)

3A 098090

TYRES AND WHEELS. PART 1-TYRES-SECTION 3.-OFF-THE-ROAD TYRES

The specification provides guidance to the use of tyres on earthmoving machinery and mobile cranes in transit on the highway, and recommends maximum loads, pressures, dimensions etc. For various types of use. /TRRL/

British Standards Institution Standard BS AU 50: Part 1: 3A, May 1974, 32 pp, 14 Tab.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 211932)

3A 098113

ROAD PAVEMENTS. MECHANICAL STABILIZATION

This specification establishes the characteristics of and the construction procedure for mechanically stabilized road subbases, bases and wearing courses consisting of soil, aggregates or any combination of these materials. /TRRL/ [Portuguese]

National Civil Engineering Laboratory, Portugal Standard No. 269, June 1973, 3 pp

ACKNOWLEDGMENT: National Civil Engineering Laboratory, Portugal, Transport and Road Research Laboratory (IRRD 211885)

PURCHASE FROM: National Civil Engineering Laboratory, Portugal Avenida do Brasil, Avenida do Brasil, Orig. PC

3A 098474

TOOLS AND RULES OF CONCRETE PLACEMENT

Current methods of concrete placement are examined in terms of both the equipment and the best ways of use of the equipment. The best tools for reaching lower elevations are chutes of flexible steel, or drop chutes (elephant trunks) of rubber or flexible plastic. Concrete buggies adapt to horizontal movement or traverse slopes to 5:1. Different types of manual and powered walk behind units are listed. In general, buggies should have pneumatic, cushion, or foam-filled tires to enhance speed and smoothness and minimize concrete segregation. Different types of buckets are described which are most efficient over vertical distances. Lighter magnesium buckets can be up to 1/4 yd. larger for a given crane capacity. Belt conveyors are especially adapted to long distances and high concrete volumes. Swinging and cantilevering units, swivel on a turntable, retract and extend up to 70 ft. They also cover larger areas. Different kinds of concrete pumps are mentioned. Pumped concrete has gone up to 576 ft., and 200 ft. along horizontal distances. The advantages of pumped concrete are reviewed. Twenty eight rules which establish economies are set forth.

Construction Methods and Equipment Vol. 57 No. 6, June 1975, pp 40-42, 1 Fig.

3A 098960

PREPARATION AND OPERATION OF DIESEL ENGINES IN CONSTRUCTION AND INDUSTRIAL MACHINERY FOR OPERATION IN COLD CLIMATE

This publication contains the summaries of many papers and varying subjects pertaining to cold weather preparation of diesel engines for operation in cold weather and arctic climates. It has been difficult to avoid controversial areas and still present what we hope represents the areas which require attention when operating a diesel engine in cold and/or arctic climates and some of the varying specialized equipment our experience indicates can be helpful. /GMRL/

Bugelski, WG (Cummins Engine Company, Incorporated)

Society of Automotive Engineers, (SASI 75-908) SAE #750473, Feb. 1975, 17 pp

3A 099533

ALARM INDICATING DEVICES

The purpose of this paper is to describe the results obtained during some attempts to gain extended engine life by means of warning and information systems. Data will be presented on cylinder head mortality rates since the introduction of the initial rudimentary alarm system. Experience gained from problems encountered with the elementary systems has led to an examination of the purposes and limitations of monitoring systems as applied to earthmoving equipment. This in turn has led to the development of a second-generation system which, it is hoped, will overcome some of the deficiencies of the elementary system without introducing major problems of its own. /GMRL/

Vidovic, HT Murray, CB, Jr (General Diesel and Equipment,

Incorporated)

Society of Automotive Engineers, (SASI 75-1074) SAE #750562, Apr. 1975, 6 pp

3A 099535

AN "IN-HOUSE" TECHNICAL FORECAST

This paper describes a technical forecasting program that was used at the John Deere Works' Engineering Department and—even though we have not

proven its effectiveness--tells you why we think it works. It also tells what construction machinery will probably be like 20 years from now. /GMRL/

Lux, WJ (John Deere Dubuque Works)
Society of Automotive Engineers, (SASI 75-1080) SAE #750569, Apr. 1975, 5 pp

3A 099536
WORK CAPABILITY FACTORS FOR DOZER AND LOADER TIRES OPERATING IN LOAD AND CARRY SERVICE

Since tire heat becomes a major potential problem in Load and Carry service, a method was required to determine the performance capabilities of Dozer and Loader tires so that optimum tire life could be achieved. This paper covers the need for tire limits; basic Dozer and Loader tire design requirements; the method established for determining tire capabilities in Load and Carry service, and finally the factors differentiating this rating system from the TMPH system which is used for transport type vehicles. /GMRL/

Cvengros, DV Olsen, RJ (Goodyear Tire and Rubber Company)
Society of Automotive Engineers, (SASI 75-1081) SAE #750574, Apr. 1975, 6 pp

3A 099538
DEVELOPMENT OF A ONE-PIECE RIM FOR EARTHMOVER TIRES

The off-highway, 15 deg bead seat tire and its 15 deg tapered bead seat drop center rim is a new concept for today's earthmoving vehicles. The drop center rim concept offers significant advantages over the more common removable flange rim in weight reduction, safety, and durability. This paper describes those advantages, as well as the development and testing of the rim and tire design. /GMRL/

Annis, WT (Firestone Tire and Rubber Company)
Society of Automotive Engineers, (SASI 75-1083) SAE #750572, Apr. 1975, 6 pp

3A 099541
THE APPLICATION OF CENTRALIZED LUBRICATION SYSTEMS TO MOBILE EQUIPMENT

Recent developments in centralized lubrication systems have made them more compatible with the operational demands of the construction industry. This system delivers the correct amount of lubrication to each bearing, can warn the operator in the event of a lubrication failure and directs maintenance personnel to the problem area during a scheduled downtime. It has a wide variety of pumping methods, controls and monitors. Safety of personnel, continuous lubrication, reduced downtime, reduced usage of lubricants, longer machine life and higher profits are the results of a good lubrication program. /GMRL/

Mueller, B (Ritter Engineering Company)
Society of Automotive Engineers, (SASI 75-1085) SAE #750585, Apr. 1975, 6 pp

3A 099601
THE CORNOUAILLE BRIDGE AT THE ODET ESTUARY [Le pont de cornouaille a l'embouchure de l'odet]

The authors give the reasons for the selection of the site: width of the river reduced to 260m, presence of rock very near the surface, ease of construction of access roads, and details of the design: six-span metal deck orthotropic slab bridge, the total length of which between the outside bearings is 610m; length of spans: 60-65m, 110-200m, 110-65M (the 200m span being the longest in France for bridges of this type). Details are given of the soil Gneiss mass (the upper part of which was weathered), construction of foundations in the river (dry method of construction with the help of cofferdams), land bearings (abutments resting on four reinforced concrete wells). The river piers consisting of a reinforced concrete massive shaft, the stability of which against ship collision was calculated for horizontal stresses of 1000 t. Data are presented on the box girder bridge deck (metal sheets and cross bars). A new construction method was used for manufacture and erection; the deck was entirely precast in the factory per section. Launching was done by bringing the sections to the launching frame by means of a piece of equipment called diplodocus. Brief details are given of the structural stability, the deck having been designed as a continuous six span girder. The effect of the wind on the structure was studied for A 100m cantilever.

Protection against corrosion was carried out in the workshop. The internal part of the box girder was sanded and coated with two layers of copon-met-1-pon, and one layer of epoxy-pitch. The external part was sanded, coated with zinc and 5 layers of glycerophaltic paint. The surfacing of the orthotropic slab is 6cm thick, and it was tested on a ring road in quimper. First, the surface of the slab was brushed and subjected to blowing with compressed air, then a waterproofed course was applied consisting of elastomer on which chippings were spread; the asphaltic concrete wearing course is 4cm thick. Further details are given of bearing devices, expansion joints, footpath edges, parapets, drainage, signalisation, ancillary structures and maintenance. /TRRL/ [French]

Thouzeau, C Leouzeau *Moniteur des Travaux Publics et du Batiment*
Vol. 69 No. 34, Aug. 1972, pp 10-18, 7 Fig., 5 Phot.

ACKNOWLEDGMENT: Laboratoire Central des Ponts et Chaussees, Transport and Road Research Laboratory (IRRD 100942)

3A 099616
THE PROBLEM OF THE EXHAUST FUMES FROM DIESEL ENGINES IN UNDERGROUND GALLERIES [Le probleme des gaz d'echappement des moteurs diesel dans les galeries souterraines]

It is recalled that all exhaust fumes are dangerous, unless treated or eliminated according to safety requirements. They cause special problems in underground galleries. Diesel engines are most often used in underground construction work, and this article deals more specially with them: nature of exhaust gases, use of ventilation to maintain toxic gases at non-dangerous level, consequences of insufficient ventilation, and treatment of exhaust fumes. /TRRL/ [French]

Cahiers de Notes Documentaires No. 69, Oct. 1972, pp 391-396, 7 Fig., 2 Tab., 1 Ref.

ACKNOWLEDGMENT: Road Safety Study and Research Fund, Belgium, Laboratoire Central des Ponts et Chaussees, Transport and Road Research Laboratory (IRRD 100952)

3A 099618
COMPACTION OF BITUMINOUS SURFACINGS [Le compactage des revetements bitumineux]

This article presents an overall study of the problem of the compaction of bituminous surfacings. It aims at facilitating the application of theoretical principles to practical problems with a view to obtaining optimum compaction taking into account various constraints such as availability of funds, materials, equipment, labour, and environmental conditions. The article is divided into six-parts: definition; aims; factors influencing compaction: thickness of the layers to be compacted, aptitude of the mixture to compaction, rolling equipment, air temperature and temperature of the surface to be covered, rolling temperature, compaction method; compaction due to traffic; typical example of satisfactory compaction; references on the subject. /TRRL/ [French]

Hodeotte, JBK (Laboratoire de Controle et de Recherche, Canada) *Bulletin de Liaison des Lab des Ponts et Chaussees* No. 63, Jan. 1973, pp 141-147, Figs., 1 Tab., Refs.

ACKNOWLEDGMENT: Laboratoire Central des Ponts et Chaussees, Transport and Road Research Laboratory (IRRD 101051)

PURCHASE FROM: Laboratoire Central des Ponts et Chaussees 58 Boulevard Lefebvre, 75732 Paris Cedex 15, France Orig. PC

3A 099619
REINFORCED EARTH IN THE SETE INTERCHANGE [La terre armee dans l'echangeur de sete]

The sete interchange is built alongside a canal on highly compressible soil. Because of these conditions, a large number of retaining structures had to be built, most of which were constructed with reinforced earth. The author gives two main reasons for the use of this material: savings in the cost of the project and possibility of uninterrupted traffic flow during construction. The bulk of the project consisted of the design of the foundations of the structures. After briefly recalling the principles governing reinforced earth construction and the technology used, the author describes in detail the design and calculation of the reinforced earth retaining walls. /TRRL/ [French]

Schlosser, F *Bulletin de Liaison des Lab des Ponts et Chaussees* No. 63, Jan. 1973, pp 149-171, Figs, Tabs., Photos., Refs.

ACKNOWLEDGMENT: Laboratoire Central des Ponts et Chaussées, Transport and Road Research Laboratory (IRRD 101052)

PURCHASE FROM: Laboratoire Central des Ponts et Chaussées 58 Boulevard Lefebvre, 75732 Paris Cedex 15, France Orig. PC

3A 099621

TECHNICAL DAYS DEVOTED TO ROADS IN CORSICA-PART 2-LIGHTLY-TRAFFICKED ROADS [Journées techniques de la route de Corse-Deuxième partie- Les routes économiques]

This article comments on papers dealing specifically with the constructional and administrative problems of lightly-trafficked roads. The first paper by remillon stresses the drawbacks of applying to lightly-trafficked roads pavement design and strengthening methods used for heavily-trafficked roads. Proposals are put forward for the extensive utilization of local materials with a view to realizing large savings in construction costs. The second report by ceintrey recommends the use of non-conventional materials for the construction of low-cost roads, and emphasizes the need for close cooperation between laboratory and in-situ tests when developing new construction techniques. The last two papers by cartier and lanore outline the experience of both authors in the administrative aspects of lightly-trafficked road construction in two departments in france (morbihan and dubs). Discussions of the papers are appended. /TRRL/ [French]

Remillon, M (Viafrance); Ceintrey, M Cartier Lanore *Revue Generale des Routes et des Aerodromes* Vol. 43 No. 484, Feb. 1973, pp 41-47, Figs., 2 Tab.

ACKNOWLEDGMENT: Laboratoire Central des Ponts et Chaussées, Transport and Road Research Laboratory (IRRD 101054)

3A 099718

HONSHU-SHIKOKU BRIDGE PROJECT

The project to link Honshu and Shikoku Islands in Japan is reviewed, which, scheduled for completion in 1985, will require the construction of three major bridge and highway systems at Kobe-Naruto (route A), Kojima-Sakaidé (route D) and Onomichi-Imabari (route E). Route A will consist of 81 km of highway and 79 km of railway links, both systems using the same 3-span suspension bridge over the 4 km Akashi Strait. Route D crosses a number of straits of 9400 M total length using 3-span suspension bridges, truss bridges and viaducts. The total length of the highway link is 39 km and the railway 49 km, again with both using the same bridges although separated on land. Route E is a highway-only link of 61 km total length crossing the straits via several islands with various types of bridges of lengths ranging from 300-800 M. Details are given of the structural design standards, construction costs, bridge design, economics and estimates of future public, private and freight traffic volume for the three structures in the project. /TRRL/

Matsuzaki, Y (Honshu-Shikoku Bridge Authority) *Civil Engineering in Japan* Vol. 12 1973, pp 27-45, 10 Fig., 11 Tab., 1 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 211959)

3A 099912

DEPTH OF CONCRETE COVER OVER BRIDGE DECK REINFORCEMENT

Fifty concrete bridge deck spans in New York State were surveyed with a pachometer for depth of clear concrete cover. Compliance with a design requirement for a minimum of 2 in. (51 mm) occurred at 77.3 percent of the locations measured. Spans having a high degree of compliance also tended to have relatively uniform cover depths. The degree of compliance appeared to be related to construction practices. The distribution of cover depths on individual spans was generally not normal, and a construction tolerance of plus or minus 1/2 in. (plus or minus 13 mm) was determined to be reasonable for the type of requirement under which the decks were built.

Amsler, DE Chamberlin, WP (New York State Department of Transportation) *Transportation Research Record* No. 535, 1975, pp 73-81, 6 Fig., 3 Tab., 11 Ref.

ACKNOWLEDGMENT:

PURCHASE FROM: TRB Publications Off Orig. PC, NTIS Repr. PC, Microfiche

3A 125074

CHANNEL: FRENCH MINERS FIGHT CASCADE AS BRITISH MOLE BARES TEETH FOR PILOT

The author gives an account of progress that has been made (up to the end of 1974) with the channel tunnel. Progress that has been made by the French near Calais, where trouble has been encountered in the access tunnel (descenderie) through the ingress of 120 litres of water per second is described. Extensive grouting with bentonite and cement has failed to waterproof the tunnel and neither a small alpine roadheader nor a large Demag roadheader has been able to perform satisfactorily. A Robbins mole is now being tested and in order to bring it into use as soon as possible, an additional tunnel is being planned. Details are given of the progress made by the British near Dover, where both access tunnels (one 400m and the other 287m plus a 100m viaduct) and a 180m long assembly chamber have been driven, the latter 40m beneath the channel. The priestley 50m long tunnelling machine has also been assembled ready to commence work. Brief details are given of the proposed 3 phases of construction of the tunnel and the article includes information on the different conditions and policies in France and Britain. /TRRL/

Hayward, D *New Civil Engineer* No. 126, Jan. 1975, pp 19-22, 2 Fig., 6 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 212673)

PURCHASE FROM: Institution of Civil Engineers 26-34 Old Street, London EC1V 9AD, England Repr. PC

3A 125076

CMI SLIPFORM PAVER MAKES THE GRADE

An account is given of the paving techniques adopted by John Laing construction for the 7.8 km Windover to Funtley section of the m27 in Hampshire, in which the CMI slipform paver is laying two adjacent 7.15 m wide strips to form the three lanes and hard shoulder for each 14.3 m wide carriageway. The sub-grade is a gravelly, sandy clay mixture, with the 270 mm thick pavement being constructed on a type 1 crushed limestone sub-base. Joints, which are set out ahead of the paving units, follow a sequence of 3 warping to 1 contraction joint, all at 5m spacing. The placing and spreading of the concrete, compaction and finishing of the slab, and method of cutting transverse joints, are briefly described. Surface irregularity measurements using a multi-wheeled profilometer, indicate a good to fair standard of finish, so far. Mention is made of the problem of selecting a design sub-base thickness which will be adequate to carry construction traffic. Part of the m27 western carriageway will include a 1.8 km experimental section designed by the TRRL, the purpose of which will be to test the real life skidding resistance of concrete made with coarse limestone aggregate. /TRRL/

Walker, M *New Civil Engineer* No. 129, Feb. 1975, pp 24-26, 1 Fig., 1 Tab., 2 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory

3A 125087

DESIGN AND CONSTRUCTION OF THE WELLESLEY STREET UNDERPASS, AUCKLAND

The Wellesley Street Underpass was the first major motorway structure to be completed in a fully built up section of the central business district of Auckland. It consists basically of a motorway cutting and associated retaining walls, and a traffic bridge over the cutting. A description of the structure includes details of the conventional reinforced concrete construction of approach walls, and the "soldier column and plank" precast walls used over the major part of the cutting. Seismic effects were not considered in the design of the structure, but its performance is being checked against the seismic resistance principles of mononobe and okabe. Brief details are given of vibration measurements taken during construction, and of the lighting of the completed structure. /TRRL/

Russell, T *New Zealand Engineering* Vol. 29 No. 11, Nov. 1974, pp 308-312, 2 Fig., 3 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 212677)

3A 125088

COLD PLANING ON THE M4

The article describes the resurfacing of the M4 for a 1200 metre section spanning the length of Junction 22 Newhouse Roundabout. It is explained that the whole stretch was re-covered, rather than patched, because there was complete loss of chippings and in some areas the surfacing had come away. Limitations such as the maintenance of traffic flow in the summer peak and the need to do the work in frost-free conditions, dictated an autumn work programme which could be carried out quickly. There is a description of the use of the cold planers and the modifications made to maintain an even cut. The speed of cutting and deterioration of the picks are included. The machines used required a separate pick-up operation for the debris: the rate at which the pick-up is achieved limits the speed of the overall operation, and estimates are given of the optimum speed. Alterations to traffic movement are briefly reported: few delays occurred. Finally costings of the scheme are presented, indicating that the scheme was quick and economical. /TRRL/

Almond, JD (Avon County Council, England) *Surveyor - Public Authority Technology* Vol. 144 No. 4305, Dec. 1974, pp 26-27, 1 Fig., 6 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 212680)

3A 125099

CRYOGENIC TREATMENT OF SHAFTS AND TUNNELS

One of the geotechnical processes able to contend with unstable or saturated soil conditions in civil or mining engineering, is that of soil-freezing. In this technique, a temporary conversion of the interstitial soil moisture forms a strong and impermeable frozen soil membrane around the excavation zone. With the development of cryogenic techniques, nitrogen is available in liquid form offering a rapid means of soil freezing. Typical applications of the technique include shaft deepening tunnel faces, sealing gaps in cofferdams and wherever temporary structural support is needed. Two examples are given of the use of soil freezing on a sewer tunnelling project in Edinburgh. /TRRL/

Harris, GP (Foraky Limited) *Tunnels and Tunnelling* Vol. 6 No. 5, Sept. 1974, pp 69-70, 2 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 212703)

PURCHASE FROM: ESL Repr. PC, Microfilm

3A 125113

TUNNELLING UNDER MANCHESTER

The article describes the methods used in the construction of the post office communication tunnel system between Manchester and Salford. The tunnel system, being built at a depth of 100-200 ft in bunter sandstone, is designed to connect a number of large diameter apparatus tunnels housing telecommunications equipment and support systems. Access to the concrete lined apparatus tunnels was provided by 23 ft and 18 ft diameter shafts lined with cast-iron bolted rings down to the sandstone level and below that with concrete. The sandstone was found to be very abrasive and to cause rapid wear of handling equipment. /TRRL/

Collins, SP *Tunnels and Tunnelling* Vol. 6 No. 5, Sept. 1974, pp 30-33, 15 Phot., 2 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 212699)

3A 125147

EVALUATION OF UNIT LOAD HANDLING EQUIPMENT (EMBRACING EQUIPMENT FOR PALLETS, PACKAGED LOADS AND CONTAINERS), A CONFERENCE ARRANGED BY THE MANIPULATIVE AND MECHANICAL HANDLING MACHINERY GROUP OF THE INSTITUTION OF MECHANICAL ENGINEERS

Among the papers presented at the conference were the following: the valuation and selection of fork lift trucks, Carpenter, MJ; Self-Loading Vehicles, Their Mechanical Features and Application, Holt, JB; The Development, use and evaluation of mobile cranes and rough terrain fork lift Trucks used in the Construction Industry, Summers, MJ; The ergonomics of mechanical handling vehicles (with special regard to Fork Lift Trucks) Astley, RW; Review of Tractor Trailer Units used on British

Railways Roll on/Roll off and Container Terminal Operations, Styles, PR; Evaluation of Side Loader Machines, Rundle, M; The Evaluation of Straddle Carriers, Dally, HK and Wilkinson, BE; Long Span Container Cranes, Larkin, JE; Container Cranes on British Rail, Robinson, PJ; Container Spreaders, Bisby, A, 1973. /TRRL/

Institution of Mechanical Engineers Conf Paper No. CP 1/73, No Date, 182 pp, Figs., Tabs., Photos., Refs.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 212191)

PURCHASE FROM: Institution of Mechanical Engineers 1 Birdcage Walk, Westminster, London SW1H 9JJ, England Repr. PC

3A 125181

INVENTORY AND CHARACTERISTICS OF THE MAIN CIVIL ENGINEERING TYPES OF EQUIPMENT [Repertoire et caractéristiques des principaux matériels de génie civil]

This publication reviews civil engineering equipment manufactured in France and other countries, gives the main characteristics of the machines and addresses of suppliers. The equipment is grouped according to the classification of the blue scale, edition 1970, giving the main characteristics and weight of the equipment. Addresses and telephone numbers of the manufacturers and distributing agents are in alphabetical order at the beginning of the book. /TRRL/ [French]

Federation Nationale des Trav Publ & des Synd Aff Textbook 1973, 412 pp, Figs., Tabs., Refs.

ACKNOWLEDGMENT: Laboratoire Central des Ponts et Chaussées, Transport and Road Research Laboratory (IRRD 101121)

3A 125220

KINGSWAY ISLAND PEDESTRIAN SUBWAYS

This article gives an outline of the design and construction of a subway system which has been constructed at the junction of the Kingsway with Princess Way and other streets. It consists of a sunken island linked with five radial subways and two perimeter subways, designed to provide for a flow of 3400 pedestrians per hour. The author gives a brief account of the main construction work. The first stage of this work, commenced in 1972, involved excavation of the outer grass verges, cutting of the existing concrete road and excavation of the radial subways and placing of 3.1m by 2.4m by 1.2m precast concrete subway units, each weighing 8 tons. The author follows this with an outline of the joining of the radial and peripheral subways, the excavation of the central island and the construction of the ramps and steps. He then gives an outline of the accommodation works and finishing. This involved lining the walls with tiles, the provision of adequate drainage and lighting, the provision of a wall to prevent exhaust gases entering the pedestrian area; the use of coloured paving slabs, trees, bushes and shingle to improve its appearance, and the provision of seats for weary pedestrians. The author reports that good use is being made of the subways, which were opened in 1973. /TRRL/

Lawrence, C *Institution of Municipal Engineers, Journal of* Vol. 102 No. 2, Feb. 1975, pp 29-30, 1 Fig., 3 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 212992)

3A 125240

PIPE INSTALLATION WITHOUT EXCAVATION. THE BADGER SYSTEM [Tendidos de tuberías sin zanja. El sistema Badger]

The Badger system is a modern process of installing pipes or cables under the ground without having to excavate trenches. The method can be easily adapted to loose terrain and to the installation of pipes with a diameter between 76 and 300 mm. It requires tracked vehicles equipped with a kind of plough, the role of which is to dig a furrow in the soil. Guiding and levelling devices are also parts of the system. /TRRL/ [Spanish]

Scorpio *ATEMCOP* No. 25, Jan. 1972, pp 10-12, 3 Fig.

ACKNOWLEDGMENT: Transportation & Soil Mechanics Laboratory, Spain, Transport and Road Research Laboratory (IRRD 101098)

3A 125247

THE CONSTRUCTION OF THE SEIKAN TUNNEL [La construction du Tunnel de Seikan]

The Seikan Tunnel will link the Northern Hokkaido Island to the Main Honshu Island in Japan under the Strait of Tsugaru. It will be the longest railway tunnel in the world. The main characteristics of the tunnel are described: total length (53,850 km), length under the sea (23,300 km), maximum depth of the strait (140 m), depth of the tunnel under the bottom of the sea (100 m), cross-section of the main double-track tunnel (9,60 m), minimum radius of curvature (6500 M), longitudinal gradients (12 for 1000 and 3 for 1000). Volcanic rocks lay under the sea for a third of the width and sedimentary rocks from the miocene era for the other two thirds. Site investigations showed three main zones: north side (Hokkaido): tuff (sigma 40 kg/cm²)/ south side (Honshu): harder rock (sigma 700 kg/cm²)/ to the north and the centre: microcracks and small amount of water; to the south: faults with important ingress of water. It is not envisaged to take special precautions against earthquakes. An outline is given of the main drilling operations. It is forecasted that progress will be 300 m/month with the Telescopic Atlas Copco drilling machine (4 m cutting diameter; rate of progress: 2 m/h; overall power: 440 kw; total weight 95t). The work carried out 6 days per week, day and night, with three teams enables 1500 m to be completed the first year; the following 800 m took nearly two years. The terrain crumbled easily and necessitated support by means of metal arches and mesh fixed into position with shotcrete placed immediately behind the jacks of the machine. Those arches are placed into position without stopping the machine every 0,80 to 1,20 m and even every 0,60 m. The final reinforced concrete lining will be 0,70 M thick. After the first 1500 m section, the strength of the rock diminished progressively resulting in the machine being abandoned. Investigations are being conducted to decide on the next drilling method. The total cost of the work is estimated at 200 milliards yens per km of the railway tunnel which will have two tracks and two service galleries. The end of the works is programmed for may 1976. /TRRL/ [French]

Ruffert, G (Torkret GmbH) *Travaux Souterrains* No. 174, Mar. 1973, pp 25-28, 3 Fig.

ACKNOWLEDGMENT: Laboratoire Central des Ponts et Chaussées, Transport and Road Research Laboratory (IRRD 101138)
PURCHASE FROM: PYC-Edition 254 rue de Vaugirard, Paris 15e, France Orig PC

3A 125298

STUDY OF THE FAILURE OF FIVE EMBANKMENTS ON COMPRESSIBLE SOIL [Etude de la rupture de cinq remblais sur sols mous]

This article summarizes five studies of the failure of embankments built on compressible soil observed over the last 10 years either on construction sites or during full-scale tests. The first part of the article consists of a brief bibliography, which deals with landslides observed during the last 20 years. The second part describes each failure in detail: nature of the subgrade, conditions of construction, description of the landslide, calculation of stability. The third part deals with the form of failure observed, the shear strength of the embankment, and values of the safety coefficient up to failure point. /TRRL/ [French]

Pilot, G *Bulletin de Liaison des Lab des Ponts et Chaussées* No. 64, Mar. 1973, pp 89-101, Figs., Tabs., Refs.

ACKNOWLEDGMENT: Laboratoire Central des Ponts et Chaussées, Transport and Road Research Laboratory (IRRD 101068)
PURCHASE FROM: Laboratoire Central des Ponts et Chaussées 58 Boulevard Lefebvre, 75732 Paris Cedex 15, France Orig. PC

3A 125315

IMPROVED SUBGRADE-LOGICAL TECHNICAL DEVELOPMENT OR JUST A CLEVER WORD [La couche de forme-développement Logique de la technique du artifice de langage]

The author recalls that the role of the improved subgrade is to ensure the transition between earthworks and pavement. This transition role can be envisaged from different viewpoints which are briefly analyzed: transition between earthworks contract and pavement contract; transition between construction techniques used for earthworks and pavement; transition in time; transition between the average quality of the materials used in earthworks and pavement (quality which is very difficult to forecast); transition as regards the statistical dispersion of the quality of the quality

of the materials; and transition between materials widely differing in price. The very idea of "improved subgrade" is ambiguous in itself. Depending on the point of view adopted (point of view of the pavement design or that of the execution of the works) the roles of the subgrade can appear very contradictory. Because of the necessary increase in the quality of the successive pavement layers (average performance of materials, allowance for execution of the work), it is always better to err on the side of great thickness/fairly low quality at the level of the improved subgrade to ensure the quality of the completed pavement. /TRRL/ [French]

Bulletin de Liaison des Lab des Ponts et Chaussées No. 64, Mar. 1973, pp 57-62, Photos.

ACKNOWLEDGMENT: Laboratoire Central des Ponts et Chaussées, Transport and Road Research Laboratory (IRRD 101065)
PURCHASE FROM: Laboratoire Central des Ponts et Chaussées 58 Boulevard Lefebvre, 75732 Paris Cedex 15, France Orig. PC

3A 125379

TRIANGULAR DEVICE LIFTS CANTILEVERED GIRDERS TO SPAN PIERS

This article describes a free-advance erection method employing a triangular lever to lift deflecting cantilevered webs into place. The triangular rig is built of tubular steel in the shape of an isosceles triangle, one corner of which can be set in a recess cast in the side of each pier so that the piers function as a fulcrum. The entire set-up operation takes 1.5 to 2 hours.

Construction Methods and Equipment Vol. 57 No. 7, July 1975, pp 60-61, 1 Fig., 2 Phot.

3A 125380

CANTILEVERED SUPPORTS AND DOLLY-DELIVERED GIRDER SECTIONS KEEP FREEWAY HIGH ATOP BUSY CITY

This article describes a method of constructing an elevated freeway above a densely populated area through the use of cantilevered supports and dolly-delivered girder sections. When completed the structure consisted of pairs of box girders set 23 feet apart and supporting the 85-foot wide, 6-lane, 11.8-inch thick reinforced and prestressed concrete roadway. Girder depth, ranging from 6 to 11.8 feet, varied according to the length of the free span, from a short 209 feet to a 301-foot maximum. Accuracy of alignment and distance between girders was vital to the construction method.

Hoffmann, P *Construction Methods and Equipment* Vol. 57 No. 7, July 1975, pp 64-65, 4 Phot.

3A 125381

REVISED OUTFALL CONSTRUCTION METHOD CONQUERS SURF AND SAND

When rugged surf and shifting sand halted construction of an ocean outfall sewer in Rio de Janeiro, a new contractor came in and completed the 2.6-mile job with revised techniques. Methods included powerful boom-mounted dredging pumps and a moveable jack-up barge for pile driving and concrete pipe placement. The major difficulty encountered was dredging and keeping open the surf-zone trench for each 59-foot pipe section. It was found that the use of pipe piles instead of rock bed was a faster and cheaper construction method.

McCrary, E *Construction Methods and Equipment* Vol. 57 No. 7, July 1975, pp 68-69, 1 Fig., 4 Phot.

3A 125498

THE PARIS-BRUXELLES A2-E10 MOTORWAY. THE COMBLES-HORDAIN SECTION [L'Autoroute A2-E10 Paris-Bruxelles-La section Combles-Hordain]

The 42-km Combles-hordain section of the paris-bruxelles motorway was opened to traffic on 19th december 1972. This section was built in the record time of 18 months. New technological means and very strict planning enabled construction to proceed at that pace. Efforts were made at all levels, and details are given of earthworks carried out in low-quality terrain, construction of concrete engineering structures (one bridge was built every other month) and pavements (use of local materials, use of chippings rolled into the precoated surfacings, spreader capable of spreading over a 10.70 m width, etc.). In spite of the rate at which the motorway was built, quality did not suffer thanks to constant and severe quality control. /TRRL/ [French]

Desbazeille, B Ozanne, P *Revue Generale des Routes et des Aerodromes*
Vol. 43 No. 485, Mar. 1973, pp 31-42, Figs., Tabs., Photos.

ACKNOWLEDGMENT: Central and Regional Labs of Bridges & Highways, Fr.
Transport and Road Research Laboratory (IRRD 10160)

3A 125615

CONSTRUCTION OF ROAD BRIDGES OVER THE JHELUM AND SUTLEJ RIVERS, PAKISTAN

The paper describes the construction of two prestressed concrete road bridges in Pakistan. The first on the Jhelum river at Jhelum, 90 miles north of Lahore on the grand trunk road to Peshawar about 770 miles from Karachi at the coast. The second on the Sutlej river near Bahawalpur, 420 miles north of Karachi and 260 miles by road south of Lahore. (figure 1). Construction of the Jhelum bridge was started in August, 1965 and completed in July, 1968. Construction of the Bahawalpur bridge was started in May, 1966 and completed in August, 1968. The tender value of each bridge was \$1,750,000. (A) /TRRL/

Fishwick, AL (Lee (Donovan H) and Partners) *Highway Engineer* Vol. 22
No. 1, Jan. 1975, pp 19-25, 1 Fig., 11 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD
213308)

3A 125618

CONCRETE ROAD CONSTRUCTION IN BRITAIN TODAY

This paper is concerned with the construction of concrete roads in Britain today. After a brief introduction, the authors review the development of current design requirements, making reference to the DOE specifications and technical memoranda and publications by TRRL. An account is given of the development of construction techniques with particular reference to the introduction of mechanical dowel placing techniques and the formation and sealing of grooves. The next part of the paper is concerned with the economics of concrete roads with special reference to the things that have happened since 1969 to improve the outlook for concrete road construction, these include the TRRL analysis of the relative costs of flexible and concrete roads, specification changes and the acceptance of aggregates other than gravels. The authors discuss the surface of concrete roads in relation to the quality of ride and skid resistance, particular reference is made to the plastic grooving machine. After a brief discussion of roads in relation to the environment the authors conclude by discussing future developments including the use of the rapid analysis machine, the addition of carborundum to improve durability and skid resistance, the introduction of deep grooving and the possible development of better methods of case hardening the surface. This paper was prepared for presentation at the symposium on cement utilisation in road construction, Ankara, Turkey. /TRRL/

Harris, RS Mills, IR
Humphreys (Howard) and Sons R&D Rept. Oct. 1974, 7 pp, 1 Fig., 11 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD
213165)

3A 125619

STATE OF THE ART: PAVEMENTS

This bulletin is the first draft of a document which sets out to combine a number of state of art assessments (SOTA) relating to pavement practice in New Zealand. Although the SOTA are less authoritative than codes of practice, it is believed that the document will significantly reduce the detail and explanation required within the codes themselves. The document is essentially qualitative in nature- quantification being considered appropriate to the codes of practice. Each chapter respectively deals with the different aspects of pavement practice namely: the evaluation of pavements; types of pavements; pavement materials; quality control and variability; pavement design; pavement construction; laboratory and field evaluation; earthwork and subgrade; subbases and bases; surfacings; aggregates; drainage; stabilization; maintenance and research. Each chapter commences by defining the subject, includes definitions of the technical terms used- (which are summarized in the form of a glossary of terms) and gives a considered listing of facts, near facts and logical conjectures relating to its subject area. /TRRL/

Smith, AD
National Roads Board, New Zealand R&D Rept. RRU Bulletin #2,
1974, 72 pp

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD
213163)

3A 125653

TRENDS IN DESIGN AND CONSTRUCTION OF HIGHWAY STRUCTURES IN CANADA

This resume of the bridging activity in Canada in recent times makes special reference to the latest trends in design methods, construction techniques and use of improved materials. The author points out that the selection of any structure is based upon economic considerations. The following types of bridges are discussed: the cast-in-place post-tensioned bridges, precast, prestressed beam bridges and steel girder bridges. Standard charts are available for detailing and drafting. Details are given of the use of elastomeric bearing pads and rota bearings and the advantages of prestressed concrete over reinforced concrete are stressed. It is pointed out that durability of concrete decks is affected primarily by sealing, spalling and cracking of the concrete. The need for joint-sealing is discussed and an account of some notable achievements in long span crossings such as the Port Mann bridge, Deas Island tunnel and the Concordia bridge in Montreal is given. /TRRL/

Bhasin, PC *Indian Highways* Vol. 2 No. 11, Nov. 1974, pp 5-14

ACKNOWLEDGMENT: Transport and Road Research Laboratory
(IRRD-213311)

3A 126135

FIFTY YEARS OF ALUMINUM CONSTRUCTION

The development of aluminum applications in construction equipment since 1925 is reviewed. Preferred alloys, products, and methods of joining are examined as related to engine vehicle bodies, cranes, scaffolding, formwork, structures, architecture, tools, and equipment. During the 50-yr life of the Construction Division of ASCE, aluminum has grown from specialized application to become an accepted structural metal of general utility. The light weight and corrosion resistance, coupled with the versatility of the extrusion process, has given it an important place that can only continue to expand in the next half-century. /ASCE/

Marsh, C (Concordia University, Canada) *ASCE Journal of the Construction Division* Proceeding Vol. 101 No. CO3, ASCE #11591, Sept. 1975, pp 583-605, 6 Fig., 5 Tab., Photos., 15 Ref.

3A 126136

NORTHERN OFF-ROAD TRANSPORTATION IN THE 70'S

A general review of the present state-of-the-art of off-road transportation with emphasis on northern and Arctic operation on the American Continent. Defines off-road transportation, vehicle categories and applications, and looks at basic mobility parameters, e.g., ground pressure, resistances to motion, tractive effort, horse power/weight ratios, drawbar pull, track and wheel ground contact effects, and transmission. Particular problems associated with northern operations are examined, e.g., cabs, heaters, metallurgical problems, maintenance, and abuse of vehicles. Basic and special design considerations are also presented. /ASCE/

Presented at the July 15-19, 1974, ASCE, EIC, RATA Joint Transportation Engineering Mtg., Montreal Quebec, Canada (Preprint MTL-33).

Thomas, IA (Canadair Flextrac Limited) *ASCE Journal of the Construction Division* Proceeding Vol. 101 No. CO3, ASCE #11573, Sept. 1975, pp 635-646, 4 Fig., Photos., 1 Ref.

3A 126481

RETEMPERING OF PROLONGER-MIXED CONCRETE WITH ADMIXTURES IN HOT WEATHER

The effect of water-reducing, and water-reducing and retarding admixtures on prolonged-mixed concrete at 30 C (86 F) was studied over a range of dosages. Loss of slump during mixing (for 1 or 2 hr), and the total mixing water required for regaining the initial slump of 10 cm (4 in.) after retempering, were measured. Results show that while loss of slump was higher (compared with the reference concrete) with the admixtures, the total mixing water after retempering was less. At the recommended dosage of admixtures, the differences in both parameters were very small and so were the differences in compressive strength. At higher dosages, however, a pronounced reduction in the total mixing water was observed, with a parallel significant increase in strength. /Author/

Ravina, D (Technion - Israel Institute of Technology) *American Concrete Institute, Journal of* Vol. 72 No. 6, No 72-23, June 1975, pp 291-295, 3 Fig., 5 Tab., 1 Ref.

3A 127135

INCREMENTAL LAUNCHING OF CONCRETE STRUCTURES

Development and current details of the incremental launching method of concrete structures-known as Taktchiebeverfahren in Europe-are described. The method permits employment of a highly industrialized approach to construction of major concrete bridges and other heavy and long structures. The process requires a minimum of temporary erection and support equipment; however, it makes it imperative that a consistent high degree of quality control is applied to the entire work. The method has been found to be very economical. Bridge spans longer than 330 ft (100 m) can be fabricated, and girders up to 2000 ft (600 m) long can be built and launched in a continuous operation. /AUTHOR/

Based on a presentation at the symposium on Segmented Bridge and Construction at the 1974 ACI Fall Convention. Atlanta, Ga.

Grant, A *American Concrete Institute, Journal of* Vol. 72 No. N8, Aug. 1975, pp 395-402, 13 Fig.

3A 127338

A METHOD OF PREDICTING COMPACTION TIME FOR HOT-MIX BITUMINOUS CONCRETE

A heat-transfer model was used to develop an accurate and flexible procedure for predicting the available compaction time for hot-mix bituminous concrete placed during various climatic conditions, and the extrinsic and intrinsic factors which have the greatest influence on the cooling rate of hot-mix bituminous concrete were determined. The predictive method is presented as a climatic input chart and several accompanying compaction time curves. The compaction time curves were developed for numerous pavement systems, initial pavement surface temperatures, and initial bituminous mixture temperatures. The time for the bituminous concrete layer to reach an average temperature of 175 F was used as the available compaction time. The validity of the procedure is supported by excellent comparisons between the measured and predicted compaction times. The results of the study indicate that an increase in the bituminous mixture temperature, existing surface temperature, and layer thickness will increase the available compaction time. An increase in wind velocity causes a decrease in the available compaction time. A solar radiation increase will cause an increase in the available compaction time. Hot mix bituminous concrete lifts placed during cold weather should be greater than 1 in. thick. Air temperature alone is not a valid criterion for determining whether bituminous concrete paving can be accomplished during cold weather. The method developed provides a procedure whereby interaction of the climate, pavement system, bituminous mixture temperature, and equipment capabilities can be evaluated to produce a paving operation which is effective and efficient. The method developed to predict compaction times can be used to establish specifications for cold weather bituminous concrete construction.

Proceedings of the meeting held in Houston, Texas, February 1973.

Tegeler, PA (Illinois Department of Transportation); Dempsey, BJ (Illinois University, Urbana) *Association of Asphalt Paving Technologists Proc* Vol. 42 1973, pp 499-523, 16 Fig., 2 Tab., 10 Ref.

3A 127473

FUEL CONSERVATION

Controlling fuel economy requires attention to several areas-equipment, selection, basic job planning, machine maintenance and operating practices. To-day's machines have engineering features that make possible economies that were unavailable with older equipment, e.g. the hydraulically angled bulldozer blade, the self-loading elevating scraper, and articulated motor grader. A bar chart is used to illustrate the general range of potential fuel savings possible with good operating practices: use of the right size backhoe buckets (too wide or too narrow can increase fuel consumption), and keeping scraper haul roads smooth (this will increase scraper efficiency). Equipment maintenance for fuel consumption begins at the engine. overconsumption of fuel due to poor maintenance is a matter of degree, with potential approaching the limits as conditions worsen, i.e. plugged air cleaner, wrong timing (injection) plugged fuel filter, defective nozzle (injection), and burned valves. Combinations of these conditions may not be directly cumulative, due to their interrelationships. Tires make a difference to fuel consumption; rolling resistance must be minimal and correct inflation is important. The

importance is stressed of the engine idle speed, frequent lubrication, and operation at the most efficient rpm. The higher the average load on the engine, the greater the fuel economy. Increasing load from 50 percent to 80 percent of rated engine horsepower on the JD 450-C crawler by shifting to a higher gear results in a fuel saving of 17 percent. Fuel saving suggestions are also made for backhoe and excavator operators.

Constructor Vol. 57 No. 9, Sept. 1975, pp 22-24, 3 Fig.

3A 127474

DOUBLE-TUBE TREMIE USES AMBIENT WATER TO PROTECT MIX

The tremie system described here used a clip valve and surrounding water to empty the tremie tube and keep it dry-between discharges. The double tremie system consists of an outer pipe with slits along its walls that permit water to flood the systems annular space between tubes, and an inner plastic tube of textured 2-mm-thick PVC, reinforced with nylon fiber to increase the tube's strength and life. The equipment is designed for placing concrete underwater over a wide area by repeated resetting of a small number of pipes without endangering the quality of the finished concrete. As falling concrete inflates the plastic tube, a dip valve in its bottom end opens to discharge mix. When concrete stops falling, water entering the outer pipe through the slits squeezes remaining concrete from the inner tube. The bottom valve immediately seals the tube after final mix is discharged. With the tube squeezed flat and the valve closed, the tremie system can be repositioned for continued concreting, without fear of introducing water that might dilute or segregate the mix. Details are outlined of the successful placing of 33,000 yd. of concrete underwater for a dry-dock flooring using the double-tube method. Three double-tube tremies mounted on a 90-ft-long, 40-ft-wide raft assembled from plugged steel pipes handled the concreting. Nine men handled the tremie pipes; six others attended pumps and slicklines, and each 740-yd load was placed in a 10-hr shift.

Cryogenics Vol. 57 No. 9, Sept. 1975, pp 54-55, 4 Fig.

3A 127475

CONCRETE ADMIXTURES AND AGENTS

Versatile and efficient, modern-day products guarantee major time and cost-saving advantages as they customize and adapt concrete for virtually every type of application. Admixtures fall into one of six categories: air entraining, water reducing, retarding, accelerating, pozzolans, and workability agents. Air entrainers produce small air bubbles in the concrete to improve workability and placement with reduced water content. Darvaair, a liquid that is typically added to a mix in rates from 3/4 to 3 fl oz per 100 lb. of cement, is designed for use in mass concrete and in high cement factor, low-slump paving mixtures. Master Builders MB-VR (water soluble) and Agent No. 2001 are other air entraining admixtures discussed here. Water reducing admixtures lower cement content requirements and improve workability. Plastiment concrete densifier, Pozzolith polymer admixture ready to use solutions from Grace's WRDA line, and imported water reducers are reviewed. Retarding admixtures (extend setting time) discussed here include Pozzolith-R (Retarder), Sikamix 100 Plastiment, retarders in Grace's Daratard line, and a latex-adding process for reducing and preventing slump loss. Accelerators are used primarily in cold weather to speed cement hydration to prevent frost damage; these include Trimtex accelerator which can be used for all specs that call for calcium chloride solutions, and the Darex-Set Accelerator admixture which can be used when potential corrosion of embedded or stressed steel must be avoided. Workability agents ease the mixing, handling and placing of concrete; such agents include Pozzolith polymer type admixture, the Darex pumping aid, and Castle Chemical's CPA. Agents designed to improve concrete include numerous products-many of them multipurpose sealers, coatings and bonding materials. Serviced/Horn clear or White-pigmented concrete compounds, waterproofing compounds, Stearox 100, and Clear-Pruf, Sikagard 663, epoxies, Sikamix 122 Grant-Aid, Daraweld-C, and Bond-E are some concrete improving agents which are discussed here.

Donnelly, CW *Construction Methods and Equipment* Vol. 57 No. 9, Sept. 1975, pp 63-71, 10 Phot.

3A 127502

WRAPPING IT UP WITH NYLON FABRIC FORMS

Techniques with nylon fabric forms are described which are adaptable to erosion control, underwater concreting, encasing piles, lining tunnels, producing drains and other uses. These nylon forms are flexible containers

that can be filled by pressure injection with fluid fine-aggregate concrete. They permit controlled bleeding of mix water through the fabric, which reduces the water cement ratio. This causes rapid stiffening, produces high strength, and provides exceptional durability. The double-wall fabric comes in two designs: a quilted type capable of relieving hydrostatic pressure, and another type with a uniform cross-section for use where the primary objective is impermeability and a low coefficient of hydraulic friction.

Concrete Construction Vol. 20 No. 9, Sept. 1975, pp 389-390, 9 Fig.

3A 127527

PAVEMENT DESIGN AND THE DECISION-MAKING PROCESS

The history of pavement design is briefly reviewed, and development in and future prospects for utilizing systems engineering in the decision-making process is discussed. Pavement design has evolved from the use of standard sections of different categories of soil, climate, and traffic conditions to that of empirical relationships between structural designs, materials, traffic, climate, and subgrade conditions based on test programs such as the AASHTO Road test. Recently, interest has been expressed in the concept of total cost analysis. A Systems Analysis Model for Pavements (SAMP5) is one approach to considering initial construction, operation, and user costs in the decision making process. The SAMP6 program (an improvement of SAMP5) requires 12 classes of variables: program control and miscellaneous; environmental (2) and serviceability (3) traffic and reliability (2); constraint; traffic delay; maintenance; cross-section, cost model and shoulder; tack coat, prime coat, bituminous materials; wearing surface, overlay, pavement material; and shoulder layer material. The SAMP6 program operation normally considers between 1,000 and 2,000 different trial designs. The output of the SAMP6 is provided in 3 parts: summary of input data; summary of the best design strategy for each material and larger combination; and the best design strategy in order of increasing total cost per square yard of traffic lane. Illustrations of the application of SAMP6 include a comparative study of the economics of staged construction and planned rehabilitation versus the "no-overlay" or strong initial construction approach, and a study of the effect of fluctuating material costs on optimum design. The operational SAMP6 program provides decision-makers with the capability of comprehensively selecting optimum strategies and updating decisions as conditions change.

Proceedings from a conference on Utilization of Graded Aggregate Base Materials in Flexible Pavements, March 25-26, 1974, Oak Brook Hyatt House, Oak Brook, Illinois.

Smith, HA

National Crushed Stone Association, National Sand and Gravel Association, National Slag Association 1974, pp II 1-12, 1 Fig.

3A 127533

CHARACTERISTICS OF GRADED AGGREGATES AS RELATED TO THEIR BEHAVIOR UNDER VARYING LOADS AND ENVIRONMENTS

This presentation which focuses upon the characteristics of plant processed graded aggregates and the responses of such materials under static and repetitive loading as well as their responses to freezing conditions, discusses typical data which illustrate that graded aggregates can be used with confidence and reliability when such materials are incorporated into a well designed pavement. The necessary and desirable characteristics can be assured through good specifications without performing elaborate and sophisticated testing, through such tests are required when and if a dispute over the suitability of a given material arises. A figure is used to illustrate the latest revision of ASTM D 2940 gradation specification; graded aggregates meeting the requirements as stated in this specification will possess the characteristics necessary to withstand static and repetitive loading under a variety of environmental conditions. Strain control triaxial testing, elastic response and plastic responses under repetitive loading, and responses to freezing environment are discussed. It is pointed out that graded aggregates can be uniformly produced and supplied. Such aggregated do not fatigue after a large number of load applications; they become more rigid with use and resist permanent deformations; they are not adversely affected by high summer temperatures; they do not contribute to excessive resilient deformations that cause fatigue cracking of the surfacing (therefore fully compatible with bituminous surfacing); they are ideally suited to stage construction-they can be used in pavements with minimum surfacing thickness to help ease the energy shortage; determinatal frost heaving effects can be minimized by replacing unsuitable soils with graded aggregates; they

can be used for cement or bituminous stabilized bases with less cementitious agent than other unprocessed mixtures; and potential improvements of stability, rigidity and durability are dependent on many factors e.g. compaction, max size etc.

Proceedings from a conference on Utilization of Graded Aggregate Base Materials in Flexible Pavements, March 25-26, 1974, Oak Brook Hyatt House, Oak Brook, Illinois.

Kalcheff, IV (National Crushed Stone Association)

National Crushed Stone Association, National Sand and Gravel Association, National Slag Association 1974, p VIII1-32, 36 Fig., 8 Tab., 15 Ref.

3A 127689

FULL-DEPTH ASPHALT AIRFIELD PAVEMENTS

A brief review is presented of the newly revised edition of The Asphalt Institute airfield pavement design manual. A new design procedure predicated upon multilayered elastic concepts is introduced. The method is based on the necessity for designing against two types of pavement distress: (1) Cracking in the asphalt layer due to fatigue; and (2) excessive deformation due to overstressing the subgrade. The design method is based on the theory that a full-depth asphalt pavement is a multilayered elastic system and that the application of load to the pavement produces two critical elastic strains: (1) Horizontal tensile strain at the bottom of the asphalt concrete layer; and (2) vertical compressive strain at the top of the subgrade layer. Design criteria based on maximum allowable values for the strains are used in developing the design procedure. Influence and effects of materials and environmental factors are examined. /ASCE/

Presented at the October 16-22, 1972, ASCE Annual Environmental Engineering Meeting, Houston, Texas.

Witczak, MW (Maryland University, College Park); Shook, JF

(Asphalt Institute) *ASCE Journal of Transportation Engineering* Proceeding Vol. 101 No. TE2, ASCE #11331, May 1975, pp 297-309, 7 Fig., 4 Tab., 11 Ref., 2 App.

3A 127781

BRIDGING THE NORTHUMBERLAND GAP

This article describes the North Seaton bridge which crosses the River Wansbeck Valley at a skew of approximately 25 degrees and links north and south Northumberland. This six-span prestressed concrete viaduct, 180M long and 12.4M wide, carries the newly constructed south east Northumberland spine road across the river. The in-situ, post-tensioned structure consists of twin T-Beams. Each T-Beam has its own independent line of support columns, and each pair of columns is skewed to line up with the flow of the tide. Bank seats support the ends of the deck, which is hinged at the south end and has an expansion joint at the north end. Details are given of the deck formwork used, casting of the concrete and bbrv system of prestressing. The bridge deck is supported on five piers each comprising two reinforced concrete columns. The piers except no. 1 pier stand on A concrete columns. The piers except No. 1 pier stand on a 14 h section steel piles driven to a depth of 15 M in the underlying rock. All five foundations are set skew to the line of the bridge and are buried to reduce scour and obstruction of the river bed. Data are also presented on the construction of the abutments and costs. /TRRL/

Contract Journal Vol. 265 No. 4995, May 1975, p 31, 1 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 214432)

3A 127782

IT'S QUICKER BY GEODRAIN

Details are given of a new system known as geodrain, developed and marketed by Terrafigo AB of Gothenburg, Sweden, for draining a clay soil to induce settlement before building work starts. The system consists of a ribbed plastic strip enclosed in a paper sleeve of wet strength through which water can filter when the geodrain has been installed in the ground. The device measures 4mm by 100mm and is supplied in rolls of about 150M in length. The geodrain works on broadly the same principle as the sand drain. Comparisons have been carried out between both types of drain at the Swedish Geotechnical Institute. The ground consisted of loose post glacial clay with an underlay of glacial varved clay. Results showed that with geodrain the horizontal surface movement was restricted to a maximum of 5mm whereas with the sand drains the total horizontal movement was

around 100 mm. Shear strength of the soil in the immediate vicinity of the geodrain during installation was reduced by only 5% compared with 30% for a sand drain. Various types of machinery can be used to install geodrains in all cases lighter than that needed in the installation of sand drains. /TRRL/

Contract Journal Vol. 265 No. 4995, May 1975, p 29, 2 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 214431)

3A 127897

TUNNELLING AND FALSEWORK HAZARDS

Extracts from some of the papers presented at the conference "Tunnelling and Falsework Hazards" held at the Institution of Civil Engineers in London in March 1975 are given. The papers include: Structural Safety and the Doe, Bridle, RJ; Tunnel Hazards-UK Experience, Muir Wood, AM, Unforeseen Loads on Falsework, Mott, JCS; Making Falsework Safer, Bragg, SL. /TRRL/

Bridle, RJ Buirle, RJ Mott, JCS Bragg, SL *Surveyor - Public Authority Technology* Vol. 145 No. 4319, Mar. 1975, 3 pp, 1 Fig.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 215057)

PURCHASE FROM: IPC Building and Control Journals Limited 32 Southwark Bridge, London SE1, England Repr. PC

3A 127926

IMMERSED-TUBE TUNNELS

This article gives a general account of the use of immersed tube tunnels with particular reference to the Hong-Kong cross harbour tunnel designed by British engineers and the proposed Tees tunnel which is likely to be the first of its developed in the USA does not closely match the envelope this type of tunnel and the conditions under which it can be constructed. The two alternative types, steel shell and the European developed concrete box, are discussed. The former developed in the USA, does not closely match the envelope required by traffic and hence has to be located at a greater depth. However if ventilation is required the segmental spaces can be used for this purpose. Steel shell construction is also favoured by a combination of low material costs combined with high labour costs. The Hong Kong bridge is of the steel shell type, is 1536 metres long and has four lanes. The tube comprised two steel shells linked by diaphragms and keel concrete, later filled with tremie concrete. The units, weighing about 6,000 tons, varied in length from 99 to 113 metres. They were placed by an all purpose screed and lay barge using laser beam for alignment. The proposed Tee's tunnel is of rectangular concrete box construction, 915 metres long and with four lanes. It will normally be self ventilating, but fans can be used under exceptional traffic conditions. The article outlines the proposed method of construction which involves manufacture of the units on a casting bed and their subsequent placement by means of a lowering dock. /TRRL/

Culverwell, DR (Freeman Fox and Partners) *Consulting Engineer* Vol. 39 No. 4, Apr. 1975, pp 47-53, 3 Fig., 4 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 214484)

3A 127929

FIELD SUPERVISORS & DUTIES AND RESPONSIBILITIES. VOLUME 1, CONTRACT ROADWORKS

This publication which is intended to help those responsible for the supervision of roadworks carried out by contract, covers general aspects, details of sampling, testing and site tests, and provides an inspection guide. The general aspects briefly reviewed here include public relations, documents and records, preliminary works, order of work, materials, emergencies, contract payments and cleaning up. Abbreviated instructions (must be supplemented by instructions from the engineer) are set forth for sampling materials encountered in roadworks. These materials include soils and pavement materials, tars and bituminous materials, precast concrete drainage structures, concrete constituents, concrete mix, paint, and the dispatch of samples. Aggregate tests and concrete tests are detailed and matters for inspection are listed. The latter include provision for traffic, protection of the public and property, safe construction practices, access to and security of abutting properties, public utilities, setting out, earthworks, drainage, pavements, surfacing, roadside furniture, and closing of works.

Svenska Vagforeningen May 1975, 24pp, 1 Fig., 1 Tab., 2 App

3A 127943

BIG EARTHMOVERS AND REVISED JOB-PHASING SPEED HIGHWAY CONSTRUCTION

The rephasing of job sequences to boost production (and cut construction times by 25 percent in a project utilizing massive earthmoving machines, indicates that even after a contract is awarded, re-evaluation of equipment and methods can improve job payoff. Planning called for building a culvert to reroute an existing canal prior to construction of two multi-plate tunnels under the old canal bed. On completion of this, construction would commence on an haul road construction and cutting and filling. Reconsideration determined that installing a diversion pipe across a curve in the canal would enable the culvert and multiplate tunnel to be built simultaneously. Although initial plans did not include the company's already-owned high-capacity machines, reanalysis indicated that a revised approach could slash job time from 37 to 28 months and a decision was made to use the jumbo equipment. Temporary on-grade traffic across a previously restricted roadway permitted work around telephone poles and the beginning of cuts and fills. The building of a 24x290x40-ft. high structural steel haul bridge, and a 120-day settlement during winter are described. Earthmoving was accomplished in 2 stages: first 5 million yd. was completed and the spreads then shut down to permit 12 and 24-ft-wide paving by slipformer; another 8 months of earthwork is scheduled to begin with bottom dumps and loaders and one spread of scrapers. Details are also outlined of the working of the bottom dumps, keeping the roads smooth, the working of the scrapers and wheel dozers, diversion of the canal, and the bridges.

Drossel, MR *Construction Methods and Equipment* Vol. 57 No. 10, Oct. 1975, pp 30-32, 5 Fig.

3A 127954

MECHANIZED CONSTRUCTION OF CONCRETE ROADS

Aimed at those concerned with construction and intended as a source of information for those involved with the design and detailing of new roads, this booklet provides a basic introduction to the subject, provides information on recent developments in plant and methods, and presents a practical guide to good site practice. The methods and machinery described here are those best adapted to British conditions. Basic carriageway structure and pavement design requirements are discussed; pavement slab, carriageway joints, sub-base and separation membrane are covered. Details of paving with fixed-form plant are described which cover full-width or abutting-slab paving, two-course or single-course paving, advance preparations for paving, concrete spreading, compaction, finishing, adjusting spreaders, compactors and finishers, surface texturing, curing, joint formation, joint sealing, and the paving of variable widths. The relative merits of slipform paving and fixed-form paving are discussed, and the details of slip-form paving are set forth. These include line and level control, the Guntert and Zimmerman slip-form paver, the CPP60 slip-form paver, the CMI Autograde slip-form paver, and paving with the slip-form plant. Special applications of slip-form paving are noted. Batching and mixing, plant location and transport of concrete are also covered.

Walker, BJ Beadle, D
Cement and Concrete Association 46-013, June 1975, 75 pp, 94 Fig., 4 Tab., 2 App.

PURCHASE FROM: Cement and Concrete Association 52 Grosvenor Gardens, London SW1W 0AQ, England Repr. PC

3A 128279

OUSE BRIDGE. WHAT WENT WRONG AT PIER 15?

Brief details are given of the construction method used on the ouse bridge and the stage of the project when there was partial collapse of a military trestle leg at one of the structure's main river piers in July 1975. The remedial work undertaken is described and an outline is presented of the various stages and the methods used in the construction of the bridge which was begun in 1973. /TRRL/

Gosneg, J *Contract Journal* Vol. 266 No. 5006, Aug. 1975, pp 28-29, 1 Fig., 2 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 215159)

3A 128468

PRECAST PRESTRESSED SEGMENTAL ELEVATED URBAN MOTORWAY IN ITALY

The design and construction of an elevated urban motorway that was built in the city of Bolzano, Italy, using precast prestressed concrete segmental construction is described. The viaduct consists of 74 spans giving an overall length of 2580 m (1.6 miles). The superstructure is made up of one post-tensioned concrete multi-cell box-section spine beam with cantilever side slabs. The basic construction method of the superstructure is the span-by-span mode using precast segmental units erected on falsework and post-tensioned together. Each of the 34.5-m (113.2 ft) spans is composed of nine segments 2.20 m (72.8 ft) wide by 1.6 m (5.2 ft) deep and weighing 110 tons. The precast elements are connected by a thin layer of epoxy resin adhesive. In the wintertime, the surface to be bonded was electrically heated. The average erection time cycle for the superstructure was one span per week. The viaduct was completed in April of 1974. /Author/

Gentilini, B Gentilini, L. *Prestressed Concrete Institute, Journal of* Vol. 20 No. 5, Sept. 1975, pp 26-43, 23 Fig., 2 Tab.

3A 128498

INVESTIGATION ON SUGAR-ADMIXED CONCRETE FOR PAVEMENTS

Certain investigations conducted at CRRRI into the use of small quantities of sugar as a concrete admixture with particular reference to paving concrete have been reported. It is indicated that the optimum benefit is obtained by adding 0.05 percent sugar by wt. of cement into the mix, which would also be the most suitable amount compatible with constructional requirements. Besides the retarding action, addition of sugar increased both workability and strength of concrete resulting in appreciable economy in cement in the adjusted mix for a specified strength and workability. The field tests under hot and moderate weather conditions confirm the laboratory findings and show that the maximum benefit from use of sugar in concrete is derived in warm to hot weather. A full-scale experimental pavement length using sugar-admixed concrete has also been constructed in Haryana in collaboration with the P.W.D. of that State.

Ghosh, RK Chatterjee, MR Bhatia, ML Bhatnagar, RC *Road Research Papers* No. 133, Dec. 1973, 26 pp, 6 Fig., 10 Tab., 1 Phot., 16 Ref.

3A 128520

COMPUTER ANALYSIS OF SEGMENTALLY ERECTED PRECAST PRESTRESSED BOX GIRDER BRIDGES

The economic advantages of precasting can be combined with the structural efficiency of prestressed concrete box girders for long span bridge structures when erected by segmental construction. The complete superstructure is precast in box segments of convenient size for transportation and erection. These precast segments are erected in cantilever and post-tensioned together to form the complete superstructure. This report details the development of an analysis technique with an associated computer program to permit efficient analysis of constant depth segmental prestressed concrete box girders at all stages of erection. An existing box girder analysis program developed for analysis of completed structures was substantially altered to make it applicable to the multistage construction problem. The computer program has been written to simulate the complete construction sequence after a reasonable amount of user-generated data. The program provides a complete analysis for stresses and deflections at each stage of construction and will, at the user's option, compute revised tendon stresses for all tendons stressed earlier in the sequence and bonded by grouting. The use of the computer program is demonstrated by means of several practical examples, including an analysis of the first bridge of this type in the United States, erected at Corpus Christi, Texas. The general applicability of the program was verified in a related study by Kashima wherein measurements were made in a realistic model study of the Corpus Christi bridge and good correlation was obtained.

Work sponsored by the Texas Highway Department. Work done in cooperation with the Federal Highway Administration, Department of Transportation.

Brown, RC, Jr Burns, NH Breen, JE
Texas University, Austin Intrm Rpt. RR 121-4, Nov. 1974, 240 pp, figs.,
Tabs., 33 Ref., 3 App.

Res Study 3-5-69-121

3A 128562

RECYCLED MATERIALS REJUVENATE RURAL ROAD

In an effort to rejuvenate county roads at low cost, a rural road has been ripped up, its 2700 tons of asphalt materials crushed and reprocessed and then used to repave within the existing right-of-way. The \$98,000 experimental work to repave the 1-mile segment consisted of 3 stages. In the first stage, the 22-ft wide surface was ripped, crushed in place, the asphaltic material was windrowed and then hauled 12 miles to the asphalt plant where they were stockpiled. A Cat 14 grader with rippers and a Cat DW 20 equipped with Hyster compactor wheels were used. The second stage consisted of subbase preparation using materials already in place in right-of-way. The 4-in. thick calcium chloride treated base was ripped and windrowed and pushed to each side. In this way, elevation was reduced about a foot as the width of the road was increased. Foreslopes were changed from between 1-1/2: 1 and 1:1 to 3:1. When completed the new pavement will be 22 ft wide with 6-ft shoulders on each side. The base materials consisted of 25 percent clay and 75 percent gravel, and had once been treated with calcium chloride. The third stage included processing the recycled materials through a drum mixer at a conventional hotmix plant. It was found necessary to add virgin asphalt. The experimental mile was divided into 4 test sections: 1/2 mile had an additional 2-1/2 percent new asphalt; next quarter mile had 3-1/2 percent added; next eight mile had 4-1/2 percent; and the last eight had 4-1/2 percent with 30 percent of minus 3/4 inch limestone. Further details and plans for the future are outlined.

Roads and Streets Vol. 118 No. 10, Oct. 1975, 2 pp, 3 Fig.

3A 128656

STRUCTURAL NOTES AND DETAILS

Information is provided and advice is given on the resolution of problems related to the use and application of various design techniques, the design and construction of connections, structural repair of buildings and structures, the simplification of specifications, the use of site instructional notes, and formal reports. The details and advice are grouped under the following headings: site investigations, foundations (general and complex items), watertight concrete testing and checking materials, precast structural details (general and complex items), composite construction-general and complex applications, structural details, structure notes relating to prestressed concrete, structural repairs and modifications, and contract organizations (programmes, data boards, executives). Two appendices are provided. One provides a glossary of technical terms, and the other, items which relate to the calculation of safety factors.

Maxwell-Cook, JC
Cement and Concrete Association 1975, 168 pp, Figs., Tabs., 2 App.

3A 128661

IOWA'S EXPERIENCE WITH FULL-DEPTH ASPHALT PAVEMENTS

Observations are presented of full-depth asphalt pavements constructed of hot mixtures on interstate, primary and country highways, in which the lower course is placed directly on the existing earth subgrade, or an earth subgrade mixed with small amounts of lime, portland cement, gravel, or crushed limestone. The wearing surfaces of these pavements are usually layers of hot-mix asphalt concrete, but chip seals are also fairly common on county highways. Full-depth pavements constructed on the foregoing types of subgrades or subbases, using mixtures produced in a drum are also discussed. Large full-width finishing machines, and storage and surge silos are commonly used. Self-propelled vibratory rollers are increasingly used. Specifications have permitted drum mixes using conventional hot mix temperatures for all asphalt-treated base mixtures. Automatic screed controls have been used. Thick lift construction has become an important aspect of construction. Comments are also made regarding stabilization needs, design thickness, the optimum asphalt-content and aggregates.

Stump, MJ (Iowa State Highway Commission) *Paving Forum* Sept. 1975, pp 8-11, 1 Fig.

3A 128695

USE OF WOVEN MATERIALS IN IMPROVED SUBGRADES [Utilisation des textiles en couche de forme]

The design of improved subgrades laid on soil of different consistencies, which are sensitive to frost and water gives rise to numerous problems. Five experimental sections were built by the laboratory in Nancy in which woven and non-woven materials were used. The aims were : (1) to verify the

anti-pollution role of structural additional materials laid under a granular improved subgrade and on top of a saturated clayey soil; (2) to measure the influence of those added materials on the traffic behaviour and deformability of the underlying layer; (3) to define laying techniques, although the experiments applied only to special site conditions (clayey supporting soil with a low consistency at the surface, light traffic, use of granular material) and did not demonstrate the methods of use for each type of textile; two main results were observed: (a) in the short term, possibility of laying a granular improved subgrade on top of a clayey soil of low consistency, which results in a slight increase in compaction efficiency; (b) in the longer term, non-pollution of the improved subgrade and marked consolidation of the soil. /TRRL/ [French]

Douard, JY *Bulletin de Liaison des Lab des Ponts et Chaussées* No. 68, Nov. 1973, pp 9-11, 5 Phot.

ACKNOWLEDGMENT: Central and Regional Labs of Bridges & Highways, Fr, Transport and Road Research Laboratory (IRRD 101478)

PURCHASE FROM: Central and Regional Labs of Bridges & Highways, Fr 58 Boulevard Lefebvre, 75732 Paris Cedex 15, France Orig. PC

3A 128709

SECOND REPORT OF THE ADVISORY PANEL ON CONCRETE ROAD CONSTRUCTION (1973-74)

The Advisory Panel on Concrete Road Construction, set up in 1972, has completed its second full year of operation. This report describes the problems encountered during this second year, dealing in more detail with the formation of joints and remedial work. The unsatisfactory situation arising when untried plant is used on a normal contract is again highlighted and changes to the DOE specification for road and bridge works described. The panel places great importance on the reduction of contractual disagreements by ensuring that the specification is unambiguous. (A) /TRRL/

Transport and Road Research Laboratory R&D Rept. SR 133UC, 1975, 12 pp, 3 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 214744)

PURCHASE FROM: Transport and Road Research Laboratory Old Wokingham Road, Crowthorne, Berkshire RG11 6AU, England Orig. PC

3A 128712

AN NEW CIVIL ENGINEERING SPECIAL FEATURE ON THE 150TH ANNIVERSARY OF BRUNEL'S THAMES TUNNEL: MEN AND MOLES, TUNNELLING THROUGH THE AGES

This special tunnelling feature contains the following articles: The Thames Tunnel, Hayward, D; The growth of Shield Tunnelling, Harding, H; The State of the Art, Muir-Wood, A; The Channel Tunnel, Bartlett, J; The Bentonite Machine, Walsh, T; Research Projects, Hayward, D; Compressed Air Hazards, Jackman, P; Pipejacking, Marks, P; The Tunnellers' Contract, Hardy, A; Tunnel Linings, Donovan, J; Rapid Transit, Bubbers, B; Immersed Tubes, Pequinot, C. /TRRL/

New Civil Engineer No. 147, June 1975, pp 5-45, Figs., Photos.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD-214939)

3A 129009

PAST AND FUTURE OF CONSTRUCTION EQUIPMENT-PART III

To predict the construction equipment of the future, it is divided into equipment of the near future and that of the distant future. Equipment of the near future can best be described by extrapolating from present machines. New equipment must now be designed under the constraints of OSHA, EPA, and the labor unions. It will be safer, have less noise, and provide more comfort for the operator. Equipment in the distant, future will incorporate new systems of excavation, concrete mixing and placing, and use of new materials. Use of automation, electronic controls, and new devices will increase productivity and decrease labor requirements. /ASCE/

Douglas, J (Stanford University) *ASCE Journal of the Construction Division* Proceeding Vol. 101 No. C04, ASCE #11778, Dec. 1975, pp 699-701

3A 129010

PAST AND FUTURE OF CONSTRUCTION EQUIPMENT-PART II

Basic earthmoving machine concepts were developed before 1950. In the early 1950's, three advancements initiated major refinements of construction machines: High-strength steel, nylon cord for tires, and high-speed light-weight high-output diesel engines. This expansion of technology led to larger capacity machines in the 1950's, expanded product lines in the 1960's, and machines with more productivity in the 1970's. Machine evolution, a day-to-day year-to-year process, ends when man has no further need to move the earth he lives on. The end is not in sight, for there is only the future. /ASCE/

Klump, EH (Caterpillar Tractor company) *ASCE Journal of the Construction Division* Proceeding Vol. 101 No. C04, ASCE #11777, Dec. 1975, pp 689-698, 8 Fig., 1 Tab., 1 Ref.

3A 129018

A HALF-CENTURY OF COLD-REGIONS CONSTRUCTION

A review of construction practices in cold regions of the United States and Canada since 1925 reveals that, despite current emphasis on work in these areas, the industry has successfully completed a large number of projects under adverse cold conditions throughout this 50-yr period. Over 50 North American cold-regions projects are reviewed, including buildings, excavation, piling, roadway, bridge, dam, canal, and waterworks projects. Mention is made of cold weather construction practices in foreign countries, and a current project, the Trans-Alaska Pipeline, is noted. /ASCE/

Bennett, FL (Alaska University, Fairbanks) *ASCE Journal of the Construction Division* Proceeding Vol. 101 No. C04A, SCE #11780, Dec. 1975, pp 839-851, 66 Ref.

3A 129487

DESIGN CONSIDERATIONS FOR A DIRECT-FIRED PROPANE HEATER TO PREHEAT THE BASE FOR COLD-WEATHER PAVING

A prototype direct-fired propane heater with variable gas rate and speed was designed for preheating the base to study cold-weather paving of thin mats. The results obtained were compared with those predicted by the computer program. The computer program was then used to simulate cold-weather paving. Statistical analysis of the data revealed that only three of the eight variables were significant. The effect of these three significant variables on the time available for compaction was found to be linear. A nomogram was constructed to predict the time available for compaction. From the results of this study, a 12 by 12-ft (3.6 by 3.6-m) propane heater producing approximately 300,000 btu/hr-sq ft (9300 kW/sq m) and moving 2 min ahead of the paver at a speed of 20 to 80 ft/min (6.1 to 24 m/min) is recommended as a final design. Propane gas consumption for such a heater is estimated to be 1,980 lb/hr (890 kg/h), which will result in a fuel cost of \$138/hr.

Shah, ND Dickson, PF (Colorado School of Mines) *Transportation Research Record* No. 549, 1975, pp 55-62, 7 Fig., 2 Tab., 5 Ref.

PURCHASE FROM: TRB Publications Off Orig. PC

3A 129493

PERFORMANCE OF A LARGE CORRUGATED STEEL CULVERT

Because few published field data exist to help in the development and evaluation of design criteria for large buried structures, a construction project involving such a structure was instrumented in Thunder Bay, Ontario. The structure was a shallow-buried, elliptical, corrugated-steel pipe with a 16-ft (4.9-m) height and a 27-ft (8.2-m) span. A concrete relief slab was placed on the fill several feet (meters) over the crown to distribute the vehicle loads. Pressures around the structure and under the slab were measured by using embedded stress gauges. Horizontal and vertical extensometers measured strains in the backfill. Radial extensometers inside the structure provided the structural deformation pattern. Data was obtained during construction and during live load tests with heavy vehicles. The results provided information on the magnitudes and distribution of stresses and deformations, the influence of construction procedures, and the apparent moduli of the backfill. Even though the cover over the structure provided by the backfill and slab was only about 20 percent of the span, the deflections and stresses in the pipe from the heavy vehicle loads were much smaller than those produced by the dead weight of material placed over the crown. Many cycles of live loading were required before the culvert system

began to respond elastically to the loading. The final soil pressure distribution around the structure and the observed deflections were greatly influenced by the construction procedures.

Selig, ET (State University of New York, Buffalo); Calabrese, SJ (Law Engineering Testing Company) *Transportation Research Record* No. 548, 1975, pp 62-76, 17 Fig., 1 Tab., 1 Ref.

PURCHASE FROM: TRB Publications Off Orig. PC

3A 129564

SOIL MELTING-A PRACTICAL TRIAL

The article describes the subterranean system designed for tunnelling in loosely compacted formations in which a glass lining is formed to support a tunnel roof either as a temporary or a permanent measure. In tests the roof and sides of an experimental tunnel were formed by melting a series of 50mm diameter horizontal holes approximately 2M deep in a loose fill material using electrically heated consolidating subterranean penetrators. The holes were sufficiently close for the glass linings to fuse and so produce a double walled lining reinforced by webs. After tunnel roof and walls were formed, the fill material could be excavated by hand. A long-term development of this system includes equipment to melt a continuous kerf around the periphery of a tunnel being constructed in unconsolidated material so that the melt would be deposited in the form of a thick glass tunnel lining. /TRRL/

Williams, RE (Los Alamos Scientific Laboratory) *Tunnels and Tunnelling* Vol. 7 No. 1, Jan. 1975, pp 44-45, 1 Fig., 7 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD-214675)

3A 129565

PILING PROBE FOR BENTONITE BOREHOLES

This article gives a brief account of tests that are being conducted by CIRIA and BRE to find out whether the use of a bentonite slurry during the construction of concrete bored piles affects the friction between the pile and the strata. Three pairs of piles have been constructed using an auger for the first two and a bucket type drill with a bentonite suspension for the third. In the first, concrete was placed through a single hopper and in the second through a tremie pipe. Precautions were taken to ensure that friction measurements were restricted to the pile/london clay boundary and avoided friction at the base of the pile. Push rods indicate the distribution of strain over the length of the pile and vibrating wire gauges give a check on the strain and give more information on the distribution of skin friction. Brief details are given of the loading and recording methods used. Preliminary analysis of the results suggests that the bentonite is not detrimental to side friction and may even enhance it. /TRRL/

Contract Journal Vol. 266 No. 5002, July 1975, p 31, 1 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD-215070)

3A 129661

SPREADING OF COATED CHIPPINGS ON BITUMINOUS SURFACINGS OF THE FRENCH SEMI-GRANULAR TYPE [Le cloutage des revêtements hydrocarbonés de type français Semi-granu]

The method of spreading hard coated chippings on the surface of a bituminous layer immediately after application of the latter is defined. The technique used in France (which includes the rugochape process) is described in this article; it is a strict application of the technique described above, and it stresses the need of a satisfactorily-laid supporting bituminous layer, which can carry heavy traffic of 13 tonne-axle load vehicles. Based on the experience obtained from heavily trafficked roads over the last few years and the present knowledge on skidding, the characteristics, and behaviour of this type of surfacing are discussed. /TRRL/ [French]

Ozanne, P (Beugnet) *Revue Generale des Routes et des Aerodromes* Vol. 43 No. 491, Oct. 1973, pp 109-116, Figs., 2 Tab., Photos., 14 Ref.

ACKNOWLEDGMENT: Central and Regional Labs of Bridges & Highways, Fr (IRRD 101418), Transport and Road Research Laboratory

3A 129674

DRAWBRIDGE DESIGN BEATS LOCH LEVEN SNAGS

This article gives an account of the construction of the Balla Chulish bridge on the shores of Loch Leven, Scotland. The method of construction used is

likened to the operation of a drawbridge. After a general introduction in which the author refers to the lost time due to high rainfall and the advantages the bridge will bring, the article continues with an account of the choice of the design used. The author then gives an outline of the design, a through truss bridge with a main span of 183 M and side spans of 29 M and 82 M, which will cost 2 million. This is followed by an account of the construction of the abutments and the erection of the spans, which involved the use of special props that allowed an infinite range of height adjustment. Because the mobile crane available was inadequate to lift the steel sections out over the loch an alternative method, described in the article, was used. This involved the use of hinges at one end of each section, fixing the section parallel to the shore and pushing it through 90 degrees with the jib of the crane. This resembled the "drawbridge" method that was used to erect the structural steelwork in the main span, which is also described: this involved the use of a 30-tonne telescopic crane on bogies and the winching of the sections on another bogie. The article concludes with an outline of the way in which the bridge will be completed, and the measures to be taken to eliminate the sag in the mid-span area. /TRRL/

Contract Journal Vol. 264 No. 4986, Mar. 1975, pp 28-29, 2 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 213493)

3A 129967

FLEXIBLE PAVEMENT DESIGN AND MANAGEMENT: SYSTEMS APPROACH IMPLEMENTATION

This report describes an operational computer program (SAMP6) that provides a basis for selecting flexible pavement design and management strategies with the lowest predicted total cost over a prescribed analysis period when considering such cost elements as initial construction, routine maintenance, periodic rehabilitation, interest on investment, salvage value, and roadway users cost. The program uses the AASHTO Interim Guides as its structural subsystem and the predicted decrease in serviceability with time and traffic as developed at the AASHTO Road Test. The strategy selection capability is a quantitative procedure for considering long-term advantages and disadvantages of staged construction versus strong initial structural designs.

Lytton, RL Mc Farland, WF Schafer, DL (Texas A&M University) *Transportation Research Board NCHRP Reports* No. 160, 1975, 53 pp, Figs., Tabs., 7 App.

NCHRP 1-10 A

PURCHASE FROM: TRB Publications Off Orig. PC

3A 129981

CONFERENCE ON RIGID PAVEMENT HELD ON THE 29TH NOVEMBER, 1972 REVIEW OF METHODS OF SURFACING CEMENT CONCRETE PAVEMENTS [Conférence du 29 Novembre 1972 sur les chaussées en béton. Bilan des techniques de revêtement de chaussées en béton de ciment]

The author recalls the experience gained during the laying of the concrete surfacings of the A6 motorway, between 1958 and 1968. The article is divided into 3 parts-(1) review of the main stages of rigid pavement surfacing techniques on motorway construction sites; (2) observations on the conditions of pavements in 1972; (3) observations on the strength, roughness, and skidding resistance of surfacings, and suggestions regarding the various fields of application of rigid pavements. /TRRL/ [French]

Reverdy, G *Revue Generale des Routes et des Aerodromes* No. 486, Apr. 1973, pp 58-67, Photos.

ACKNOWLEDGMENT: Central and Regional Labs of Bridges & Highways, Fr, Transport and Road Research Laboratory (IRRD 102008)

3A 129985

BRIDGE CONSTRUCTION BY EXTRUSION SLIDING

This article describes a method of concrete bridge construction known as extrusion sliding. Briefly, the method involves constructing segments of complete cross-sections, each approximately 30 M long, in a fixed location immediately behind one abutment. As each segment is completed, it is pushed out over the permanent piers a sufficient distance to allow the following completed segment to be attached, and the cycle repeated. The article describes this method as used in the construction of the brohital

bridge across the river rhine. The segments in this case were 25 M long and weighed approximately 26 tonnes/m. The sliding was accomplished using polished stainless steel sheets and teflon coated pads, lubricated by soft soap on each pier and the far abutment. The sliding force was applied by horizontal jacks pushing a neoprene friction bearing, supporting the bridge structure, over an oil lubricated block. A relatively light, steel plate girder nose was fixed to the front of the first segment to reduce cantilever moments during sliding, and two temporary, movable, piers were erected at mid span for additional support. The article concludes by listing the advantages and disadvantages of the method and gives some potential applications. /TRRL/

Korn, H (Dames and Smith) *Concrete* Vol. 9 No. 5, May 1975, pp 16-21, 6 Fig., 1 Tab., 9 Phot., 3 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 216078)

3A 130550

AN INVESTIGATION OF PRECAST AND PRESTRESSED CONCRETE BULB TEE MULTI-BEAM BRIDGES

Multi-beam bridges, constructed from precast and prestressed concrete bulb tee sections, were evaluated through field observations and analyzed using the finite element method. Approximately 50 bridges were inspected in the states of Washington and Idaho, and data for over 100 bulb tee systems was obtained for evaluation. Personnel interviewed from agencies constructing these bridges were very accepting of the bulb tee bridge system. Their reasons for this acceptance included the ease of erection, low installation costs, and low maintenance costs. The field observations of existing bridges revealed some problems. Most of these problems have been eliminated in later designs by careful follow up work carried out by the producers and most agencies. Cost data on 81 bridges showed that the average cost per square foot of deck has been reduced by about 50 percent since 1963. Several finite element models were utilized to investigate the effect of the lateral load transfer devices. These analyses served to quantitatively illustrate the major role played by both the weld tie plate and the grout keyway in transferring the load laterally; furthermore the calculations revealed that a relatively minor amount of stiffness is contributed to the system by the diaphragms.

Report sponsored by the Federal Highway Administration, Idaho Division, Boise, Idaho.

Sack, RL

Idaho University, Moscow Final Rpt. FHWA-RD-75-84, June 1975, 61 pp

ACKNOWLEDGMENT: Federal Highway Administration (X-0006)

3A 130580

WIND LOADING ON FALSEWORK-PHASE I

Full size installations of Modular Tubular Falsework were tested in a wind tunnel. The tests considered various tower spacings, wind velocities to 100 mph, oblique incidence of wind, and varying number of tower units in the wind stream. The angle of wind incidence and the number of towers in the wind stream were found to be major factors in determining the total wind load on a falsework bent. A design method, based on an empirically established wind velocity model and the test data, is presented. /FHWA/

Nix, HD Bridges, CP Power, MG

California Department of Transportation, (CA-DOTDS-4179-1-75-4) Final Rpt. FHWA-RD-75-S0418, June 1975

Contract D-4-140

ACKNOWLEDGMENT: Federal Highway Administration (S-0418)

PURCHASE FROM: NTIS Repr. PC

3A 130627

HOW UNDERGROUND SPACE USE STARTED IN THE KANSAS CITY AREA

The recognition of the importance of subsurface openings, and their transformation through innovation in building systems and construction methods, into outstanding developments of two-tier space occupancy are described. The first underground storage facility for perishable goods was that developed in 1944 from a mine. Freezer space was developed for in-transit goods in 1946 and 1953. In 1959, a 44-acre site called "Downtown Industrial Park" was developed from a surface quarry. This development

began on the surface over the first shaft-type mine in Kansas City. The shaft went down some 60 feet from the edge of a railroad to reach Bethany Falls. This site is now two facilities either built or under construction. The biggest problem encountered after overcoming the legal hurdles of splitting the fee and developing at two different levels of the same property, is that of the building codes. The importance of the connection between underground space development and civil defense is pointed out.

Published in the Proceedings of the Symposium on the Development and Utilization of Underground Space, March 5-7, 1975, Kansas City, Mo., sponsored by the Department of Geosciences, University of Missouri, Kansas City.

Dean, L (Dean Equipment Company)

National Science Foundation Proceeding Mar. 1975, pp 25-28

3A 130771

EMISSIONS FROM FARM, CONSTRUCTION AND INDUSTRIAL ENGINES

Besides the automobile powerplant, other internal combustion engines, such as farm, construction and industrial types, contribute to national pollution. An estimate is given of how much exhaust emissions they actually contribute, and how their emissions compare to those from other sources. /GMRL/

Automotive Engineering Vol. 83 SAE #750788, Sept. 1975, 3 pp

3A 200206

HIGHWAY PAVING: WHICH WILL IT BE-ASPHALT OR CONCRETE?

SOME OF THE VARIABLES INVOLVED IN THE NECESSARY DECISION- MAKING FOR ASPHALT OR CONCRETE HIGHWAY PAVEMENTS ARE DISCUSSED. IT IS POINTED OUT THAT EVEN WHEN COMPARATIVE FIGURES ARE AVAILABLE, THE CIRCUMSTANCES AND CONDITIONS UNDER WHICH A ROAD IS BUILT MAY BE SO SPECIALIZED THAT THE RESULTS CANNOT BE SAFELY GENERALIZED TO APPLY EVERYWHERE. COSTS VARY CONSTANTLY FROM AREA TO AREA & ARE DEPENDENT ON THE LOGISTICS OF SUPPLY, THE PRICE OF AGGREGATE, STEEL, LABOR & OTHER ELEMENTS IN THE POTENTIAL BID PRICE. THE TYPE & VOLUME OF TRAFFIC TO BE CARRIED WILL AFFECT THE THICKNESS OF THE PAVEMENT REQUIRED TO SUPPORT IT EFFICIENTLY AND ECONOMICALLY. COST PER MILE FIGURES ARE AFFECTED BY THE DEGREE OF CONTRACTOR INTEREST IN A JOB, THE EXTENT OF HIS EXPERIENCE, CLIMATE, THE TYPE, CONDITIONS, AVAILABILITY AND PROXIMITY OF MACHINERY AND EQUIPMENT AND ESTIMATED MAINTENANCE COSTS. IT IS CONCLUDED THAT THE INFLATIONARY SPIRAL, SHORTAGE OF MATERIALS, NEW DEVELOPMENTS IN MACHINERY, METHODS AND DESIGN CALL FOR AN OPEN MIND AND AN ALMOST DAILY REAPPRAISAL OF THE FACTORS WHICH INFLUENCE DECISION MAKING.

World Construction Apr. 1968

3A 200343

IN SERVICE TRAINING MANUAL FOR PROJECT ENGINEERS' AND C PROJECT SUPERVISORS' WORKSHOP

LIST OF SESSIONS AND MODERATORS REGISTRATION, ORIENTATION ON GROUND RULES AND ARRANGEMENTS, H. R. J. WALSH INTRODUCTION: THE INDIANA STATE HIGHWAY COMMISSION ORGANIZATION AND THE FUNCTIONS OF PROJECT ENGINEERS AND PROJECT SUPERVISORS, R. ROATH CONTRACTORS RELATIONS, N. M. BLACKBURN RIGHT-OF-WAY PROBLEMS, S. M. SHARTLE PERSONNEL, C. N. DEVANEY ADVANCED PROJECT PLANNING, A. L. PAVELL DEOCUMENTATION, W. J. RITMAN DENSITY CONTROL, C. F. HOTLER BITUMINOUS MIXES, W. H. GOETZ, R. PAVLOVICH PROJECT MANAGEMENT, A. E. LIVINGSTON PORTLAND CEMENT CONCRETE, J. F. MCLAUGHLIN CONCRETE PAVEMENT CONSTRUCTION, G. K. HALLOCK PROGRESS ESTIMATES, J. BREWER FINAL CONSTRUCTION RECORD, G. E. SMITH, R. F. KING ADVANCED PLANNING FOR TESTS, D. LUCAS FIELD PROBLEMS, CONSTRUCTION STAFF, ISHC STRUCTURES CONTROL, M. M. PORTER FOUNDATIONS, FALSEWORK, FORMS, AND CONCRETE CONSTRUCTION, T. E. LEWIS, M. M. PORTER

STEEL, T. E. LEWIS, M. M. PORTER BRIDGE CONSTRUCTION SLIDES GRAPHICAL LAYOUT, M. M. PORTER EARTHWORK IBM CODING, J. BELLINGER

Indiana State Highway Commission 54 pp, Feb. 1969

3A 200420
STATISTICAL SPECIFICATIONS IN BITUMINOUS CONCRETE HIGHWAY CONSTRUCTION

THE NEED FOR STATISTICALLY ORIENTED ACCEPTANCE PLANS BY HIGHWAY DEPARTMENTS, AND FOR CONTROL PROCEDURES BY CONTRACTORS IS EVIDENT IN THE INCREASED DISCUSSION GIVEN THESE MATTERS IN HIGHWAY-ORIENTED MEETINGS FROM COAST TO COAST. ALTHOUGH SOME STATISTICAL SPECIFICATIONS ARE USED IN THE HIGHWAY INDUSTRY AT PRESENT, MANY MORE ARE NEEDED. THE DELAY IN ADOPTING THESE PROCEDURES HAS STEMMED FROM A RELUCTANCE ON THE PART OF HIGHWAY AGENCIES, BOTH FEDERAL AND STATE, TO PART WITH THEIR TRADITIONAL METHODS AND THE RELUCTANCE OF CONTRACTORS TO UNDERTAKE CONTROL OF THEIR OWN PROCESSES. THE STEPS BEING TAKEN BY MOST HIGHWAY AGENCIES IN IMPLEMENTING STATISTICAL SPECIFICATIONS AS WELL AS MOST OF THE IMPORTANT ITEMS IN ASPHALTIC CONCRETE SPECIFICATIONS ARE MENTIONED. /AUTHOR/

Hughes, CS *Materials Research and Standards* Oct. 1970

3A 200658
THE GREATEST ROAD CONSTRUCTION CONTRACT IN THE NORDIC COUNTRIES. FINLAND IS CONSTRUCTING WITH SWEDISH ASSISTANCE

THIS IS A REPORT ON THE MOTORWAY PROJECT BETWEEN HELSINKI AND LAHTI IN FINLAND; THE MOTORWAY COVERS A DISTANCE OF 100 KILOMETERS. MANY SWEDISH COMPANIES ARE ENGAGED IN THE DESIGN AND CONSTRUCTION OF THE PROJECT, AND TECHNICAL SOLUTIONS USED IN SWEDEN ARE NOW BEING INTRODUCED, E.G., A BRIDGE CONSTRUCTION METHOD AT KORS, JOKIVARSI. THE LOAD-BEARING PART OF THE FORMWORK CONSISTS OF A 42 METER-LONG MOULD ELEMENT WHICH IS HYDRAULICALLY CONTROLLED. SINCE THE DISTANCE BETWEEN TWO PIERS IS 20 METERS, IT IS POSSIBLE TO LET THE MOULD ELEMENT ADVANCE 40 METERS AT A TIME. /TRRL/

Byggnadsindustrin, Stockholm /Sweden/ Vol. u2 N No. 6, 1972, pp 11-2, 2 Fig, 4 Phot

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/IRRD 205 163, 2C11235924

3A 200687
ONTARIO TO TRAIN EQUIPMENT OPERATORS

THE ONTARIO ROAD BUILDERS ASSOCIATION /ORBA/ IN COOPERATION WITH THE PROVINCIAL DEPARTMENT OF EDUCATION IS INVESTING ABOUT \$1 MILLION TO ESTABLISH A TRAINING SCHOOL FOR OPERATORS OF HEAVY EQUIPMENT. VARIOUS EQUIPMENT DEALERS WILL DONATE SOME EQUIPMENT AND A NUMBER OF OIL COMPANIES ARE DONATING FACILITIES TO SERVICE THE EQUIPMENT. THE PROVINCIAL INSTITUTE OF TRADES AND OCCUPATIONS WILL OPERATE THE SCHOOL WHICH WILL BE LOCATED NEAR GEORGETOWN, ABOUT 28 MILES NORTHWEST OF METROPOLITAN TORONTO ON LAND MADE AVAILABLE BY THE ORBA. THE COURSES ARE DESIGNED TO UPDATE AND RETRAIN PEOPLE REFERRED TO THE SCHOOL BY INDUSTRY AND ALSO PROVIDE RETRAINING FOR UNEMPLOYED PERSONS UNDER A FEDERAL-PROVINCIAL TECHNICAL AND VOCATIONAL TRAINING AGREEMENT. EACH TRAINEE WILL RECEIVE 10 WEEKS OF INSTRUCTION ON GRADERS, BULLDOZERS, FRONT-END LOADERS, SCRAPERS, HEAVY-DUTY TRUCKS, CRANES AND EXCAVATING EQUIPMENT.

Mcnevin, G , Heavy Construction News, ASST EDITOR *Heavy Construction News /Canada/*

3A 200734
EDUCATIONAL NEEDS FOR RIGID PAVEMENT CONSTRUCTION

THE CHANGING PICTURE IN PORTLAND CEMENT CONCRETE PAVEMENT CONSTRUCTION PRACTICES IS PRESENTED AND SOME SUGGESTIONS ARE OFFERED ON NEEDED PROGRAMS OF CONTINUING EDUCATION AND TRAINING. COMMUNICATIONS ARE DISCUSSED AS A TOOL FOR TEACHING A SKILL. THE PORTLAND CEMENT ASSOCIATION, NATIONAL READY MIX CONCRETE ASSOCIATION AND THE AMERICAN CONCRETE INSTITUTE ARE WORKING WITH THE DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE TO DEVELOP A 2-YEAR CURRICULUM AND MATERIALS FOR TRAINING WORKERS IN CONCRETE TECHNOLOGY AND VARIOUS JOB CLASSIFICATIONS. THE FIRST PHASE OF THE PROGRAM IS INTENDED TO: (1) PROVIDE COURSE CONTENT AND TEACHING GUIDES FOR AN AREA OF VOCATIONAL EDUCATION WHERE NO SUCH TRAINING EXISTS, (2) BROADEN EMPLOYMENT OPPORTUNITIES IN AN EXPANDING INDUSTRY FOR NON-ACADEMIC POST HIGH SCHOOL YOUTH, (3) PROVIDE A BASIS FOR IN-SERVICE JOB UPGRADING AND OTHER ADULT VOCATIONAL EDUCATION PROGRAMS, (4) REDUCE A CRITICAL SHORTAGE OF SKILLED MANPOWER IN THE GROWING CEMENT AND CONCRETE INDUSTRIES, (5) PROVIDE NEW AVENUES OF EMPLOYMENT FOR PERSONS FROM SOCIALLY OR ECONOMICALLY DISADVANTAGED GROUPS, AND (6) INITIATE VOCATIONAL EDUCATION TRAINING PROGRAMS TO FILL THE MANPOWER NEEDS OF THE CEMENT AND CONCRETE INDUSTRIES. THE SECOND PHASE OF THE PROGRAM WILL BE A 2-YEAR PILOT PROGRAM TO PROVIDE THROUGH FIELD TESTS THE LEVEL OF TRAINING FOR WHICH THE BASIC CURRICULUM IS DESIGNED. ADAPTATION OF CURRICULUM MATERIALS DEVELOPED IN THE FIRST PHASE FOR OTHER LEVELS OF VOCATIONAL EDUCATION AND FOR TRAINING PROGRAMS FOR SPECIFIC OCCUPATIONS WILL BE ACCOMPLISHED IN THE THIRD PHASE. IT IS ADVISED THAT THERE ARE NEEDS FOR SEVERAL KINDS OF EFFORTS IN CONTINUING EDUCATION FOR BETTER BUILDING OF PORTLAND CEMENT CONCRETE PAVEMENTS. SUGGESTIONS ARE FOR BETTER MANAGEMENT AT THE TOP, BETTER SUPERVISION, BETTER OPERATION OF EQUIPMENT, BETTER SPECIFICATIONS, AND BETTER INSPECTION WHICH CAN ALL BE OBTAINED THROUGH CONTINUING EDUCATION.

Highway Research News, Hwy Res Board 1969

3A 201267
THE COST OF DOING VERSUS THE COST OF NOT DOING

A SERIES OF FOUR ARTICLES, EXPRESSING THE OPINIONS OF A MANAGER, AN ELECTED OFFICIAL, A ROADS SUPERINTENDENT AND A CONSULTING ENGINEER ON THE VALUES OF ROAD RECONSTRUCTION AGAINST THAT OF MAINTAINING OUTDATED SYSTEMS. THERE IS AGREEMENT THAT SAVINGS ARE TO BE REALIZED FROM RECONSTRUCTION, BUT FINANCIAL REQUIREMENTS MUST BE EVALUATED IN A GOOD TRANSPORTATION PLAN. QUALITY CONSTRUCTION AND GOOD GEOMETRIC DESIGN ARE NECESSARY TO ENSURE TRAFFIC SAFETY AND PAVEMENT SERVICEABILITY. /CGRA/

Foster, JW , Board of Works Simcoe Ont Aitcheson, I , Reeve of The Township of Sullivan Ont Guyer, G , Township of Saugueen Ont Graham, AJ , Consulting Engineer, OTTAWA *Municipal World /Canada/* Mar. 1966

3A 201772
OPTIMUM LIFE OF EQUIPMENT FOR MAXIMUM PROFIT

A GROUP OF EQUATIONS IS DEVELOPED IN THIS PAPER TO STIMULATE THE COSTS OF OWNING, MAINTAINING, AND OPERATING CONSTRUCTION EQUIPMENT. BY MANIPULATING THE VARIABLES IN THESE EQUATIONS, THE DECISION-MAKER IS ABLE TO CONFIRM QUANTITATIVELY THE DECISIONS HE MUST MAKE WHICH INVOLVE THE ECONOMIC LIFE OF HIS EQUIPMENT. THE ECONOMIC LIFE OF A PIECE OF EQUIPMENT IS DEFINED AS THAT LIFE WHICH MAXIMIZES

THE RETURN TO THE OWNER DURING THE LIFE OF HIS ENTERPRISE. IN MAKING DECISIONS ABOUT EQUIPMENT POLICY, MODERN ECONOMIC ENVIRONMENT DICTATES A CONSIDERATION OF AT LEAST THE FOLLOWING BASIC CONCEPTS: (1) TIME VALUE OF MONEY; (2) TECHNOLOGICAL ADVANCES IN EQUIPMENT (OBsolescence); (3) EFFECT OF TAXES (DEPRECIATION TECHNIQUES); (4) INFLUENCE OF INFLATION; (5) INCREASED COST OF BORROWING MONEY; (6) CONTINUING REPLACEMENTS IN THE FUTURE; AND (7) INCREASED COST OF FUTURE MACHINES. ALL OF THESE CONCEPTS ARE INCLUDED IN THE MODEL WHICH IS DESCRIBED. /AUTHOR/

Douglas, J *Am Soc Civil Engr J Construction Div* Jan. 1968

ACKNOWLEDGMENT: Traffic Systems Reviews & Abstracts

3A 203622

MODULAR SYSTEMS FOR SHORE PROTECTION

MODULAR CONSTRUCTION, AS IT IS USED IN PROTECTING THE SHORE BY CHECKING EROSION AND PROTECTING BEACHES FROM WAVE DAMAGE, IS DISCUSSED WITH RESPECT TO INTERLOCKING REVETMENTS, REVETMENT MATTRESSES, PRECAST PERMEABLE GROIN, PERFORATED BREAKWATER, AND POLYPADS. INTERLOCKING REVETMENTS CONSIST OF PRECAST CONCRETE SECTIONS THAT INTERLOCK IN NUMEROUS SHAPES AND SIZES WHEN PLACED ON AN EMBANKMENT. REVETMENT MATTRESSES ARE USUALLY OF NYLON, SECTIONALIZED AND THEN FILLED WITH A FINE AGGREGATE CONCRETE OR MORTAR. THE PRECAST PERMEABLE GROIN--A 30 X 6 X 5' PERFORATED PRECAST CONCRETE BOX WITH 6" REINFORCED CONCRETE WALLS AND PERFORATIONS OVER THE SIDE WALLS--IS DESIGNED TO RETARD ONLY A SMALL PERCENTAGE OF THE LITTORAL DRIFT. A PERFORATED BREAKWATER STRUCTURE--SERVING AS A WHARF TOO--UTILIZED THE HOLES ON THE SEAWARD SIDE OF THE BREAKWATER TO DISSIPATE WAVE ENERGY. POLYPADS ARE NOTHING MORE THAN LARGE PRECAST CONCRETE STRUCTURES USUALLY INTERLOCKING IN A VARIETY OF SHAPES DESIGNED FOR THE PURPOSE OF PROTECTING THE SHORE AND USED WHEREVER THERE IS HEAVY WAVE ACTION OR IN BREAKWATERS.

Wilder, CR Koller, ER *Civil Engineering Asce* Oct. 1971

3A 203638

PREFABRICATED HIGHWAYS

TO FACILITATE MORE EFFICIENT AND ECONOMICAL WAYS OF REPAIRING AND BUILDING ROADS AND BRIDGES IN URBAN AREAS THAT ARE SUBJECT TO BOTH CONSTRUCTION TIME RESTRICTIONS AND HIGH RATES OF CHANGE, SEVERAL NEW METHODS OF CONSTRUCTION ARE DESCRIBED. PRECAST CONCRETE COMPONENTS ARE POST-TENSIONED TOGETHER BY STANDARD OR SPECIAL TEFLON COATED TENDONS. A NUMBER OF HIGHWAY BRIDGES UTILIZING SUCH CONSTRUCTION TECHNIQUES HAVE ALREADY BEEN BUILT, BUT ONLY A FEW EXPERIMENTAL HIGHWAY PAVEMENTS HAVE BEEN TRIED TO DATE. A NEW TECHNIQUE DESCRIBED BY STITCHING PAVEMENT SLABS TOGETHER WITH CURVED TENDONS SHOULD EXPEDITE THE GREATER USE OF PREFABRICATED ROADWAYS. ALSO MENTIONED ARE NEW METHODS OF USING PREFABRICATED FOOTING AND FOUNDATIONS, PARTICULARLY FOR BRIDGE CONSTRUCTION. /AUTHOR/

Zuk, W *Am Soc Civil Engr J Transportation Eng* Vol. 98 No. te 2, May 1972, pp 387-94

3A 203651

GEOTECHNICAL PROJECT AND QUALITY CONTROL OF HIGHWAY CONSTRUCTION IN AN ISLAND /IN PORTUGUESE/

THIS PROJECT CONCERNS THE BEHAVIOR OF PAVEMENTS CONSTRUCTED BY NON-STANDARD TECHNIQUES NECESSITATED BY DIFFICULTIES IN OBTAINING MATERIALS ON

ITAPARICA ISLAND (BAHIA STATE). THE TWO METHODS EMPLOYED WERE THE USE OF FINE AGGREGATES AND CATIONIC EMULSIONS FOR COLD-MIX ASPHALT SURFACING AND THE APPLICATION OF TECHNIQUES TO AVOID THE INCONVENIENCES ASSOCIATED WITH THE USE OF 'MASSAPE' CLAYEY SOILS IN EARTHWORKS.

Tavares, NETO P
Road Research Institute /Brazil/ 1971

ACKNOWLEDGMENT: Road Research Institute /Brazil/

3A 203969

FLEXIBLE CULVERTS UNDER HIGH FILLS-EQUILIBRIUM CONSIDERATIONS

THIS REPORT ON LOADS ON FLEXIBLE CULVERTS ON HIGH FILLS CONSIDERS ONLY EQUILIBRIUM STATES OF THE FLEXIBLE CULVERT AND IGNORES THE PROBLEM OF BUCKLING. IT IS ESSENTIALLY A REFINEMENT OF AN EARLIER ANALYSIS BY THE SAME AUTHORS OF RIGID PIPE. COMPARISONS WERE MADE WITH FIELD TEST RESULTS AND STATEMENTS ABOUT THE EFFECTS OF CONSTRUCTION METHODS, CULVERT RIGIDITY AND BASE MATERIAL WERE POSSIBLE. THE AUTHORS CONCLUDE THAT THE FINAL PRESSURE DISTRIBUTION COULD BE GRAVELY AFFECTED BY THE INITIAL CONFIGURATION AND ITS SUBSEQUENT MOTION. /BPR/

Brown, CB Green, DR Pawsey, SF
California University, Berkeley, California Division Highways, California Department Public Works June 1967

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (6-1 67)1C63020558, PB 176 175, 1C23021042

3A 203985

BEHAVIOR OF THE REBUILT WOLF CREEK CULVERT

THE RECONSTRUCTION AND INSTRUMENTATION IS DESCRIBED OF AN 18.5 FOOT DIAMETER STRUCTURAL-PLATE CULVERT UNDER 85 FEET OF COVER. THE IMPERFECT TRENCH TYPE OF CONSTRUCTION WAS USED. THE INSTRUMENTATION CONSISTED OF: SR-4 STRAIN GAGES PLACED ON THE CULVERT WALLS AT APPROXIMATELY MID-HEIGHT, CARLSON SOIL STRESS METERS PLACED ON THE OUTSIDE WALLS OF THE CULVERT AND IN THE FILL, AND SETTLEMENT CELLS WHICH WERE TAKEN ON LEVELS ON THE CULVERT INVERT, VERTICAL AND HORIZONTAL DIAMETERS, AND LEVELS OF THE ROADWAY PROFILE. OVERALL, THE INSTRUMENTATION PERFORMED SATISFACTORILY. RESULTS CORRELATED WELL AND DEMONSTRATED THAT THE VERTICAL LOAD ON THE CULVERT WAS MUCH LESS THAN THE WEIGHT OF THE OVERLYING COLUMN OF EARTH--A HIGHLY FAVORABLE LOAD CONDITION WHICH THE IMPERFECT TRENCH METHOD OF CONSTRUCTION WAS EXPECTED TO PRODUCE. THERE WAS NO MEASURABLE DIFFERENTIAL SETTLEMENT OF THE PAVEMENT ATTRIBUTED TO THE IMPERFECT TRENCH METHOD. /AUTHOR/

Willett, GA Scheer, AC
Montana State University, Bureau of Public Roads /US/ 1968

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4615174 68)PB 179 884, PB 183 693, 3C23021404

3A 204378

STRUCTURAL ANALYSIS AND DESIGN OF PIPE CULVERTS

GENERALLY ACCEPTED METHODS FOR THE STRUCTURAL DESIGN OF PIPE CULVERTS REQUIRE DETERMINATION OF THE MAGNITUDE AND DISTRIBUTION OF LOADING AND SELECTION OF A READILY AVAILABLE RIGID (CONCRETE) OR FLEXIBLE (CORRUGATED METAL) CULVERT COMPATIBLE WITH THE LOADING. ALTHOUGH THE MARSTON-SPANGLER AND THE MORE RECENTLY DEVELOPED RING COMPRESSION THEORIES ARE CURRENTLY BEING USED EXTENSIVELY AS A BASIS FOR DESIGNING BURIED CONDUITS, A GREAT DEAL OF ENGINEERING JUDGMENT IS INVOLVED IN APPLYING THESE LOAD DETERMINATION PROCEDURES, PARTICULARLY IN

THE CASE OF RIGID CULVERTS. IN ADDITION, DURABILITY AND HANDLING PROBLEMS, WHICH ARE FREQUENTLY CRITICAL IN THE CASE OF FLEXIBLE CULVERTS, REQUIRE THE EXERCISE OF CONSIDERABLE ENGINEERING JUDGMENT. ONE OF THE MAJOR UNCERTAINTIES FACED BY THE PRESENT-DAY DESIGNER IS ASSOCIATED WITH THE APPROPRIATE CONSIDERATION OF CONSTRUCTION PRACTICES. THIS PROBLEM, TOGETHER WITH THE DIFFICULTY OF SPECIFYING A GENERALLY ACCEPTABLE FAILURE CRITERION, MAKES THE SELECTION OF A SUITABLE SAFETY FACTOR EXTREMELY COMPLICATED. PERHAPS THE MOST IMPORTANT REASONS THAT DICTATE THE NEED FOR AN EVALUATION OF CURRENT DESIGN PRACTICES FOR BOTH RIGID AND FLEXIBLE CULVERTS ARE THE FOLLOWING: (1) THERE IS SERIOUS CONCERN ABOUT THE EXTRAPOLATION OF CURRENTLY USED EMPIRICAL RELATIONSHIPS AND FIELD EXPERIENCE TO THE LARGER DIAMETER PIPES AND HIGHER FILLS COMING INTO USE; (2) WITH CULVERT-SIZE HIGHWAY DRAINAGE STRUCTURES RESULTING IN AN EXPENDITURE OF ABOUT \$500,000,000 ANNUALLY, THE POSSIBILITY OF OVERCONSERVATISM IN CULVERT DESIGN SHOULD BE EXPLORED; AND (3) CURRENT METHODS USED IN THE DESIGN OF PIPE CULVERTS FAIL TO REFLECT IN A RATIONAL WAY MANY OF THE FACTORS THAT INFLUENCE BEHAVIOR IN THE FIELD (FOR EXAMPLE, A BETTER UNDERSTANDING OF SOIL-PIPE INTERACTION IS NEEDED TO FURTHER THE DEVELOPMENT OF INTERMEDIATE-STIFFNESS PIPES MADE OF DIFFERENT MATERIALS, SUCH AS PLASTICS). EMPHASIS DURING THE STUDY WAS PLACED ON (1) IDENTIFICATION OF CONDITIONS FOR WHICH CURRENTLY USED DESIGN PROCEDURES, WITH MODIFICATIONS AND IMPROVEMENTS, ARE SATISFACTORY FOR CONTINUED JUDICIOUS USE; (2) IMPROVEMENTS TO METHODS FOR SELECTING SOME OF THE MORE IMPORTANT MATERIAL PROPERTIES USED IN EXISTING DESIGN METHODS; (3) DETERMINATION OF CONDITIONS FOR WHICH DIFFERENT APPROACHES SHOULD BE DEVELOPED; AND (4) RECOMMENDATION OF LONG-RANGE RESEARCH NEEDS. FROM THE DESIGNERS' STANDPOINT, A MOST IMPORTANT FINDING IS THAT DURABILITY, HANDLING, AND CONSTRUCTION CONSIDERATIONS ARE MUCH MORE SIGNIFICANT THAN STRUCTURAL DESIGN PARAMETERS WHEN SELECTING A SUITABLE GENERALLY AVAILABLE PIPE CULVERT FOR CASES INVOLVING SMALL PIPES TO BE PLACED UNDER SHALLOW-TO-MODERATE FILLS. CURRENTLY USED EMPIRICAL DESIGN PROCEDURES APPEAR ADEQUATE FOR THE MAJORITY OF THESE CASES. MORE COMPLEX ANALYSIS AND DESIGN PROCEDURES SHOULD BE EMPLOYED WHEN LARGE-DIAMETER PIPES ARE TO BE USED, AND THERE IS A VITAL NEED FOR EXTENSIVE RESEARCH IN THE AREA OF EXTRA LARGE PIPES, PIPE ARCHES, AND OTHER THAN ROUND SHAPES. ALSO, THERE IS A NEED TO INVESTIGATE MORE FULLY THE EFFECT OF HEAVY CONSTRUCTION LOADS ON PIPES UNDER SHALLOW FILLS. /HRB/

Krizek, RJ Parmelee, RA Kay, JN Elnaggar, HA *Highway Research Board Nchrp Reports* 1971

HRIS 23 218259, 1P23218258

3A 205294

FROST CONSIDERATION IN HIGHWAY PAVEMENT DESIGN' WEST-CENTRAL UNITED STATES-AND DISCUSSION

THE WEST-CENTRAL UNITED STATES AREA INVOLVES REGIONS OF DIVERSE CLIMATE AND TOPOGRAPHY, RANGING FROM THE FOREST AND LAKE REGION OF NORTHERN MINNESOTA THROUGH THE VAST PLAINS AND LOWLANDS TO THE OZARKS IN MISSOURI AND ARKANSAS. IT CAN GENERALLY BE SUBDIVIDED INTO THREE PHYSIOGRAPHIC PROVINCES' THE GREAT PLAINS, CENTRAL LOWLANDS, AND THE OZARK PLATEAU REGION. THERE WERE NO SIGNIFICANT FROST PROBLEMS IN THE SOUTHERN PORTION OF THE WEST CENTRAL STATES OTHER THAN THE DETERIORATION OF PORTLAND CEMENT CONCRETE WHICH IS NOT DISCUSSED. PROGRESSING NORTHWARD, THE BEST COURSES FOR SUB-

GRADE SOILS BECAME SUCCESSFULLY INVOLVED IN FROST ACTION RESULTING IN MORE NUMEROUS DEEP SEATED PROBLEMS. DESIGN AND CONSTRUCTION PRACTICES USED IN SEVERAL FROST AREAS CANNOT BE APPLIED IN LESS SEVERE AREAS WITHOUT ADJUSTING TO LOCAL CONDITIONS. GENERAL FROST DESIGN PRACTICES ARE EFFECTIVE IN MINIMIZING MOST OF THE PROBLEMS. A FEW ARE NOT FULLY SOLVED AND IMPROVEMENTS ARE POSSIBLE IN THE AREA OF BASE DESIGN FOR RIGID AND FLEXIBLE PAVEMENTS, CULVERT PLACEMENT, AND A NUMBER OF OTHERS. THE GREATEST ADVANCES HAVE BEEN MADE IN SOLVING SUBGRADE AND BASE PROBLEMS THROUGH IMPROVED DESIGN, GRADING AND BASE CONSTRUCTION PROCEDURES.

Fredrickson, F C Mcdonaldson, EB *Highway Research Record, Hwy Res Board* 1963

3A 205329

FRICITION STUDIES IN BONDED CEMENT CONCRETE PAVEMENT SLABS

A SMOOTH BASE IS DESIRABLE FOR A PRESTRESSED CONCRETE PAVEMENT SO THAT LOSSES IN PRESTRESS DUE TO FRICTIONAL RESTRAINT AT THE INTERFACE BELOW CAN BE REDUCED TO MINIMUM. IN THE CASE OF NON-PRESTRESSED RIGID PAVEMENTS, OPINION IS VARIED REGARDING THE EFFICACY OF A SMOOTH BASE. IN INDIAN HIGHWAY PRACTICE, WHERE THE STAGE CONSTRUCTION METHOD IS COMMON, THE CONCRETE SLAB IS BONDED TO A WELL CONSOLIDATED WATER-BOUND MACADAM BASE BELOW. THIS BONDING INCREASES THE EFFECTIVE THICKNESS OF THE SLAB. FURTHERMORE, THE FORCE OF ADHESION AT THE INTERFACE IS EXTREMELY HIGH AND IN THE CASE OF RESTRAINED CONTRACTION OF THE SLAB, THE FAILURE TAKES PLACE WELL INSIDE THE BASE AND THE SLAB SIMPLY ACTS AS A BONDED SURCHARGE INITIATING THE DEFORMATIONS. IN OTHER WORDS, THE CLASSICAL DRAG THEORY DOES NOT SEEM TO BE VALID FOR BONDED SLABS. /AUTHOR/

Venkatasubramanian, V *Highway Research Record, Hwy Res Board* 1966

3A 205429

A GUIDE TO THE STRUCTURAL DESIGN OF FLEXIBLE AND RIGID PAVEMENTS IN CANADA

THIS DOCUMENT SUGGESTS METHODS FOR THE STRUCTURAL DESIGN OF CONVENTIONAL FLEXIBLE AND RIGID PAVEMENTS FOR ROADS WITH RURAL CROSS-SECTIONS WHICH WILL, WITHIN 10 YEARS AFTER CONSTRUCTION, HAVE ANNUAL AVERAGE DAILY TRAFFIC VOLUMES PER LANE OF 1,000 OR MORE VEHICLES INCLUDING 10 PERCENT OR MORE TRUCKS AND BUSES. THE DESIGN PROCEDURES ARE BASED UPON THE RESULTS OF A 7-YEAR PROGRAM OF RESEARCH ON THE PERFORMANCE OF THOUSANDS OF SECTIONS OF PAVEMENT OF VARIOUS DESIGNS ON THE PRIMARY HIGHWAYS IN ALL PROVINCES OF CANADA, SUPPLEMENTED WITH DATA FROM OTHER SOURCES SUCH AS THE AASHO ROAD TEST. THE FLEXIBLE PAVEMENT DESIGN PROCEDURE IS BASED ON LIMITING VALUES OF PAVEMENT SURFACE BENKELMAN BEAM REBOUND. THE RIGID PAVEMENT DESIGN RECOMMENDATIONS ARE BASED UPON DESIGNS WHICH ARE CURRENTLY BEING USED WITH SUCCESS IN CANADA. THE GUIDE CONTAINS STANDARD PROCEDURES FOR MEASURING BENKELMAN BEAM REBOUND, FOR ESTIMATING THE STRENGTH OF A SECTION OF FLEXIBLE PAVEMENT AND FOR DETERMINING THE PRESENT PERFORMANCE RATING. EXAMPLES OF DESIGN AND CONSTRUCTION CONTROL ARE GIVEN. IN THE GUIDE, EQUAL ATTENTION IS GIVEN TO CONSTRUCTION CONTROL. EVIDENCE INDICATES THAT THE UNIFORMITY OF CONSTRUCTION IS THE PRIMARY VARIABLE CONTROLLING PAVEMENT PERFORMANCE. /CGRA/

Canadian Good Roads Association

3A 205464

CEMENT-TREATED SUBBASE PRACTICE IN U.S. AND CANADA

IN AREAS WHERE GRANULAR MATERIALS MEETING SUBBASE SPECIFICATIONS ARE SCARCE, CEMENT-TREATED SUBBASES OFTEN PROVIDE AN ECONOMICAL SOLUTION. BESIDES PREVENTING EROSION CAUSED BY PUMPING, CEMENT-TREATED SUBBASE CAN USE INEXPENSIVE SUBSTANDARD GRANULAR MATERIALS AND CAN PROVIDE A STABLE, WATER-RESISTANT WORKING TABLE FOR THE CONTRACTOR. USE OF THINNER CONCRETE SLAB IS PERMITTED, RESULTING IN IMPROVED PAVEMENT PERFORMANCE. HISTORY AND DEVELOPMENT OF CEMENT-TREATED SUBBASES, NOW USED IN 31 STATES AND PROVINCES, IS PRESENTED. DETAILS ARE INCLUDED ON SUGGESTED CRITERIA FOR GRANULAR MATERIALS AND CEMENT REQUIREMENTS, ON DESIGN AND PERFORMANCE OF EXPERIMENTAL PROJECTS, ON STRUCTURAL PROPERTIES, ON CONSTRUCTION METHODS USED FOR FINE-GRADING, AND ON PERFORMANCE OF PROJECTS IN SERVICE.

Kawala, EL *Am Soc Civil Engr J Highway Div* Oct. 1966

3A 205471

LAYERED SYSTEM DESIGN AS APPLIED TO CONCRETE PAVEMENTS

CONCRETE PAVEMENT PRECONDITIONED AND PRESTRESSED LAYERED SYSTEM PERFORMANCES UNDER WHEEL LOADS ARE PREDETERMINED NOT ONLY BY THE STRENGTH PROPERTIES INCORPORATED IN THE LAYERS BY CONSTRUCTION PROCEDURES, BUT MORE IMPORTANTLY BY THE CONFINING INFLUENCES OF THE RIGID CONCRETE LAYER ON THE OTHER LAYERS AND BY THE SHEARING CONTINUITY INCORPORATED BETWEEN LAYERS. THE FUNDAMENTAL PERFORMANCE CHARACTERISTICS OF CONCRETE PAVEMENT SYSTEMS ARE TREATED IN DETAIL IN ORDER TO PROVIDE ESSENTIAL BASES FOR UNDERSTANDING AND JUDGEMENTS REGARDING THE EFFECTIVENESS OF /1/ THE REINFORCING ACTION AND LOAD SPREADING CAPACITY, /2/ THE STRESS REDUCING INFLUENCE OF THE PAVEMENT SYSTEM ON THE VERTICAL STRESSES IMPOSED IN THE SUPPORTING SUBGRADE, AND /3/ THE CAPACITY OF CONCRETE PAVEMENT SYSTEMS TO RESIST TENSILE STRESSES AND SHEAR STRESSES IN REGIONS WHICH ARE VULNERABLE TO BREAKDOWN BY BENDING AND SHEAR DEFORMATIONS. THE PRINCIPAL PROBLEMS OF DESIGN AND CONSTRUCTION OF CONCRETE PAVEMENT SYSTEMS ARE /1/ TO LIMIT ACCUMULATED PAVEMENT SETTLEMENTS, /2/ TO ENSURE THE PAVEMENT STRUCTURE AGAINST CRACKING AND BREAKDOWN, AND /3/ TO INCREASE THE LIFE OF THE PAVEMENT STRUCTURE. DESIGN OF MULTI-LAYER CONCRETE PAVEMENT SYSTEMS TO SATISFY THESE REQUIREMENTS INVOLVE THE DETERMINATION OF THE NUMBER OF LAYERS, THE DETERMINATION OF THEIR TENSILE STRENGTHS, SHEAR STRENGTHS AND E-VALUES, AND THE EVALUATION OF THICKNESS REQUIREMENTS FOR THESE LAYERS. THE PROBLEMS OF DESIGN AND CONSTRUCTION TO MEET THESE REQUIREMENTS ARE TREATED AND ILLUSTRATED. RECOMMENDATIONS ARE MADE FOR CONSTRUCTION METHODS AND PROCEDURE SEQUENCE TO ATTAIN SATISFACTORY PERFORMANCES AND LONG LIFE OF CONCRETE PAVEMENTS.

Burmister, DM
New Mexico University 1963

3A 205497

ASPHALT PAVEMENT ENGINEERING

COMPLETE INFORMATION IS GIVEN ON ALL TYPES OF ASPHALT PAVEMENTS INCLUDING THE LATEST DESIGN CRITERIA AND CONSTRUCTION METHODS SO THAT THE READER WILL BE ABLE TO DESIGN AN ASPHALT PAVEMENT FOR ANY LOADING OR TRAFFIC SITUATION. THE MOST RECENT RECOMMENDATIONS OF THE NATIONAL ASPHALT PAVEMENT ASSOCIATION, THE ASPHALT INSTITUTE, AND STATE HIGH-

WAY DEPARTMENTS ARE INCLUDED TO ASSIST THE READER IN MAKING DESIGN DECISIONS. SPECIAL FEATURES INCLUDE PERFORMANCE DATA AS RELATED TO PAVEMENT STRUCTURE THICKNESSES FOR A COMPLETE RANGE OF REPETITIVE LOADINGS, AN ECONOMICAL AND PROVEN METHOD OF EXTENDING THE USEFUL LIFE OF ASPHALTIC CONCRETE PAVEMENTS BY AN EMULSION OF OILS AND RESINS, AND A DISCUSSION OF THE EFFECT OF THE CHEMICAL COMPOSITION OF ASPHALT CEMENTS UPON QUALITY AND DURABILITY WHEN ANALYZED BY THE MALTENE DISTRIBUTION PARAMETER. THE BOOK DESCRIBES THE VARIOUS TYPES OF ASPHALT PAVEMENTS AND GIVES SPECIFICATIONS FOR THEM. IT DISCUSSES THE PRODUCTION GRADATION, AND QUALITY OF MINERAL AGGREGATES USED IN THE VARIOUS TYPES OF ASPHALT PAVEMENTS AND DESCRIBES THE NECESSARY PROPERTIES OF AN ASPHALT CONCRETE MIXTURE. IT DESCRIBES AND ILLUSTRATES IN DETAIL DESIGN PROCEDURES AND CONSTRUCTION METHODS FOR SPECIFIC PAVING SITUATIONS. MANY USEFUL TABLES AND A SERIES OF DESIGN PROBLEMS COVERING ALL TYPES OF ASPHALT PAVEMENTS ARE INCLUDED. /AUTHOR/

Wallace, HA Martin, JR
Mcgraw Hill Book Company 351 pp, 1967

3A 205502

LABORATORY TESTS WITH A HEAVY-DUTY ROLLING LOAD MACHINE

THIS PAPER DESCRIBES A HIGH-CAPACITY ROLLING LOAD TESTING MACHINE AND THE RESULTS OF TESTS PERFORMED WITH IT OVER THE LAST THREE YEARS AT WEST VIRGINIA UNIVERSITY. THE TESTING MACHINE IS BEING USED FOR THE EVALUATION OF BASECOURSE MATERIALS IN A SIMULATED HIGHWAY. CONSIDERABLE ECONOMY IN ROAD AND HIGHWAY CONSTRUCTION COULD BE REALIZED IN WEST VIRGINIA IF SOME CONSTRUCTION METHOD WERE DEvised THAT WOULD UTILIZE THE STATE'S ABUNDANT AND WELL-DISTRIBUTED SUPPLY OF SANDSTONE. THE BEST EVALUATION WOULD COME FROM HIGHWAYS CONSTRUCTED OF SUCH MATERIALS. AN EVALUATION EXPENSIVE IN BOTH TIME AND MONEY. A PROPERLY DESIGNED ROLLING LOAD TESTING MACHINE, ALONG WITH A CAREFULLY PLANNED TESTING PROGRAM, MIGHT REDUCE THE COST IN BOTH ASPECTS. OPINION AS TO THE USEFULNESS OF ROLLING LOAD MACHINES OR TEST TRACKS OVER THE PAST SEVERAL YEARS HAS BEEN DIVIDED. ONE MACHINE HAS BEEN ABANDONED WHILE ANOTHER VERY LARGE MACHINE HAS BEEN CONSTRUCTED RECENTLY AT WASHINGTON STATE UNIVERSITY. CIRCULAR TRACKS ARE IN USE AT THE UNIVERSITY OF ILLINOIS AND AT THE AMERICAN OIL COMPANY IN WHITING, INDIANA. /AUTHOR/

Haynes, RR Worrell, DT *Highway Research Record, Hwy Res Board*
1967

3A 205536

SURFACING COURSES-NORWAY

THIN WEARING COURSES ARE DISCUSSED AND DIVIDED INTO THREE GROUPS: (1) VERY THIN WEARING COURSES ACTING AS A KIND OF IMPROVED DUST-LAYER, (2) PERMANENT OR SEMI-PERMANENT WEARING COURSES, AND (3) TEMPORARY WEARING COURSES ON HEAVILY TRAFFICKED ROADS. MANY KINDS OF DUST-PREVENTING PROCEDURES WERE TRIED. ONE COMMON METHOD IS TO SPREAD A BITUMINOUS BINDER WITH THE AIM OF PENETRATING THE SURFACE AND BINDING THE DUST. THIS METHOD HAS OFTEN FAILED BECAUSE THE BINDER HAS NOT CREATED A CRUST STRONG ENOUGH TO STAND THE TRAFFIC. IT IS RECOMMENDED THAT THE BINDER CONTAIN AMINE AND THE GRAVEL MUST HAVE A SUITABLE GRADING CURVE INCLUDING A WANTED AMOUNT OF FILLER, RESULTING IN A DENSE, DURABLE CRUST OR CARPET. AN EXPERIMENTAL ROAD WAS CONSTRUCTED TO ATTEMPT TO DETERMINE A CONSTRUCTION METHOD TO SECURE THE CONSTANT, PROJECTED QUANTITY OF BINDER

AND MINERAL AGGREGATES ON EACH SQUARE FEET. THE PERMANENT WEARING COURSES COMPRISED SURFACE COURSES OF A THICKNESS FROM ABOUT 2.5 TO 4 CM. THE BASE MUST HAVE SUFFICIENT BEARING CAPACITY AND CONSIST OF EITHER GRAVEL OR CRUSHED ROCK, MECHANICALLY STABILIZED. TEMPORARY WEARING COURSES ARE THIN-AROUND 3.5 CM THICKNESS. THIS WAS PLACED ON A BASE WHOSE UPPER LAYER CONSISTED OF ASPHALT STABILIZED CRUSHED ROCK, EITHER PENETRATED OR CENTRAL MIXED, AND A THIN LAYER OF LEAN ASPHALT CONCRETE. STAGE CONSTRUCTION IS DISCUSSED BECAUSE OF THE NECESSITY CAUSED BY INCREASING TRAFFIC AND AXLE-LOADS.

Brudal, H *Perm Intl Assoc Road Congresses Proc* 1967

3A 205543

RIGID PAVEMENTS-GREAT BRITAIN

IMPROVED TECHNIQUES FOR USING THE SLIP-FORM PAVER AND CONVENTIONAL PAVING TRAINS ARE DISCUSSED. THE PROTECTION OF THE SUB-GRADE FROM CONSTRUCTIONAL LOADS AND FROM MOISTURE PENETRATION IS USUALLY PROVIDED BY A SUB-BASE OF EITHER A GRANULAR MATERIAL OR LEAN CONCRETE, BUT CEMENT STABILIZED MATERIALS ARE ALSO USED. THE NECESSARY THICKNESS OF THE SUB-BASE IS RELATED TO THE TYPE OF SUB-GRADE, THE SUB-BASE MATERIAL, AND THE WEIGHT OF THE CONSTRUCTIONAL TRAFFIC. GREATER ACCURACY IS NOW ACHIEVED IN THE SHAPING OF THE SUB-BASE BY LAYING THE SUB-BASE MATERIAL WITH WIRE-GUIDED MACHINES AND THIS ACCURACY LEADS TO A REDUCTION IN THE WASTED CONCRETE NEEDED TO MAKE UP IRREGULARITIES IN THE SUB-BASE. THE EMPIRICAL METHOD OF PAVEMENT DESIGN CONTINUES TO BE USED. WITH LITTLE CHANGE IN THE REQUIRED JOINT SPACINGS, JOINT ASSEMBLIES HAVE NOW BEEN DEVELOPED WHICH CAN RAPIDLY SET ACCURATELY AND RIGIDLY. EXPERIMENTAL WORK IS BEING CONDUCTED ON TEMPERATURE VARIATIONS IN CONCRETE SLABS. OBSERVATIONS ARE CONTINUED ON THE EXPERIMENTAL PRESTRESSED CONCRETE ROADS AT WINTHORPE. ESTABLISHED METHODS OF MIX DESIGN USED ARE EMPIRICAL AND TRIAL MIXES ARE USUALLY MADE TO DETERMINE THE MOST SATISFACTORY MIX TO BE USED. THE SURFACE TEXTURE OF A CONCRETE ROAD IS APPLIED BY BRUSHING THE SURFACE IN A TRANSVERSE DIRECTION AND TESTS HAVE BEEN DEVELOPED WHICH MAKE IT POSSIBLE TO ASSESS THE SKIDDING RESISTANCE PROPERTIES OF THE APPLIED TEXTURE. A RE-ASSESSMENT IS BEING MADE OF CONSTRUCTION TECHNIQUES USED ON MINOR ROADS. AIR ENTRAINING AGENTS ARE USED TO PROVIDE RESISTANCE TO FROST AND DE-ICING SALT.

Sharp, DR *Perm Intl Assoc Road Congresses Proc* 1967

3A 205544

CONCRETE SLABS AND USE OF ADMIXTURES TO IMPROVE THE QUALITY OF CONCRETE-ITALY

THE THICKNESS OF CONCRETE SURFACINGS IS VARIABLE IN ITALY, VARYING FROM 15 TO 22 CM. REINFORCEMENT STUDIES ARE BEING CONDUCTED TO INCREASE THE RESISTANCE OF CONCRETE IN BENDING AND IN TENSION. LABORATORY TESTS ARE USED IN RESEARCHING THE EFFECT OF THE ADDITION OF THIN STEEL PIANO WIRES. EXPERIMENTAL PAVEMENT SECTIONS HAVE BEEN CONSTRUCTED WITH REINFORCEMENT CONSISTING OF METALLIC MESH. THE FUNCTION OF THE MESH IS TO PREVENT THE ENLARGEMENT OF CRACKS WHICH COULD BE FORMED AT THE SURFACE. TRANSVERSE JOINTS WERE CONSTRUCTED BY INSERTING A THIN PLANK OF TIMBER INTO THE CONCRETE. AFTER THE PASSAGE OF THE FINISHER THE UPPER LAYER OF THE CONCRETE IS CUT AND THE PLANK IS REMOVED. CONCRETE SLABS AFFECTED BY THERMAL ATMOSPHERIC VARIATIONS ARE SUBJECTED TO EXPANSIONS AND CONTRACTIONS. DISPLACEMENT OF THE ARRISES RESULTS FROM THOSE WHICH ARE NOT CONCORDANT. THE MATERIAL FOR FILLING THE

JOINTS MUST BE WATERTIGHT TO PREVENT THE INFILTRATION OF WATER. MASTICS FROM TAR PITCH AND A CERTAIN QUANTITY OF ASBESTOS FIBRE ARE USED ON AIRPORT RUNWAYS AND ARE RESISTANT TO THE ACTION OF FUELS. SYSTEMATIC STUDIES OF THE VARIATION OF TEMPERATURE WITHIN THE CONCRETE SLABS WERE CONDUCTED WITH THERMAL ELECTRIC PROBES. GRAPHS SHOW THESE VARIATIONS AND THE PROGRESSIVENESS OF THE INCREASE OF TEMPERATURE IN PROPORTION TO THE REDUCTION IN THICKNESS OF THE SLAB, AS WELL AS THE INFLUENCE OF THE SURFACE. THE ADDITION OF SYNOPAL TO BITUMINIZED HIGHWAYS IS RECOMMENDED FOR BETTER VISIBILITY. EXPERIMENTAL WORK IS CONDUCTED ON PRESTRESSED SLABS TO ELIMINATE TRANSVERSE JOINTS. THE USE OF ENTRAINMENT AGENTS TO INCREASE THE RESISTANCE OF CONCRETE TO THE ACTION OF FREEZING AND THAWING IS DISCUSSED. ADDITIVES WHICH ACT AS PLASTICIZERS THEREBY INCREASING MECHANICAL STRENGTH OR PREVENTING ITS REDUCTION AND SET RETARDERS ARE ANALYZED.

Ariano, R *Perm Intl Assoc Road Congresses Proc* 1967

3A 205563

DEVELOPMENTS IN THE APPLICATION IN PRACTICE OF A FUNDAMENTAL PROCEDURE FOR THE DESIGN OF FLEXIBLE PAVEMENTS

THE EVALUATION OF EXISTING PAVEMENTS AND THE DESIGN OF AIRFIELD PAVEMENTS ARE BRIEFLY DISCUSSED FROM THE POINT OF VIEW OF A FUNDAMENTAL DESIGN APPROACH. THE DEVELOPMENT AND THE VALIDITY OF THE APPROACH ARE DISCUSSED IN THE LIGHT OF SUBSEQUENT LABORATORY AND FIELD INVESTIGATIONS. A NEW COMPUTER PROGRAM WHICH GIVES THE PRINCIPAL STRESSES AND STRAINS AT ANY POINT WITHIN A MULTI-LAYER ELASTIC SYSTEM PERMITS CONSIDERATION TO BE GIVEN TO THE INFLUENCE OF MULTI-WHEEL ASSEMBLIES AND TO THE SHEAR STRESSES IN THE VARIOUS STRUCTURAL LAYERS UNDER LOAD. TRENDS, DEDUCED USING ELASTIC THEORY, FOR SURFACE DEFLECTIONS AND THE STRESS DISTRIBUTION IN COMPOSITE CONSTRUCTIONS (INCORPORATING CEMENT BOUND BASE LAYERS) ARE BRIEFLY DISCUSSED. THE FUNDAMENTAL DESIGN APPROACH IS DEFINED AS A PROCEDURE IN WHICH THE THEORETICAL STRESS DISTRIBUTION IN ELASTIC LAYERED SYSTEMS AND THE IN-SITU DYNAMIC PROPERTIES OF THE CONSTRUCTION MATERIALS ARE APPLIED TO THE DESIGN OF PRACTICAL ROAD STRUCTURES. THE DESIGN OF A STRUCTURE IS CARRIED OUT BY SELECTING SUITABLE THICKNESSES OF ASPHALT AND UNBOUND GRANULAR MATERIALS SO THAT, UNDER THE DESIGN LOAD, THE CRITICAL STRESSES OR STRAINS DO NOT EXCEED PERMISSIBLE VALUES FOR THE DIFFERENT MATERIALS. THE IN SITU DYNAMIC MODULI OF THE CONSTRUCTION MATERIALS, AND THE STRESSES OR STRAINS THAT CAN BE PERMITTED TO DEVELOP WITHIN THEM MUST BE KNOWN IN ORDER TO DO THIS. DISCUSSIONS ARE PRESENTED ON DESIGN CURVES FOR SPECIFIED LIFE OF MIXED TRAFFIC LOADINGS, APPLICABILITY OF ELASTIC THEORY TO ROAD BEHAVIOR AND GENERAL COMMENTS ON DESIGN. THE DISCUSSIONS PRESENTED ON A VARIETY OF ASPECTS OF FLEXIBLE PAVEMENT DESIGN SERVE TO ILLUSTRATE THE COMPLEXITY OF THE PROBLEMS WHICH REMAIN TO BE OVERCOME. THE ELASTIC THEORY EMPLOYED DOES NOT WHOLLY REPRESENT THE BEHAVIOR OF THE MATERIALS USED, YET IT PERMITS RATIONAL GUIDELINES TO BE DEVELOPED. MODIFICATIONS ARE NEEDED CONCERNED WITH THE MAXIMUM SHEAR STRESSES DEVELOPED AT ANY POINT IN THE STRUCTURE. THE MINIMUM SHEAR STRENGTH THEORETICALLY REQUIRED AT ANY POINT IN THE UNBOUND GRANULAR LAYERS CAN NOW BE CALCULATED AND DESIGN CURVES SHOULD BE EXTENDED TO COVER THIS ASPECT.

Dormon, GM Edwards, JM *Intl Conf Struct Design Asphalt Pvmts* Aug. 1967

3A 205573

A SIMPLE GUIDE FOR THE DESIGN OF FLEXIBLE PAVEMENTS USING CRUSHED STONE

FLEXIBLE PAVEMENT DESIGN MUST CONSIDER THE FOLLOWING THREE ELEMENTS: (1) THE FOUNDATION, EITHER A FIRM, UNYIELDING SUBBASE OR A STABILIZED OR OTHERWISE IMPROVED SUBGRADE, (2) THE BASE WHOSE FUNCTION IS TO TRANSMIT AND CUSHION WHEEL LOAD STRESSES TO AN EXTENT THAT THE FOUNDATION AND SUBGRADE ARE NOT OVERSTRESSED, AND (3) THE BITUMINOUS MAT, A COMBINATION OF LAYERS OF AGGREGATES AND BITUMINOUS BINDERS WHOSE FUNCTION IS TO RESIST ABRASION, TANGENTIAL STRESSES FROM ACCELERATION AND DECELERATION, AND THE INFILTRATION OF MOISTURE. EMPHASIS IN THE DISCUSSION IS LAID ON THE ADVANTAGES AND THE PROPER USE OF DENSE GRADED CRUSHED STONE FOR THE FOUNDATION AND BASE COURSES. IT IS EMPHASIZED THAT THE GRADING SHOULD BE UNIFORM AND CONTINUOUS FROM THE MAXIMUM SIZE DOWN TO AND INCLUDING THE DUST OF FRACTURE. THE MAXIMUM SIZE OF AGGREGATE SHOULD BE THE LARGEST THAT CAN BE HANDLED WITHOUT SEGREGATION. THE PLASTICITY INDEX SHOULD BE KEPT AS LOW AS POSSIBLE. NON-PLASTIC FINES ARE SHOWN TO BE THE BEST. THE AGGREGATE SHOULD BE COMPACTED TO THE MAXIMUM DENSITY OBTAINABLE AND SHOULD CONSIST OF CRUSHED STONE THROUGHOUT THE SIZE RANGE TO ASSURE THE HIGHEST STRENGTH AND GREATEST RIGIDITY. THE IMPORTANCE OF ACHIEVING THE MAXIMUM DENSITY PRACTICABLE FOR THE GRADING SELECTED FOR THE JOB IS EMPHASIZED. THE CHOICE OF THE TYPE AND THICKNESS OF THE BITUMINOUS MAT DEPENDS UPON A NUMBER OF FACTORS. FOR RURAL HIGHWAYS AND LOCATIONS WHERE TRAFFIC VOLUMES ARE APT TO BE LIGHT, ADVANTAGE MAY BE GAINED THROUGH THE USE OF STAGE CONSTRUCTION, BY WHICH A TEMPORARY OR SEMI-PERMANENT WEARING SURFACE IS APPLIED AS PART OF INITIAL CONSTRUCTION, AND A FINAL SURFACING IS PROGRAMMED FOR LATER APPLICATION. A BITUMINOUS CONCRETE MAT IS NEEDED WHEN HEAVIER TRAFFIC IS EXPECTED AND WHERE SUPERIOR RIDING QUALITY IS DEEMED ESSENTIAL. ON A BASE AND FOUNDATION CONSTRUCTED FOR HEAVY TRAFFIC, A THICKNESS OF BITUMINOUS CONCRETE OF FROM 4 TO 6 INCHES IS HIGHLY RECOMMENDED. THICKNESS DESIGN OF THE BASE AND BITUMINOUS MAT IS DISCUSSED.

Nichols, FP
National Crushed Stone Association Mar. 1968

3A 205621

PRESTRESSED ROAD SECTION IN A PROVINCIAL HIGHWAY /IN DUTCH/

THE CONSTRUCTION OF AN EXPERIMENTAL PRESTRESSED ROAD SECTION, 360 M. IN LENGTH, IS DESCRIBED. A SPECIAL JOINT STRUCTURE, HAVING A BOTTOM SLAB WITH A RAISED RIDGE, WAS USED. THE PRESTRESSED SLABS, 120 M. LONG AND 15 CM. THICK SAND WITH A SLIDING LAYER OF ROAD PAPER AND PLASTIC FOIL. CABLES OF 1/2 IN. DIAMETER, SPACED 30 CM. APART IN CHANNELS 20 MM. WIDE, WERE PRESTRESSED BY MEANS OF A SPECIALLY SHAPED JACK. THE USE OF PRE-FABRICATED CONCRETE HEAD-BEAMS PERMITTED THE APPLICATION OF AN INITIAL STRESS OF 70 TO 80 KG PER SQ. CM. AS EARLY AS 24 HOURS AFTER THE SLAB CONCRETE HAD BEEN POURED. ABOUT A MONTH LATER THE FINAL STRESS OF 130 KG PER SQ. CM. WAS ATTAINED, AND THE RIDGES ON THE BOTTOM SLABS WERE THEN CONSTRUCTED. THE JOINTS WERE SEALED WITH PREFORMED RUBBER STRIP. /SWOV/ PREFORMED RUBBER STRIP. /SWOV/

Cement, Amsterdam /Neth/ Sept. 1968

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 205660

CONSTRUCTION OF AN EXPERIMENTAL PRESTRESSED CONCRETE ROAD IN BELGIUM /IN DUTCH/

A PRESTRESSED CONCRETE ROAD, 440 M. IN LENGTH, WAS BUILT FOR THE STUDY OF CONSTRUCTIONAL PROBLEMS. PART OF THE COARSE AGGREGATE WAS REPLACED BY AN ARTIFICIAL LIGHT-WEIGHT MATERIAL IN ORDER TO REDUCE THE ELASTIC MODULUS OF THE CONCRETE AND THE VARIATIONS IN STRESS DUE TO CREEP AND SHRINKAGE. THE PAVEMENT WAS BUILT BETWEEN TWO REINFORCED CONCRETE ANCHORAGE SYSTEMS. THREE TRANSVERSE JOINTS WERE CONSTRUCTED: TWO OF THEM FOR PRETENSIONING BY MEANS OF SCREW-JACKS, THE THIRD ONE BEING A MEASURING JOINT. TWO LAYERS OF SHEET-PLASTIC WERE USED AS A SLIDING LAYER BETWEEN THE SLAB AND THE BASE. TEMPERATURE AND STRESS MEASUREMENTS WERE CARRIED OUT DURING CONSTRUCTION AND DURING FOUR YEARS AFTER CONSTRUCTION. /TRRL/

Huijghe, G *Wegen /Netherlands/* Vol. 44 No. 11, Nov. 1970, pp 292-98, 5 Fig, 1 Tab, 5 Phot, 3 Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 205685

PAVEMENT OVERLAYS USING POLYESTER RESIN AND ASPHALT LAMINATES

LAMINATED RESIN AND ASPHALT OVERLAYS ARE DURABLE COATINGS UNDER HEAVY VEHICLES AND WHERE SURFACE TEXTURES ARE REQUIRED. BOTH LARGE AND SMALL PARTICLES CAN BE HELD FIRMLY IN PLACE AGAINST TRAFFIC ABUSE. RUMBLE STRIP DURABILITY SHOWS IMPROVEMENT OVER THE USE OF ASPHALT ALONE. FOR THE MOST PART CONVENTIONAL EQUIPMENT AND PROCEDURES SUFFICE FOR CONSTRUCTING THESE NEW SYSTEMS. ALTHOUGH A SPRAY RIG IS NEEDED, COMPONENTS ARE COMMERCIALY AVAILABLE. ALL OF THE EQUIPMENT USED IS PORTABLE, INDEPENDENT OF LARGE CENTRAL PLANTS, AND MAY BE APPLIED IN REMOTE AREAS. INSTALLATION COSTS, THEN, ARE MINIMUM. WHILE THE INITIAL COSTS OF RESINS IS HIGH COMPARED WITH THOSE OF CEMENT AND ASPHALT, THEY HAVE DESIRABLE PROPERTIES THAT NEITHER OF THESE OTHER MATERIALS POSSESS.

Schmidt, RJ Percival, DF Hein, TC *Highway Research Board Bulletin* 1961

3A 205694

FULL-SCALE ASPHALTIC CONSTRUCTION IN THE RESEARCH LABORATORY

THE BROAD GAP BETWEEN RESEARCH ON ASPHALTIC CONCRETE SPECIMENS PREPARED IN LABORATORY BENCH-TYPE EQUIPMENT AND TEST ROADS OR PUBLIC HIGHWAYS HAS BEEN NARROWED BY PROVIDING FULL-SCALE PAVING EQUIPMENT IN A RESEARCH FACILITY. THIS FACILITY PERMITS ASPHALTIC CONCRETE PAVEMENT CONSTRUCTION UNDER CONDITIONS OF CONTROL WHICH CANNOT BE REACHED IN FIELD OPERATIONS. THE USE OF THIS EQUIPMENT IS DESCRIBED. CONTROLS FOR ALL MAJOR CONSTRUCTION VARIABLES ARE DESCRIBED AND SPECIAL TECHNIQUES ARE DETAILED WHERE APPROPRIATE. METHODS INCLUDE: LARGE-SCALE AGGREGATE HANDLING, SCREENING AND GRADATION BLENDING TO LABORATORY TOLERANCES, REALISTIC DRYING AND MIXING, WITH CLOSE TEMPERATURE CONTROLS, ACCURATE MEASUREMENT AND RECORDING OF HOT-MIX TEMPERATURES THROUGHOUT THE MIXING, PLACING, AND ROLLING CYCLE, CONTROLLED STEEL- AND RUBBER-WHEELED COMPACTION, AND SAMPLING TECHNIQUES FOR EVALUATION TESTS. /AUTHOR/

Schmidt, RJ *Highway Research Board Bulletin* 1960

3A 205731

DESIGN OF PAVEMENTS USING DEFLECTION EQUATIONS FROM AASHO ROAD TEST RESULTS

THE STRUCTURAL PERFORMANCE WAS INVESTIGATED OF SOME SATELLITE PAVEMENTS IN THE PIEDMONT REGION OF VIRGINIA AND THICKNESS EQUIVALENCY VALUES WERE EVALUATED OF MATERIALS USED ON THE BASIS OF AASHO ROAD TEST RESULTS. MODEL EQUATIONS SUGGESTED BY THE AASHO ROAD TEST COMMITTEE FOR DESIGNING PAVEMENTS INVOLVE VARIABLES WHICH COULD NOT BE APPLIED TO VIRGINIA BECAUSE OF DIFFERENCES IN: (1) CONSTRUCTION TECHNIQUES, (2) TYPE OF MATERIALS USED, (3) SUBGRADE PROPERTIES, (4) ENVIRONMENTAL CONDITIONS, (5) TYPE AND DURATION OF TRAFFIC, AND (6) AGE OF PAVEMENT. TWENTY PROJECTS WITH VARYING PAVEMENT STRUCTURES WERE CHOSEN FOR STUDY TO EVALUATE THE THICKNESS EQUIVALENCY VALUES OF THE DIFFERENT MATERIALS IN THE PAVEMENTS' SYSTEMS, AND TO CORRELATE THESE VALUES WITH THE PAVEMENT PERFORMANCE ALONG WITH THE VARIABLES OF SOIL SUPPORT, TRAFFIC, AND AGE. CONCLUSIONS OF THE INVESTIGATION INDICATE THAT: (1) THE STRUCTURAL PERFORMANCE OF THE PAVEMENTS CAN BE EVALUATED FROM REBOUND DEFLECTION OR CURVATURE, OR LONGITUDINAL CROSS-SECTIONAL AREA OF THE DEFLECTED BASIN, OBTAINED FROM THE BENKELMAN BEAM DATA. (2) SUBGRADE SOIL STRENGTH, WHEN DETERMINED BY THE VIRGINIA CBR METHOD CANNOT BE CORRELATED WITH SUBGRADE SOIL SUPPORT VALUES GIVEN BY THE AASHO COMMITTEE, (3) ASSUMING THICKNESS EQUIVALENCY VALUE OF ASPHALTIC CONCRETE AS EQUAL TO 1.0, THICKNESS EQUIVALENCY VALUES COULD BE CONSIDERED FOR DESIGN IN VIRGINIA WITH THE LAYERS PLACED IN THE ORDER DESCRIBED, (4) THE TOLERABLE DEFLECTION OF A PAVEMENT IS A FUNCTION OF ITS RIGIDITY, AND (5) THE METHOD USED IN VIRGINIA IS SUITABLE FOR DESIGN BUT COULD BE MADE MORE FLEXIBLE USING A NOMOGRAPH FOR THICKNESS INDEX DETERMINATION AND A DESIGN BASED ON THICKNESS EQUIVALENCY VALUES.

Vaswani, NK *Highway Research Record, Hwy Res Board* 1968

3A 205772

OPTIMAL DESIGN OF FLEXIBLE PAVEMENT SECTIONS

A SYSTEMS ANALYSIS WAS CONDUCTED TO DEVELOP A RATIONAL METHOD FOR THE OPTIMAL DESIGN OF FLEXIBLE PAVEMENT SECTIONS. THE OPTIMAL COMBINATION OF FLEXIBLE PAVEMENT COMPONENTS MUST MINIMIZE THE TOTAL IN-PLACE COST OF THE PAVEMENT SYSTEM. A DESIGN MODEL WAS CONSTRUCTED CONSISTING OF AN OBJECTIVE FUNCTION AND VARIOUS CONSTRAINT EQUATIONS. THE TOTAL PAVEMENT SYSTEM IS DESCRIBED BY THE VARIOUS DESIGN PARAMETERS WHICH REPRESENT TRAFFIC CONDITIONS, SOIL SUPPORT VALUES, PAVEMENT MATERIAL CHARACTERISTICS, ENVIRONMENTAL EFFECTS, AND PAVEMENT PERFORMANCE REQUIREMENTS. UNIT COSTS OF PAVEMENT COMPONENTS AND ALTERNATE CROSS-SECTION DESIGNS ARE CONSIDERED IN THE SELECTION OF THE OPTIMUM FLEXIBLE PAVEMENT SECTION. THE TOTAL COST OF THE PAVEMENT SYSTEM IS QUANTITATIVELY DESCRIBED BY THE OBJECTIVE FUNCTION, AND THE MINIMUM-COST SOLUTION IS OBTAINED FOR EACH COMBINATION OF MATERIAL COSTS AND DESIGN CONDITIONS. THE MATHEMATICAL DESIGN MODEL WAS SOLVED BY A MODIFIED LINEAR PROGRAMMING TECHNIQUE. THE DESIGN PROCEDURE SPECIFIES A MINIMUM PAVEMENT THICKNESS TO ACCOUNT FOR VARIOUS INFLUENCING ENVIRONMENTAL CONDITIONS. IN ADDITION TO THE TRAFFIC LOADING, SOIL SUPPORT, PAVEMENT PERFORMANCE, AND ENVIRONMENT CONSTRAINTS, PRACTICAL LIMITATIONS ON LAYER THICKNESSES ARE SPECIFIED IN CONCURRENCE WITH PRESENT HIGHWAY CONSTRUCTION PRACTICES. THE UNIT COSTS OF THE PAVEMENT COMPONENTS ARE SPECIFIED TO PERMIT THE DESIGN OF AN ACCEPTABLE STRUCTURE FOR THE LEAST COST. THIS COST-EFFECTIVENESS APPROACH SEEMS TO PROVIDE BOTH

AN OPTIMAL AND A PRACTICAL SOLUTION TO THE PROBLEM OF FLEXIBLE PAVEMENT DESIGN.

Hejal, SS Yoder, SR Oppenlander, JC
Purdue & Ind State Hwy Comm Jhrp Sept. 1969

3A 205797

USE OF EXCESS FINE AGGREGATE IN CONCRETE PAVEMENTS

THE USE OF FINE GRADED AGGREGATES IN RELATIVELY LARGE PROPORTIONS FOR CONCRETE PAVEMENTS IS DISCUSSED, PRIMARILY AS TO THE MATERIALS, CONSTRUCTION METHODS, COSTS AND SERVICEABILITY OF THIS TYPE OF ROADWAY SURFACING. INFORMATION IS GIVEN ON SUCH SURFACINGS CONSTRUCTED IN FLORIDA, KANSAS, KENTUCKY AND IOWA. THIS INCLUDES GRADATIONS, COMPOSITION, AND CONSTRUCTION METHODS.

Conner, CN Crum, RW DISCUSSEER *Highway Research Board Proceedings* 1928

3A 205854

EXPERIMENTAL VERIFICATION OF DISCRETE-ELEMENT SOLUTIONS FOR PAVEMENT SLABS

THE VALIDITY OF ANY ANALYTICAL METHOD CAN BEST BE PROVED BY COMPARING ITS SOLUTIONS WITH ACTUAL TEST RESULTS. TO OBTAIN SPECIFIC TEST RESULTS FOR USE IN VERIFICATION OF THE DISCRETE-ELEMENT METHODS, A STUDY OF SMALL-DIMENSION SLAB-ON-FOUNDATION UNDER CONTROLLED CONDITIONS WAS CONDUCTED. AN INSTRUMENTED ALUMINUM SLAB 9 BY 9 BY 1/8 IN. WAS TESTED RESTING ON A SPECIALLY PREPARED SATURATED CLAY SUBGRADE UNDER 2 LOADING POSITIONS. PLATE-LOAD TESTS WERE PERFORMED TO DETERMINE LINEAR AND NON-LINEAR CHARACTERISTICS OF THE SOIL FOR REPRESENTING THE SUBGRADE ACCORDING TO THE WINKLER ASSUMPTION. THESE CHARACTERISTICS WERE ALSO DETERMINED FROM STRESS-STRAIN RELATIONS OF THE SOIL, OBTAINED FROM UNCONFINED COMPRESSION TESTS. A COMPARISON OF DISCRETE-ELEMENT SOLUTIONS AND EXPERIMENTAL RESULTS WAS MADE FOR DEFLECTIONS, PRINCIPAL STRESSES, AND STRESSES ALONG THE EDGE FOR DIFFERENT LOADS. THE TESTS CONFIRM THAT THE DISCRETE-ELEMENT SOLUTIONS CAN BE USED WITH CONFIDENCE TO OBTAIN SATISFACTORY SOLUTIONS FOR PAVEMENT SLABS. /AUTHOR/

Agarwal, SL Hudson, WR *Highway Research Record, Hwy Res Board* 1970

3A 205945

WARPING STRESSES IN SLABS ON REISSNER FOUNDATION
WARPING STRESSES HAVE BEEN EVALUATED IN CIRCULAR AND STRIP CONCRETE SLABS RESTING ON THE GROUND BY IDEALIZING THE FOUNDATION MEDIUM BY THE REISSNER FOUNDATION. LINEAR TEMPERATURE VARIATION WHICH INCREASES WITH DEPTH OF SLAB AND WHICH RESULTS IN PARTIAL SUPPORT OF THE SLABS HAS BEEN CONSIDERED. THE RESULTS FOR DEFLECTION AND MOMENT COEFFICIENTS HAVE BEEN PRESENTED FOR VARIOUS VALUES OF NON-DIMENSIONAL LENGTH A, LOAD COEFFICIENTS Q, AND RATIOS OF RELATIVE STIFFNESS TO SHEAR STIFFNESS. THE RESULTS INDICATE THAT THE SHAPE OF THE SLAB HAS INFLUENCE ON MAXIMUM STRESSES AND DEFLECTIONS UP TO A = 6. FURTHER, THE STRESSES IN SLABS ON THE REISSNER FOUNDATION ARE HIGHER THAN THE STRESSES IN THE SAME SLABS WHEN THEY ARE PLACED ON THE WINKLER FOUNDATION. /AUTHOR/

Reddy, AS Pranesh, MR *Am Soc Civil Engr J Transportation Eng* Aug. 1971

3A 206011

PRESTRESSED HIGHWAY PAVEMENT AT DULLES AIRPORT FOR TRANSP0 72

THE ADVANTAGES OF PRESTRESSED CONCRETE PAVEMENTS ARE DUE TO THE ELIMINATION OF PAVEMENT JOINTS AND

ATTENDANT PROBLEMS, AND TO COST SAVINGS DERIVED FROM REDUCED NEEDS FOR STEEL AND CONCRETE. A PROTOTYPE PAVEMENT, PLACED IN SIX LENGTHS THAT VARY FROM 400 TO 760 FEET, WILL PROVIDE USEFUL DESIGN AND CONSTRUCTION DATA FOR FUTURE FULL-SCALE HIGHWAY AND AIRPORT PAVEMENTS. PAVEMENT DETAILS AND STRESSING PROCEDURES FOR THE ACCESS ROAD AT DULLES AIRPORT ARE DESCRIBED. AN OUTLINE OF CONSTRUCTION PROCEDURES FOR A FULL-SCALE PROJECT IS GIVEN.

Pasko, TJ *Prestressed Concrete Institute Journal* Vol. 17 No. 2, Mar. 1972, pp 46-54, 9 Fig

3A 206026

EVALUATION OF SANDWICH LAYER SYSTEM OF FLEXIBLE PAVEMENTS IN VIRGINIA

THEORETICAL AND FIELD STUDIES HAVE BEEN CARRIED OUT TO DETERMINE HOW SANDWICHED LAYERS AFFECT THE DESIGN AND PERFORMANCE OF PAVEMENT SYSTEMS. IT HAS BEEN DETERMINED THAT A FLEXIBLE SANDWICHED LAYER CAN BE ECONOMICALLY USED IN A FOUR-LAYER SYSTEM BY PROVIDING AN OPTIMUM THICKNESS OF THE SANDWICHED MATERIAL. THE OPTIMUM THICKNESS AS DETERMINED IN THIS INVESTIGATION IS THE MINIMUM THICKNESS THAT WILL: (1) ACT AS A CUSHION TO PREVENT CRACKING IN THE SOIL CEMENT SUBBASE FROM REFLECTING TO THE SURFACE, AND (2) PERMIT COMPLIANCE WITH THE DENSITY SPECIFICATIONS. FOR CRUSHED STONE THIS THICKNESS IS 4". USE OF THIS THICKNESS SHOULD INCREASE PAVEMENT LIFE AND REDUCE CONSTRUCTION COSTS. IT HAS ALSO BEEN SHOWN THAT THE FOUR-LAYER SYSTEM PAVEMENTS CAN BE EVALUATED THROUGH ELASTIC LAYERED THEORY. A THREE-LAYER SANDWICH SYSTEM OF ECONOMICAL DESIGN, BASED ON TRAFFIC REQUIREMENTS IS RECOMMENDED FOR LOW TRAFFIC VOLUMES. IN THIS CASE IT HAS BEEN DETERMINED THAT THE OPTIMUM THICKNESS IS THAT WHICH WILL (1) PREVENT REFLECTION CRACKING THROUGH THE UNTREATED AGGREGATE FROM THE 6-INCH SOIL CEMENT LAYER, AND (2) SATISFY THE DENSITY SPECIFICATION. THESE REQUIREMENTS CAN BE MET WITH A 3" TO 4" LAYER OF CRUSHED STONE WITH A PRIME AND DOUBLE SEAL. THE EVALUATION OF THE FOUR-AND-THREE-LAYER SYSTEMS HAS SHOWN THAT THE STRAINS AND THE RESULTING PAVEMENT LIFE CAN BE PREDICTED FROM DYNAFLECT DEFLECTIONS. /AUTHOR/

Vaswani, NK
Virginia Highway Research Council Apr. 1972

3A 206091

SYMPOSIUM-TECHNOLOGY OF THICK LIFT CONSTRUCTION WITH DISCUSSION

THIS SYMPOSIUM ON THICK LIFT CONSTRUCTION IS DIVIDED INTO FOUR SECTIONS. THE FIRST SECTION--STRUCTURAL DESIGN CONSIDERATIONS--ILLUSTRATES EXISTING AND POTENTIAL PAVEMENT DESIGN (THICKNESS SELECTION) PROCEDURES FOR THICK LIFT ASPHALT CONCRETE SECTIONS RESTING DIRECTLY ON PREPARED SUBGRADES. IN ADDITION, A METHOD USING RECENT RESEARCH DEVELOPMENTS INTENDED TO BROADEN THE DESIGN FRAMEWORK FOR SUCH PAVEMENTS AND BASED ON CONCEPTS EMBODIED IN THE SHELL PROCEDURE IS ALSO BRIEFLY ILLUSTRATED. THE SECOND SECTION--MIX DESIGN CONSIDERATIONS--POINTS OUT THAT CONVENTIONAL MIX DESIGN PROCEDURES ARE GENERALLY SUITABLE FOR DESIGNING ASPHALT PAVING MIXTURES FOR THICK LIFT CONSTRUCTION. IT ALSO IS POINTED OUT THAT INFORMATION IS AVAILABLE ON HOW VARIOUS MIX DESIGN VARIABLES AFFECT THE BASIC MATERIAL PROPERTIES OF ASPHALT PAVING MIXTURES SUCH AS ELASTIC, FATIGUE, AND FRACTURE STRENGTH PROPERTIES. SECTION THREE--LABORATORY CONSIDERATIONS--DEALS PRIMARILY WITH THOSE METHODS UTILIZED TO OBTAIN THE MATERIAL PARAMETERS USED IN THE DESIGN PROCEDURES DISCUSSED IN THE FIRST SECTION. SECTION FOUR--CON-

STRUCTION METHODS--PRESENTS A CONTEMPORARY VIEW OF CONSTRUCTION METHODS AND PROCEDURES. A DISCUSSION IS INCLUDED WHICH DEALS WITH VARIOUS QUESTIONS ARISING FROM THIS SYMPOSIUM.

Monismith, CL Mclean, DB Kallas, BF Terrel, RL Marker, V Awad, IS *Assoc Asphalt Paving Technol Proc Proceedings* Vol. 41 Feb. 1972, pp 257-382, 68 Fig, 17 Tab, 111 Ref

3A 206140

MODERN CONCRETE ROADS IN BENELUX

AT THE ANNUAL MEETING OF THE RESEARCH CENTRE FOR ROAD CONSTRUCTION SCW ON 18 OCTOBER 1972 FOUR SPEECHES WERE DELIVERED. (1) MR. VAN DE FLIERT SPOKE ABOUT "TOPICAL PROBLEMS OF CONCRETE ROAD CONSTRUCTION IN THE NETHERLANDS". (2) MR. MAES DISCUSSED "DESIGN AND CONSTRUCTION OF CONCRETE ROADS IN BELGIUM". (3) MR. GREVELT GAVE SOME DETAILS ABOUT THE USE OF THE SLIPFORM PAVER IN BELGIUM, AND (4) MR. SIPKEMA, IN CONCLUSION, DEALT WITH THE STAGES OF EXECUTION: STABILIZATION OF THE ROADBASE, PLACING THE FORMWORK, LAYING THE BASECOURSE AND THE TOPCOURSE, AND FINISHING OF THE SURFACE. HE FINALLY MADE A COMPARISON BETWEEN THE CLASSICAL CONSTRUCTION METHOD AND THE METHOD USING A SLIPFORM PAVER.

Fliert, JD Maes, J Grevelt, E Siphkema, JS
Studiecentrum Wegenbouw /Neth/ Conf Paper 1972, pp 38-74, 6 Fig, 1 Tab

ACKNOWLEDGMENT: Transport & Road Res Lab /UK/IRRD 207 242, 2C25236245

3A 206189

PAST PERFORMANCE OF COMPOSITE PAVEMENTS

EXISTING EXPERIMENTAL COMPOSITE PAVEMENTS ARE REVIEWED. PERFORMANCE IS STUDIED IN RELATION TO DESIGN, CONSTRUCTION, TRAFFIC AND OTHER FACTORS. THE DESIGN FEATURES AND PERFORMANCE OVER THE FIRST THREE YEARS OF SUCH A PAVEMENT IN MILTON, ONTARIO ARE DESCRIBED. THIS PAVEMENT IS TWO MILES LONG IN THE WEST BOUND LANES OF A MAJOR FOUR LANE CONTROLLED ACCESS HIGHWAY.

Smith, P *Highway Research Record, Hwy Res Board* 1963

3A 206196

RIGID PAVEMENT CONDITION SURVEYS

THE TYPE OF RIGID PAVEMENT CONDITION SURVEY CHOSEN WILL DEPEND ON THE TYPE AND EXTENT OF THE INFORMATION NEEDED BY THE SURVEY USER. INFORMATION OF THE PROPER TYPE MAY BE USEFUL IN PAVEMENT DESIGN, MAINTENANCE SCHEDULING, HIGHWAY ADMINISTRATION, PREDICTION OF MAINTENANCE COSTS, AND THE DEVELOPMENT OF NEW METHODS AND MATERIALS FOR PAVEMENT CONSTRUCTION. SURVEY TYPES INCLUDE RECONNAISSANCE, RATING PANELS, STATISTICAL COUNTS OF THE NUMBER OF TIMES SOME PAVEMENT CHARACTERISTICS ARE OBSERVED, SEMI-DETAILED SURVEYS, DETAILED STRIP MAPS, PICTORIAL OR PHOTOGRAPHIC, USE OF SURFACE ROUGHNESS MEASURING DEVICES, AND DETAILED INVESTIGATIONS. MOST REASONABLY COMPLETE SURVEYS OF PORTLAND CEMENT CONCRETE PAVEMENTS WOULD INCLUDE SOME MEASURE OF SURFACE ROUGHNESS, SKID RESISTANCE, DURABILITY, ADEQUACY OF ANY SPECIAL DESIGN FEATURES AND AN INDICATION OF THE DESIGN'S STRUCTURAL ADEQUACY UNDER CURRENT TRAFFIC CONDITIONS. GENERAL CONDITION SURVEYS MAY LOCATE CONDITIONS REQUIRING MORE DETAILED STUDY. THE CONDITION STUDY IS AN IMPORTANT TOOL FOR EVALUATING DESIGN, CONSTRUCTION TECHNIQUES AND MATERIALS.

Teske, WE *Highway Research Record, Hwy Res Board* 1963

3A 206209

BEHAVIOR OF EXPERIMENTAL CONTINUOUSLY-REINFORCED CONCRETE PAVEMENTS IN MISSISSIPPI

THE FIRST TWO CONTINUOUSLY-REINFORCED CONCRETE PAVEMENTS CONSTRUCTED BY THE MISSISSIPPI STATE HIGHWAY DEPARTMENT HAVE BEEN DESIGNATED AS EXPERIMENTAL SECTIONS. THESE PAVEMENTS CONTAIN SEVERAL DESIGN FEATURES WHICH ARE RELATIVELY NEW IN THIS TYPE OF CONSTRUCTION. THIS PAPER DESCRIBES THE PERFORMANCE OF THE PAVEMENTS. A BRIEF DESCRIPTION OF THE DESIGN FEATURES AND THE CONSTRUCTION METHODS USED FOR BOTH PAVEMENT IS PRESENTED. LONGDITUDINAL MOVEMENTS OF THE PAVEMENT HAVE BEEN MEASURED PERIODICALLY, AS HAVE CRACK WIDTH CHANGES. CRACK SURVEYS HAVE BEEN PERFORMED, PARTICULARLY IN THE EARLY WEEKS AFTER CONSTRUCTION. DATA ON END MOVEMENTS, CRACK WIDTHS, AND CRACK FREQUENCY AND METHODS USED FOR OBTAINING THE DATA ARE PRESENTED AND DISCUSSED. IT IS BELIEVED THAT THE MISSISSIPPI PAVEMENTS ARE THE FIRST TO BE PLACED ON A SOIL-CEMENT BASE, AND IN DE SOTO COUNTY, THE FIRST TO USE CONCRETE PILES AS A MEANS OF END ANCHORAGE.

Spigolon, SJ *Highway Research Record, Hwy Res Board* 1964

3A 206214

EVALUATION OF PAVEMENT PERFORMANCE RELATED TO DESIGN, CONSTRUCTION, MAINTENANCE AND OPERATION THIS PAPER PRESENTS A SUMMARY OF THE FINDINGS OF THE MICHIGAN PAVEMENT PERFORMANCE STUDY, A FIVE-YEAR PROGRAM /1958-1963/ TO EVALUATE PAVEMENT PERFORMANCE FROM FIELD SURVEYS OF EXISTING PAVEMENTS. IN THE FIVE-YEAR PERIOD, EQUIPMENT AND PROCEDURES FOR RECORDING AND ANALYZING PAVEMENT PROFILES HAVE BEEN DEVELOPED AND PROFILES OF 10,000 MILES OF PAVEMENT HAVE BEEN ACCUMULATED. ALTHOUGH THERE HAVE BEEN SEVERAL PUBLISHED REPORTS OF THIS WORK AS IT PROGRESSED, THE FINAL RESULTS HAVE NOW BEEN COMPILED AND ANALYZED. THE QUANTITATIVE EVALUATION OF PAVEMENT CONDITION AND PERFORMANCE AND THE PHYSICAL INVENTORY OF EXISTING ROADS PROVIDE FACTUAL INFORMATION OF DIRECT VALUE IN DESIGN, CONSTRUCTION, AND MAINTENANCE OF BOTH RIGID AND FLEXIBLE PAVEMENT AND IN THE OPERATION OF THE STATE TRUNK-LINE SYSTEM AS A TRANSPORTATION FACILITY. THE FINDINGS OF THE FIVE-YEAR STUDY ARE REVIEWED, THE ADEQUACY OF MICHIGAN DESIGN STANDARDS IS EVALUATED, AND THE EFFECT ON PERFORMANCE OF CERTAIN CONSTRUCTION PRACTICES IS POINTED OUT. THE USE OF PAVEMENT PROFILE DATA IN MORE EFFECTIVE AND TIMELY MAINTENANCE AND THEIR VALUE IN THE OPERATION OF THE STATE HIGHWAY SYSTEM ARE DISCUSSED. /AUTHOR/

Housel, WS *Highway Research Record, Hwy Res Board* 1964

3A 206265

APPLICATION OF AASHO ROAD TEST RESULTS TO DESIGN OF FLEXIBLE PAVEMENTS IN MINNESOTA

THE PURPOSE OF THE STUDY IS TO OBTAIN DATA ON EXISTING PAVEMENTS THAT WILL LEAD TO THE ADAPTATION OF AASHO ROAD TEST CONCEPTS AND EQUATIONS FOR USE IN MINNESOTA. IN 1963 AND 1964, 50 REPRESENTATIVE PROJECTS LOCATED THROUGHOUT THE STATE WERE SELECTED FOR PRELIMINARY INVESTIGATION. A 1200- FOOT LONG BY ONE-LANE WIDE TEST SECTION WAS SELECTED IN EACH PROJECT FOR INTENSIVE STUDY. THE CONSTRUCTION HISTORY OF EACH PROJECT WAS STUDIED AND FIELD INSPECTIONS WERE MADE TO OBTAIN GENERAL INFORMATION ON THE PAVEMENT DESIGN AND CONDITION, ROADBED MATERIALS, DRAINAGE AND TOPOGRAPHY. IN THE 1200-FOOT TEST SECTIONS, BORINGS WERE MADE TO CHECK THE UNIFORMITY OF PAVEMENT STRUCTURE THICKNESSES AND ROADBED MATERIALS. INITIAL PSI VALUES WERE ESTABLISHED EITHER

BY ESTIMATION OR BY ROUGHOMETER MEASUREMENTS OBTAINED AT THE TIME OF CONSTRUCTION. PERIODIC ROUGHOMETER MEASUREMENTS ARE BEING MADE TO OBTAIN PSI VALUES FOR DETERMINING PERFORMANCE TRENDS. PERIODIC PLATE BEARING AND BENKELMAN BEAM TESTS ARE BEING MADE TO DETERMINE THE STRENGTHS OF THE VARIOUS PAVEMENT SYSTEM COMPONENTS. CLASSIFICATION TESTS OF ALL MATERIALS WERE MADE. STABILOMETER AND CBR TESTS WERE RUN ON ALL ROADBED MATERIALS AND ON SOME BASE AND SUBBASE MATERIALS. ASPHALT WAS EXTRACTED AND RECOVERED FROM THE ASPHALT CONCRETE, AND PENETRATION, SOFTENING POINT AND DUCTILITY TESTS WERE MADE ON THE RECOVERED ASPHALT. FLEXURAL BEAM, MODIFIED TENSION AND REPEATED LOAD TESTS ARE BEING MADE ON THE ASPHALT CONCRETE. TRAFFIC VOLUME, CLASSIFICATION AND WEIGHT DATA WERE COMPILED AND A PROCEDURE FOR DETERMINING TRAFFIC LOADINGS IN TERMS OF EQUIVALENT DAILY 18-KIP SINGLE -AXLE LOADS FOR EACH TEST SECTION WAS DEVELOPED.

Skok, EL Diethelm, PJ
Minnesota University Feb. 1966

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4621262 65)

3A 206294

ASPHALT CONCRETE PAVEMENT AND PERMEABILITY THE PERMEABILITY OF ASPHALTIC CONCRETE PAVEMENTS TO AIR AND WATER APPEARS TO BE A PRIMARY FACTOR IN CONTROLLING PAVEMENT DURABILITY. A HIGH PERMEABILITY OF AN ASPHALTIC PAVEMENT CAN SERIOUSLY AFFECT THE DURABILITY OF A ROADWAY. THE SUBJECT OF THIS PAPER IS A VERY GENERAL ONE AND TOUCHES ON THE PROBLEM OF PERMEABILITY AND CONSTRUCTION PRACTICES. THE PERMEABILITY MEASUREMENTS IN THIS INVESTIGATION WERE MADE USING AIR AND WATER PERMEABILITY DEVICES. BOTH INSTRUMENTS WERE PORTABLE AND THE METHODS OF MEASUREMENT WERE RAPID. DATA ACCUMULATED IN THE FIELD ARE ALSO SHOWN. THE RESULTS OF THIS STUDY INDICATE /1/ THE USE OF SOME TYPE OF FLOW RATE DEVICE SEEMS WARRANTED AS AN INDICATOR OF IN-PLACE ASPHALTIC CONCRETE COMPACTION DURING CONSTRUCTION, /2/ ON VERY DENSE PAVEMENTS AIR FLOW RATES SEEM TO BE MORE SENSITIVE INDICATORS OF COMPACTION THAN WATER FLOW RATES, AND /3/ BASED ON TRENDS SHOWN, MUCH CARE SHOULD BE TAKEN IN THE ROLLING AND COMPACTION OF HOT ASPHALTIC CONCRETE. /AUTHOR/

Gotolski, WH Ciesielski, SK Sandvig, LD
Pennsylvania State University, Pennsylvania Department Highways Jan. 1967

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4671194 67)

3A 206313

DURABILITY OF BRIDGE DECK CONCRETE

PART I GIVES A DETAILED DESCRIPTION OF SELECTED DETERIORATED BRIDGE DECKS, AND ATTEMPTS TO DETERMINE THE CAUSE OF DETERIORATION OF EACH DECK. ALSO GIVEN IS A DETAILED DESCRIPTION OF CONSTRUCTION PRACTICES AT FOUR NEW BRIDGE DECKS, INCLUDING SLUMP, AIR CONTENT, WATER CONTENT, MIXING TIME, ETC., AND THE LOCATION OF EACH LOAD ON THE DECK. THE RESULTS INDICATE MARKED DIFFERENCES BETWEEN THE SPECIFIED AMOUNTS AND THOSE ACTUALLY OBTAINED. PART II IS A DESCRIPTION OF STATISTICAL METHODS APPLIED TO QUALITY CONTROL OF CONCRETE PLACED ON TWO BRIDGE DECKS, AND A STUDY OF AIR-VOID SYSTEM PARAMETERS AND THEIR RELATION TO CONCRETE DURABILITY. THE CONTROL CHARTS SHOWN INDICATE THAT THE CONCRETE PRODUCED DOES NOT CONFORM TO STATE SPECIFICATIONS, ESPECIALLY THE SLUMP. OF PARTICULAR INTEREST IN THE STUDY OF AIR CONTENT IS THE STATEMENT THAT ALL

PARAMETERS EXCEPT AIR CONTENT SHOWED A SIGNIFICANT CORRELATION WITH DURABILITY AT THE 95 PERCENT SIGNIFICANCE LEVEL. PART III IS A REVIEW OF THE MAJOR FINDINGS AND INCLUDED ARE RECOMMENDATIONS, BASED LARGELY ON PUBLISHED WORK RATHER THAN ON THEIR RESEARCH, THAT SHOULD LEAD TO IMPROVED PERFORMANCE OF BRIDGE DECK CONCRETE. VOLUME II CONTAINS A DESCRIPTION OF FIELD SURVEY PROCEDURES AND COMPLETE FIELD SURVEY RECORDS FOR 1966-67. REPORT NO. 5 IS A MANUAL OF PROCEDURES TO BE USED IN THE EVALUATION OF BRIDGE DECK CONCRETE.

Larson, TD Malloy, JJ Price, JT
Pennsylvania State University

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4641186 67)3C26021775, 1C26021079, 1C27020115, PB-177 004, PB-177 222

3A 206323

A STUDY OF CONSTRUCTION EQUIPMENT AND INITIAL PAVEMENT ROUGHNESS AS MEASURED WITH A PROFILOGRAPH

THE DEVELOPMENT OF A PROFILOGRAPH FOR MEASURING CONSTRUCTION ROUGHNESS IS DESCRIBED. PARTICULAR ATTENTION WAS GIVEN TO THE COST, RUGGEDNESS, SIMPLICITY OF OPERATION AND MAINTENANCE DURING ITS DESIGN IN ORDER THAT SIMILAR INSTRUMENTS COULD BE MADE AVAILABLE FOR USE BY THE VARIOUS DISTRICTS OF TEXAS. THE REASONS FOR ROUGHNESS IN ASPHALTIC CONCRETE PAVING ARE DISCUSSED. THE PRIMARY TEST SITE HAD THE ADVANTAGES OF THE FOLLOWING FEATURES: (1) THE SURFACE OF THE FLEXIBLE BASE HAD BEEN PLANNED WITH AN CMI AUTOGRADE USING ELECTRONICALLY CONTROLLED GRADE APPARATUS AND WAS VERY SMOOTH AND TRUE TO CROSS-SECTION, (2) TWO ASPHALTIC CONCRETE MATS WERE PLACED USING BITUMINOUS PAVERS WITH ELECTRONICALLY CONTROLLED SCREEDS. THE ROUGHNESS WAS DETERMINED WITH THE RAINHART PROFILOGRAPH AND CONSISTED OF OBTAINING A PROFILE OVER THE AREAS IN WHICH THE ROLLERS PARKED, THE PAVER PAUSED, AND VARIOUS PAVER SPEEDS WERE USED. THIS STUDY COULD FIND NO SIGNIFICANT ROUGHNESS IN THE AREA WHERE ROLLERS PAUSED. HOWEVER, SURFACE VARIATION WAS PRESENT NEAR THE AREA IN WHICH THE PAVER PAUSED FOR A CHANGE OF TRUCKS. INCREASED ROUGHNESS WAS EXPERIENCED AS THE PAVER SPEED INCREASED. /BPR/

Lewis, RL
Texas State Department of Highways & Public Transp, Bureau of Public Roads /US/ Aug. 1967

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4723403 68)1C33020821, 1C26021175

3A 206365

SUMMARY OF STATEWIDE ROAD ROUGHNESS SURVEY FOR 1967 CONSTRUCTION PROGRAM

DATA ARE SUMMARIZED ON ROUGHNESS SURVEY RESULTS OF THE 1967 NEW CONSTRUCTION AND RESURFACING CONTRACTS IN THE SEVEN DISTRICTS IN THE STATE OF MARYLAND. EACH PUBLISHED IN SEVEN PROGRESS REPORTS. THE SEVEN DISTRICT REPORTS TABULATE THE PROJECT DETAILS, SUCH AS PAVEMENT SECTIONS, ROUGHNESS DATA, ETC. FOR THE EVALUATION OF RIDEABILITY RATINGS ACCORDING TO THE TYPE OF CONSTRUCTION. THE REPORT SUMMARIZES THE CONTRACTS OF EACH DISTRICT THEN TABULATES THE ROUGHNESS READINGS AND ASSESSES THE RIDEABILITY RATINGS SO THAT A COMPARISON CAN BE MADE AMONG THE DISTRICTS. THIS REPORT DOES NOT ATTEMPT TO LIST ANY REASONS FOR HIGH ROUGHNESS READINGS FROM THE INFORMATION AVAILABLE. IT IS INTENDED TO CORRELATE THIS 'LIMITED INFORMATION' WITH THAT BEING PREPARED BY OTHERS ON CONSTRUCTION METHODS, EQUIPMENT, CONTRACTORS, PROJECT PERSONNEL, ETC. HOWEVER, FROM THIS LIMITED INFORMATION REGARDING THE RIDEABILITY OF

FLEXIBLE PAVEMENTS, FIVE OBSERVATIONS ARE MADE: (1) A WELL-DESIGNED FLEXIBLE SECTION OF MORE THAN TWO SECTIONS WILL HAVE GOOD RIDEABILITY RATINGS, (2) MAXIMUM SIZE AGGREGATE FOR BITUMINOUS CONCRETE SURFACING APPEARS NOT TO AFFECT THE RIDE SURFACING APPEARS INCH,(3) THIN LAYER RESURFACING, WITH OR WITHOUT LEVELING COURSE, GENERALLY SHOWS A FAIR RATING, (4) OPEN CRACKING APPEARING IN ONLY ONE OR TWO YEARS WILL CHANGE AN EXCELLENT RATING TO GOOD OR FAIR, AND (5) ON PROJECTS OF THIN RESURFACING AND WIDENING, THE PLACEMENT OF THE ROUGHOMETER WHEEL WILL SHOW AN EXCELLENT RATING IF THE WHEEL HAPPENS TO TRAVEL ON THE NEW SECTION. /BPR/

Lee, A Chow, CH
Maryland State Roads Commission, Bureau of Public Roads /US/ July 1968

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4830424 69)

3A 206380

FINAL REPORT: PERFORMANCE OF CONTINUOUSLY REINFORCED CONCRETE PAVEMENT-184-SOUTHINGTON CONNECTICUT'S CRCP WAS BUILT AS AN EXPERIMENTAL PROJECT IN 1962. THE SIX-LANE DIVIDED HIGHWAY (184) WAS BUILT LANE-AT-A-TIME BY THE DOUBLE STRIKE-OFF METHOD. PLAIN WIRE FABRIC AND HIGH STRENGTH RE-BAR MATS WERE USED TO PROVIDE 0.6% REINFORCEMENT. DIFFICULTIES EXPERIENCED DURING PAVING ARE DESCRIBED. THE SECTIONS CONTAINING THE RE-BAR MATS ARE PERFORMING WELL, BUT THE FABRIC AREAS HAVE 12 WIDE CRACKS WHERE THE STEEL HAS PARTED. THE CRACKS APPEAR TO HAVE PROGRESSIVELY OCCURRED DURING EXTENDED COLD PERIODS. THE CONVENTIONAL PAVEMENT HAS EXPANDED AND CLOSED THE TERMINAL JOINTS, AND SUBSEQUENTLY TWO-FOOT WIDE RELIEF JOINTS WERE CUT INTO THE PAVEMENT. INFORMATION IS PRESENTED ON MOVEMENTS, WEATHER, CRACK OPENINGS. LOGICAL EXPLANATIONS ARE PRESENTED FOR EXPLAINING THE BEHAVIOR AND RECOMMENDATIONS ARE SUGGESTED. FOUR PREVIOUS UNCIRCULATED INFORMAL REPORTS HAVE BEEN MADE. THIS IS THE FIRST FOR WIDESPREAD DISSEMINATION. /BPR/

Sternberg, F
Connecticut State Highway Department, Bureau of Public Roads /US/ June 1969

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4830364 69)

3A 206397

FACTORS AFFECTING THE DURABILITY OF CONCRETE BRIDGE DECKS, INTERIM REPORT NO 2
BRIDGE DECK CRACKING STUDIES ON FOUR CONSTRUCTION CONTRACTS HAVE BEEN EVALUATED. THE EFFECT OF CONSTRUCTION PRACTICES, AIR ENTRAINMENT, CURING, AND WEATHER CONDITIONS ON DECK CRACKING IS DISCUSSED. DECK TEMPERATURES DURING THE FIRST 14 DAYS ARE GIVEN FOR TWO SLABS. /AUTHOR/

Stewart, CF Gunderson, BJ
California Division Highways, Bureau of Public Roads /US/ D-3-29

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4641056 70)REPORT PENDING, 1C26022025

3A 206595

PROCEEDING OF THE FOURTEENTH ANNUAL CONFERENCE OF CANADIAN TECHNICAL ASPHALT ASSOCIATION
THE PROCEEDINGS CONTAINS SIXTEEN PAPERS, ALL OF WHICH ARE REPORTS ON RESEARCH PROJECTS ON THE PERFORMANCE AND BEHAVIOR OF ASPHALT PAVEMENT UNDER VARIED CONDITIONS WITH THE USE OF VARIOUS AGGREGATES AND DIFFERENT METHODS OF CONSTRUCTION. /RATAOC/

Cook, RD Peatfield, JN Kari, WJ *Canadian Tech Asphalt Assoc Proc*
Nov. 1969

ACKNOWLEDGMENT: Roads & Transportation Assoc /Canada/

3A 206786

NEW DEVELOPMENTS IN BPR ROUGHNESS INDICATOR AND TESTS ON CALIFORNIA PAVEMENTS

THE ROUGHNESS INDICATOR WAS DEVELOPED BY THE BUREAU OF PUBLIC ROADS TO PROVIDE STANDARDIZABLE EQUIPMENT FOR MEASURING ROAD SURFACE ROUGHNESS. RESEARCH WITH THE UNIVERSITY OF CALIFORNIA HAS CONTINUED TO IMPROVE ITS ACCURACY AND CONSISTENCY AS A STANDARDIZABLE UNIT AND TO OBTAIN RECORDS OF ROAD ROUGHNESS OF THOUSANDS OF MILES OF PAVEMENTS ON THE STATE HIGHWAYS, CITY STREETS AND ON BRIDGES IN ALL PARTS OF CALIFORNIA. TESTS WERE CONDUCTED TO DETERMINE THE LIMITATIONS OF ACCURACY PROVIDED BY THE BPR DOUBLE BALL CLUTCH INTEGRATOR DESIGN AND ALSO THE ACCURACY OF AN INTEGRATOR CONSTRUCTED WITH A COMMERCIALY AVAILABLE CLUTCH. MEASUREMENTS WERE MADE TO DETERMINE THE EFFECT OF CHANGING THE SIZE OF THE TEST TIRE FROM 6.00 BY 16, WHICH IS NO LONGER AVAILABLE, TO A 6.70 BY 15 SIZE TIRE WHICH IS AVAILABLE. THE EFFECTS WERE MEASURED OF AN IMPROVED LEAF-SPRING BEARING DESIGN AND OF THE USE OF STANDARD UNIVERSAL JOINTS INSTEAD OF BALL-SOCKET JOINTS IN ATTACHING THE DASHPOTS TO THE FRAME OF THE TRAILER. THE EFFECTS OF VARYING AMOUNTS OF OUT-OF-ROUNDNESS OF THE TEST TIRE WERE MEASURED ON VARIOUS ROAD SECTIONS. IT WAS FOUND THAT THE ROAD ROUGHNESS INDEX IN INCHES PER MILE FOR CERTAIN PAVEMENTS WAS INCREASED BY APPROXIMATELY 50 PERCENT DUE TO AN OUT-OF-ROUNDNESS OF 0.05 INCHES WHICH CORRESPONDS TO THE AMOUNT OF OUT-OF-ROUNDNESS FREQUENTLY OBSERVED IN MEASUREMENTS OF PASSENGER CAR TIRES BY ATTENDANTS AT TIRE AND WHEEL ALIGNMENT SHOPS. TO PROTECT THE TEST TIRE AND ROUGHNESS EQUIPMENT FROM DAMAGE AND EXCESSIVE WEAR IN MOVING IT FROM ONE TEST SECTION TO THE NEXT TEST SECTION, A SPECIAL OUTRIGGER TRAILER WAS DEVELOPED TO CARRY THE TEST TRAILER IN A SUSPENDED POSITION BY THE USE OF A HOIST AND SPECIAL CLAMPING DEVICES. DETAILED SHOP DRAWINGS FOR THE OUTRIGGER TRAILER HAVE BEEN PREPARED. THE RESULTS OF ROUGHNESS MEASUREMENTS FOR ALL OF THE MAJOR TYPES OF PAVEMENT SURFACES USED ON STATE HIGHWAYS, CITY STREETS, AND ON VARIOUS TYPES OF BRIDGE FLOORS ARE REPORTED, ANALYZED AND CORRELATED WITH THE DESIGN FEATURES, AGE OF THE PAVEMENT AND CONSTRUCTION METHODS USED IN BUILDING THESE SURFACES. /AUTHOR/

Moyer, RA Ahlborn, G *Highway Research Board Bulletin* 1956

3A 206787

THE PAVEMENT SERVICEABILITY PERFORMANCE CONCEPT A SYSTEM IS DESCRIBED WHEREIN THE SERVICEABILITY OF PAVEMENTS IS RATED SUBJECTIVELY BY A PANEL MADE UP OF MEN SELECTED TO REPRESENT MANY IMPORTANT GROUPS OF HIGHWAY USERS. THROUGH MULTIPLE REGRESSION ANALYSIS A MATHEMATICAL INDEX IS DERIVED AND VALIDATED THROUGH WHICH PAVEMENT RATINGS CAN BE SATISFACTORILY ESTIMATED FROM OBJECTIVE MEASUREMENTS TAKEN ON THE PAVEMENTS. THESE SERVICEABILITY INDICES (OR THE DIRECT RATINGS) ALWAYS REFER TO THE CONDITIONS EXISTING AT THE TIME THE MEASUREMENTS (OR RATINGS) ARE MADE. PERFORMANCE OF A PAVEMENT MAY THEN BE DETERMINED BY SUMMARIZING THE SERVICEABILITY RECORD OVER A PERIOD OF TIME. THE SYSTEM, DEVELOPED AT THE AASHO ROAD TEST, HAS POTENTIAL FOR WIDE APPLICATION IN THE HIGHWAY FIELD, PARTICULARLY IN SUFFICIENCY RATINGS, EVALUATION OF DESIGN SYSTEMS, AND EVALUATION OF PAVING MATERIALS AND CONSTRUCTION TECHNIQUES THROUGH THE PROVISION OF AN OBJECTIVE MEANS FOR EVALUATION OF PERFORMANCE. /AUTHOR/

Carey, WN Irick, PE *Highway Research Board Bulletin* 1960

3A 206808

EVALUATING THE STABILITY OF ROAD STRUCTURES BY MEANS OF STATIC-ELASTIC THEORETICAL CALCULATIONS (IN GERMAN)

ROAD STRUCTURES, THE PROPERTIES OF WHICH DEPEND BOTH ON DYNAMIC TRAFFIC LOADING AND CLIMATIC CONDITIONS, CAN BE CHARACTERIZED ON THE BASIS OF THEIR MOMENTARY BEHAVIOR UNDER STATIC LOADING. STANDARDS WERE DERIVED FROM THE BEHAVIOR OF PROVEN STRUCTURES, WHICH, TOGETHER WITH STATIC-ELASTIC THEORETICAL CALCULATIONS, RENDER POSSIBLE AN ADVANCE COMPARATIVE EVALUATION OF THE STABILITY AND ECONOMICS OF ROAD STRUCTURES. AN ELECTRONIC COMPUTER PROGRAM WAS EVOLVED TO DETERMINE THE STRESSES AND DEFORMATIONS OCCURRING IN MULTI-LAYER ELASTIC STRUCTURES UNDER VERTICAL STATIC LOADING. USING THIS PROGRAM A CURRENT STANDARD CONSTRUCTION METHOD WAS EXAMINED FOR CONSTRUCTIONAL AND ECONOMIC JUSTIFICATION. IT WAS SHOWN TO BE SUFFICIENTLY STABLE. HOWEVER, VARIATIONS ON THE STANDARD METHOD, WHILE BEING EQUALLY STABLE, WERE SOMETIMES MORE ECONOMIC. /FG/RRL/

Gerlach, A
Hannover Technical University /Germany/ 1968

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 206928

AN EXPERIMENTAL CONTINUOUSLY-REINFORCED CONCRETE PAVEMENT IN MICHIGAN

THE EXPERIMENTAL PROJECT INCLUDES TWO 24-FT ROADWAYS EACH CONTAINING TWO 12-FT LANES. TWO TYPES OF REINFORCING STEEL, DEFORMED BAR MAT AND WELDED WIRE MESH, EACH PROVIDING A STEEL RATIO OF APPROXIMATELY 0.6 PERCENT, WERE USED IN THE CONTINUOUSLY-REINFORCED, 8-INCH UNIFORM PAVEMENT SECTIONS. THE EASTBOUND ROADWAY IS COMPOSED OF A 2-MI SECTION OF CONTINUOUS WIRE MESH, 0.7 MI OF STANDARD 9-INCH UNIFORM PAVEMENT WITH CONTRACTION JOINTS SPACED AT 99-FT INTERVALS, AND A 2-MI SECTION OF CONTINUOUS BAR MAT. THE WESTBOUND ROADWAY CONTAINS APPROXIMATELY 4 MI OF CONTINUOUSLY-REINFORCED PAVEMENT, 2 MI EACH OF BAR MAT AND WIRE MESH. RELIEF SECTIONS OF 9-INCH UNIFORM PAVEMENT 493 FT LONG, CONSISTING OF ELEVEN 1-INCH EXPANSION JOINTS, WERE PLACED AT THE ENDS OF THE CONTINUOUSLY-REINFORCED SECTIONS. CONSTRUCTION METHODS AND EQUIPMENT ARE DESCRIBED, INCLUDING CONSTRUCTION JOINTS IN THE CONTINUOUSLY-REINFORCED SECTIONS. VARIOUS CHARACTERISTICS ASSOCIATED WITH THE CONSTRUCTION PHASE OF THE PROJECT ARE DISCUSSED INCLUDING SUBGRADE SOIL CLASSIFICATION, CONCRETE AND AIR TEMPERATURES, CONCRETE STRENGTH, AND A RECORD OF CONSTRUCTION PROGRESS. STUDIES INVOLVED IN COMPARING THE PERFORMANCE OF VARIOUS PROJECT SECTIONS INCLUDE LONGITUDINAL DISPLACEMENTS OF THE ENDS, END REGIONS AND CENTER OF THE CONTINUOUSLY-REINFORCED SECTIONS, RELATIVE DISPLACEMENTS OF JOINTS AND SELECTED CRACKS, CRACK PATTERNS AND FORMATION, SURFACE ROUGHNESS, EFFECTS OF TRAFFIC PERFORMANCE OF RELIEF SECTIONS AND LOAD-DEFLECTION BEHAVIOR. IN ADDITION, ONE SECTION EACH OF BAR MAT, WIRE MESH, AND STANDARD MESH REINFORCEMENT WAS INSTRUMENTED WITH STRAIN GAGES FOR DETERMINATION OF STEEL STRESS VARIATION. /AUTHOR/

Cudney, GR *Highway Research Board Bulletin* 1960

3A 206949

PERFORMANCE OF CONCRETE PAVEMENTS AS RELATED TO SUBBASE CONSTRUCTION METHODS

FIELD STUDIES OF THE PERFORMANCE OF CONCRETE PAVEMENTS BUILT ON SUBBASES OF VARIOUS DESIGNS AND MATERIALS SHOW THAT THE METHOD OF SUBBASE CONSTRUCTION

IS AN IMPORTANT FACTOR. UNIFORMITY OF GRADATION WAS FOUND TO BE THE ONE SUBBASE QUALITY HAVING THE MOST INFLUENCE ON PAVEMENT PERFORMANCE. SUBBASE MATERIALS HAVING A SMALL MAXIMUM SIZE WERE FOUND GENERALLY TO PERFORM BETTER THAN COARSER MATERIALS BECAUSE SEGREGATION IS LESS LIKELY TO OCCUR DURING PLACEMENT. INFORMATION WAS OBTAINED DURING THE CONSTRUCTION OF 28 PROJECTS IN MANY PARTS OF THE COUNTRY REPRESENTING TYPICAL SUBBASE CONSTRUCTION METHODS. THE EFFECTS ON SUBBASE DENSITY AND GRADATION OF VARIOUS CONSTRUCTION OPERATIONS ARE DISCUSSED. THESE INCLUDE METHODS OF SUBGRADE COMPACTION, SUBBASE MIXING, PLACEMENT AND COMPACTION, AND FINE-GRADING. HEAVY CONSTRUCTION TRAFFIC ON THE COMPLETED SUBBASE NULLIFIES THE EFFORTS EXPENDED TO OBTAIN UNIFORMITY AND RESULTS IN SUBSTANDARD PAVEMENT PERFORMANCE. /AUTHOR/

Fordyce, P Geesaman, JD *Highway Research Board Bulletin* 1959

3A 206950

JOINT CONSTRUCTION IN CONCRETE PAVEMENT
RESEARCH AND DESIGN ENGINEERS HAVE DEVELOPED A VAST STOREHOUSE OF INFORMATION ON PERFORMANCE OF VARIOUS TYPES OF JOINTS IN PORTLAND CEMENT CONCRETE PAVEMENTS. THE PERFORMANCE OF SUCH JOINTS DEPENDS TO A LARGE DEGREE ON THE TYPE AND QUALITY OF THEIR CONSTRUCTION. CARELESS CONSTRUCTION PRACTICES OR INCORRECT METHODS OF CONSTRUCTION RESULTING FROM A LACK OF KNOWLEDGE OF THE JOINT FUNCTION RESULTS IN PAVEMENTS WITH BELOW STANDARD RIDING CHARACTERISTICS AND MAINTENANCE PROBLEMS. CORRECT CONSTRUCTION PROCEDURES FOR VARIOUS JOINT TYPES ARE OUTLINED AND ILLUSTRATED. INSTALLATION OF DOWELS, TIEBARS AND EXPANSION JOINT FILLERS IS EXPLAINED. /AUTHOR/

Ray, GK *Highway Research Board Bulletin* 1959

3A 206959

TYPES AND CAUSES OF FAILURE IN HIGHWAY PAVEMENTS
SIXTY-TWO DIFFERENT TYPES OF PAVEMENT DISTRESS ARE DISCUSSED AND PICTURES ARE INCLUDED WITH THE HOPE OF OBTAINING SOME AGREEMENT IN TERMINOLOGY IN REFERENCE TO FAILURES IN HIGHWAY PAVEMENTS. IT IS CONCLUDED THAT NO MATTER HOW WELL THE PRELIMINARY WORK HAS BEEN ACCOMPLISHED SUCH AS MATERIALS EVALUATION, DESIGN, PLANNING AND SPECIFICATION WRITING THE PROBLEM OF TURNING OUT A GOOD JOB RESTS WITH THE CONSTRUCTION ENGINEER.

Hveem, FN *Highway Research Board Bulletin* 1958

3A 206960

WARNING SIGNS OF PAVEMENT DISTRESS
MUCH CONCERN HAS BEEN EVIDENCED REGARDING THE ABILITY OF EXISTING PAVEMENTS TO SAFELY AND SATISFACTORILY ACCOMMODATE PRESENT DAY AND PROPOSED AIRCRAFT LOADINGS. IN ANY INVESTIGATION OF PAVEMENT PERFORMANCE, IT IS NOT ONLY NECESSARY TO DETERMINE THE PRESENT CONDITION OF THE PAVEMENT—BY SUCH MEANS AS CONDITION OR PERFORMANCE SURVEYS—BUT IT IS ALSO NECESSARY TO CONSIDER THE RESULTS OF SUCH SURVEYS IN LIGHT OF THE BASIC DESIGN PRINCIPLES AND CONSTRUCTION PRACTICES WHICH OBTAINED WHEN THE PAVEMENT WAS BUILT. IN ESSENCE, THE EVALUATION IS A REVERSAL OF THE DESIGN PROCEDURE. REPORTED HEREIN IS A GENERAL METHOD OF AIRPORT PAVEMENT EVALUATION PROCEDURE CONSISTENT WITH THE CURRENT DESIGN PRINCIPLES SET FORTH IN CIVIL AERONAUTICS ADMINISTRATION PUBLICATION, AIRPORT PAVING, DATED OCTOBER, 1956. /AUTHOR/

Lichtefeld, HJ *Highway Research Board Bulletin* 1958

3A 206961

EVALUATION OF RIGID PAVEMENT PERFORMANCE
FOR OVER FIFTEEN YEARS THE U.S. ARMY CORPS OF ENGINEERS HAS BEEN CONDUCTING AN EXTENSIVE INVESTIGATIONAL PROGRAM IN CONNECTION WITH THE DESIGN, CONSTRUCTION AND EVALUATION OF CONCRETE AIRFIELD PAVEMENTS. THIS PROGRAM HAS GIVEN CONSIDERATION TO PAVING MATERIALS, CONSTRUCTION METHODS, ANALYTICAL METHODS OF DESIGN, TRAFFIC ON SPECIALLY CONSTRUCTED TEST PAVEMENTS, AND THE CONDITION OF EXISTING CONCRETE AIRFIELD PAVEMENTS. THE PURPOSE OF THIS INVESTIGATIONAL WORK ON RIGID PAVEMENT IS TO ESTABLISH A REALISTIC METHOD OF DESIGN AND EVALUATION AND TO INSURE THAT THE PAVEMENTS CONSTRUCTED ARE IN ACCORD WITH THE REQUIREMENTS OF THE DESIGN. THIS PAPER SUMMARIZES BRIEFLY THE METHOD FOR THE DESIGN AND EVALUATION OF RIGID PAVEMENTS BASED ON THE CORPS OF ENGINEERS STUDIES. ALTHOUGH THE EVALUATION OF RIGID PAVEMENT PERFORMANCE INVOLVES MANY FACTORS, THE APPROACH TAKEN IN THIS PAPER IS THAT THE LOAD CARRYING CAPACITY OF THE PAVEMENT WITH REGARD TO BOTH THE MAGNITUDE AND THE FREQUENCY OF LOADING, MUST BE OF PRIME CONSIDERATION BEFORE FACTORS OTHER THAN LOAD CAN BE VIEWED IN THEIR PROPER PERSPECTIVE. /AUTHOR/

Mellinger, FM *Highway Research Board Bulletin* 1958

3A 207019

FIELD AND LABORATORY INVESTIGATIONS ON HOT MIX ASPHALT CONCRETE
RESEARCH WAS CONDUCTED TO INVESTIGATE THE BEHAVIOR OF HOT MIX ASPHALT CONCRETE UNDER THE ACTION OF WEATHERING AND TRAFFIC. THE EFFECT OF COMMERCIAL ANTI-STRIPPING AGENTS UPON THE PROPERTIES OF HOT MIX ASPHALT WILL BE EVALUATED. TWO SERIES OF TEST SECTIONS WERE PLACED IN THE FALL OF 1952. THE TEST SECTIONS, AN OUTLINE OF THE SAMPLING AND TESTING PROCEDURES, AND THE TEST RESULTS OBTAINED ON THE ORIGINAL MATERIAL AS WELL AS ON SAMPLES REMOVED FROM THE HIGHWAY SURFACE AFTER ONE, TWO, AND THREE YEARS OF SERVICE ARE DESCRIBED. THE CONTRIBUTING VARIABLES IN COMPARING THESE TWO TEST SECTIONS WERE: (1) THE AGGREGATE TYPES WERE COMPLETELY DIFFERENT, (2) THE ASPHALTS WERE BOTH AC-3'S, BUT NOT FROM THE SAME SOURCE, (3) THE CAPACITY, THE NATURE, AND THE PATTERN OF THE TRAFFIC DIFFERED GREATLY, AND (4) ALTHOUGH THE DESIGN FEATURES WERE ESSENTIALLY THE SAME, THE CONSTRUCTION PRACTICES ARE SELDOM IDENTICAL FOR TWO DIFFERENT CONTRACTORS. IT WAS DETERMINED THAT THE PRESENCE OF THE ADDITIVES DOES RETARD THE HARDENING OF THE ASPHALT, PARTICULARLY DURING THE FIRST YEAR OF SERVICE. THE ADDITIVES INCREASE THE RESISTANCE OF THE BITUMINOUS MIXTURES TO WATER ACTION. SPECIMENS COMPACTED IN THE LABORATORY AND ONE SAWED FROM THE PAVEMENT ALL SHOWED MUCH HIGHER STABILITY VALUES FOR THE LIMESTONE ASPHALT CONCRETE THAN FOR THE CHAT ASPHALT. THE RESISTANCE TO WATER ACTION AND THE WEATHERING OF THE TEST SECTIONS ARE SUMMARIZED IN THE TABLE. THE MODIFIED IMMERSION-COMPRESSION TEST APPEARS TO HAVE SOME MERIT AS A METHOD OF STUDYING STABILITY AND WATER RESISTANCE CHARACTERISTICS OF AN ASPHALT CONCRETE PAVEMENT. IT ALSO SEEMS WELL SUITED FOR A LABORATORY STUDY WHEN USED IN CONJUNCTION WITH THE ROLLER-COMPACTOR. THE ACCELERATED WEATHERING TEST, IN COMBINATION WITH THE DETERMINATION OF THE SONIC MODULUS OF ELASTICITY, SEEMS TO SHOW PROMISE AS A MEANS OF COMPARING THE RESISTANCE OF DIFFERENT TYPES OF MATERIAL TO THE EFFECTS OF EXTREME WEATHERING.

Shupe, JW Taylor, DC *Highway Research Board Bulletin* 1957

3A 207032

PAVEMENT CONDITION SURVEYS: SUGGESTED CRITERIA
PAVEMENT CONDITION SURVEYS ARE NECESSARY TO EVALUATE THE EFFECT UPON PAVEMENT LIFE AND SERVICE CAUSED BY VARIOUS FACTORS SUCH AS SUBGRADE SOIL OF THE VARIOUS CLASSIFICATIONS, SUBGRADE DENSIFICATION, SUBGRADE TREATMENTS, SUBGRADE DRAINAGE, SUBBASE MATERIALS AND METHODS OF PLACING, PAVEMENT MATERIALS, PAVEMENT DESIGN, PAVEMENT CONSTRUCTION METHODS, TRAFFIC, MAINTENANCE MATERIALS AND METHODS, AND CLIMATIC CONDITIONS. PAVEMENT CONDITION IS LOGICALLY MEASURED FOR PORTLAND CEMENT CONCRETE PAVEMENTS BY THE CONDITION OF JOINTS AND CRACKS, CONDITION OF THE SURFACE, AND THE AMOUNT OF CRACKING AND BREAKAGE. IN ADDITION, IT IS LOGICALLY MEASURED FOR PAVEMENTS OF THE FLEXIBLE TYPE BY THE AMOUNT OF CRACKING, TYPE OF CRACKING, RAVELING, RUTTING, SHOVING, SETTLING, BLEEDING, AND THE AREA AND DEPTH OF PATCHES. SKID RESISTANCE AND DEGREE OF BUMPINESS ARE PAVEMENT CONDITION FACTORS FOR BOTH RIGID AND FLEXIBLE PAVEMENTS. VARIOUS TYPES OF CONDITION SURVEYS ARE OUTLINED AND SUGGESTIONS MADE FOR MAKING THEM. APPENDICES PRESENT DEFINITIONS OF CONSTRUCTION TYPES, COMPONENTS, AND DEFECTS OR MANIFESTATIONS WITH ILLUSTRATIONS. SUGGESTED FORMS TO FACILITATE RECORDING AND STUDYING THE DATA OBTAINED FROM PAVEMENT CONDITION SURVEYS ARE PRESENTED IN AN APPENDIX.

Highway Research Board Special Reports 1957

3A 207036

THE AASHO ROAD TEST: REPORT 6-SPECIAL STUDIES
STUDIES ARE REPORTED WHICH WERE CONDUCTED DURING THE MAIN AASHO ROAD TEST WHICH WERE NOT DIRECTLY ASSOCIATED WITH THE PRINCIPAL EFFECTS OF THE PAVEMENT OR BRIDGE RESEARCH BRANCHES AND THOSE STUDIES CONDUCTED PRIMARILY FOR THE DEPARTMENT OF THE ARMY DURING THE SPECIAL STUDY PROGRAM FOLLOWING THE MAIN TEST. THE EXPERIMENT DESIGN AND THE INSTRUMENTATION AVAILABLE DID NOT HAVE THE REFINEMENTS TO DETECT THE EFFECTS OF THE VARIABLES OF TIRE PRESSURE, TIRE DESIGN, VEHICLE SUSPENSIONS, AND THE SEVERAL VEHICLE AND AXLE CONFIGURATIONS USED IN THESE STUDIES. THE TESTS WERE CONDUCTED PRIMARILY TO DETECT GROSS TRENDS IN THE DYNAMIC MEASUREMENTS OF STRAIN, DEFLECTION, AND DYNAMIC AXLE LOADS, AMONG OTHERS. A STUDY WAS MADE TO DETERMINE THE DYNAMIC EFFECT ON BRIDGES AND PAVEMENTS OF COMMERCIAL CONSTRUCTION EQUIPMENT, AND TO RELATE THE DYNAMIC EFFECTS OF THESE VEHICLES TO THOSE OBSERVED FOR CONVENTIONAL DUAL-TIRE TRUCK UNITS. THE DYNAMIC EFFECTS WERE INVESTIGATED ON PAVEMENTS AND BRIDGES OF VEHICLES EQUIPPED WITH SPECIAL SUSPENSION SYSTEMS. THESE WERE COMPARED TO THE DYNAMIC EFFECTS OF CONVENTIONAL VEHICLES WITH SIMILAR AXLE LOADS AND TIRE PRESSURES. TEST BRIDGES WHICH SURVIVED TESTS WITH REPEATED HIGH OVERSTRESS WERE UTILIZED IN A STUDY OF FLEXURAL BRIDGE CAPACITY. TEST RESULTS ARE PRESENTED FOR STEEL, PRESTRESSED CONCRETE AND REINFORCED CONCRETE BRIDGE STRUCTURES.

Highway Research Board Special Reports 1962

3A 207061

ANALYSIS OF CONCRETE SLABS ON GROUND SUBJECTED TO WARPING AND MOVING LOADS
A THEORY HAS BEEN DEVELOPED WHEREBY STRESSES AND DEFLECTIONS COULD BE CALCULATED FOR A SERIES OF RECTANGULAR SLABS LYING ON A VISCOELASTIC FOUNDATION AND SUBJECTED TO A MOVING LOAD. THE STRESSES AND DEFLECTIONS ARE CAUSED BY THE WEIGHT OF THE SLAB, THE MOVING CONCENTRATED LOAD, AND THE LINEAR TEMPERATURE (OR MOISTURE) VARIATIONS THAT CAUSE

SUFFICIENT WARPING SO THAT THE SLAB IS ONLY PARTIALLY SUPPORTED BY ITS FOUNDATION. THE SUPPORT CONDITIONS WERE SIMULATED BY A KELVIN VISCO-ELASTIC MODEL, AND ZONES (WHICH DEPENDED ON THE VALUE OF SUB-GRADE REACTION) WERE SET UP SO THAT THE SOLUTIONS TO THE GOVERNING DIFFERENTIAL EQUATIONS COULD BE REDUCED TO A SET OF SIMULTANEOUS ALGEBRAIC EQUATIONS. THE EQUATIONS WERE SOLVED WITH THE AID OF AN IBM 7090 DIGITAL COMPUTER USING A FORTRAN SOURCE PROGRAM. IT WAS FOUND THAT WHEN PARTIAL SUPPORT CAUSED BY WARPING EXISTS, THE TENSILE STRESS IN THE SLAB CAN INCREASE WITH INCREASING VELOCITY OF LOAD. MOREOVER, THE MAXIMUM DEFLECTION (DOWNWARD) NEED NOT OCCUR WHEN THE VELOCITY OF THE LOAD IS EQUAL TO ZERO. THE REDUCTION IN SUBGRADE SUPPORT OVER A NARROW REGION (8 FT. OR LESS) LEADS TO DEFLECTIONS AND STRESSES THAT ARE HIGHER THAN THOSE CALCULATED USING THE INITIAL VALUE OF SUBGRADE REACTION. THIS IS PARTICULARLY EVIDENT WHEN THE LOAD IS OVER THE REGION OF REDUCED SUBGRADE REACTION. /AUTHOR/

Lewis, KH Harr, ME *Highway Research Record, Hwy Res Board 1969*

3A 207158

AN EXPERIMENTAL ROAD OF CEMENT BOUND MACADAM
AN EXPERIMENTAL ROAD OF CEMENT BOUND MACADAM WAS CONSTRUCTED TO OBTAIN INFORMATION ON MATERIAL REQUIREMENTS, CONSTRUCTION METHODS AND DATA ON WHICH DESIGNS AND ESTIMATES COULD BE BASED. THE TEST ROAD INCLUDED 81 SECTIONS CONSTRUCTED WITH THREE SIZES OF LIMESTONE, THREE SIZES OF GRAVEL AND ONE SIZE OF SLAG COARSE AGGREGATE. THESE COARSE AGGREGATES WERE PENETRATED WITH GROUT OF DIFFERENT PROPORTIONS BY WEIGHT OF SAND OF VARIOUS COARSENESS WITH VARYING AMOUNTS OF WATER. THE REQUIREMENTS FOR UNIFORM AND FULL PENETRATION OF COARSE AGGREGATES BY THE GROUT WAS STUDIED. COMPACTION METHODS WERE DESCRIBED. CONCLUSIONS AND RECOMMENDATIONS WERE GIVEN PERTAINING TO SUBGRADE, COARSE AGGREGATE, GROUT, COMPACTION, CONSTRUCTION METHODS, STRENGTHS, AND QUALITY OF MATERIALS.

Fleming, EM Anderson, AA Litchiser, RR DISCUSSEER Shelton, WA DISCUSSEER *Highway Research Board Proceedings 1934*

3A 207404

INVESTIGATIONAL CONCRETE PAVEMENT IN MICHIGAN
THE MICHIGAN TEST ROAD WAS CONSTRUCTED IN 1940 FOR THE PURPOSE OF ESTABLISHING CERTAIN PRINCIPLES IN CONCRETE PAVEMENT DESIGN, IN PARTICULAR THOSE INVOLVED IN JOINT SPACING AND CONSTRUCTION METHODS. THE TEST PROJECT IS 17.8 MILES LONG AND COMPOSED OF TWO SEPARATE TEST SECTIONS, THE DESIGN PROJECT AND THE DURABILITY PROJECT. THE PROGRAM CONSISTS OF THE FOLLOWING OBSERVATIONS: (1) SEASONAL AND DAILY MEASUREMENTS OF: JOINT WIDTHS, SLAB MOVEMENT, STRAIN, TEMPERATURE AND MOISTURE OF THE CONCRETE AND SUBBASE; (2) PERIODIC MEASUREMENTS OF VERTICAL DISPLACEMENT OF THE SLABS; (3) PERIODIC CONDITION SURVEYS OF PAVEMENT; (4) CONTINUOUS RECORD OF TEMPERATURE AND PRECIPITATION; AND (5) CONTINUOUS TRAFFIC RECORD. /AUTHOR/

Coons, HC *Highway Research Board Research Reports 1945*

3A 207463

LOW TRAFFIC CONCRETE PAVEMENT PERFORMANCE AND MAINTENANCE IN IOWA
REPORTS ON PERFORMANCE AND MAINTENANCE OF 2800 MILES OF CONCRETE PAVEMENT ON THE SECONDARY ROAD SYSTEM IN IOWA ARE PRESENTED. THESE ARE RELATED TO DESIGN, SPECIFICATIONS, CONSTRUCTION EQUIPMENT AND

METHODS. INCLUDED ARE CONSTRUCTION AND MAINTENANCE COSTS AND RESULTS OF PAVEMENT SMOOTHNESS MEASUREMENTS. /AUTHOR/

Knutson, MJ
American Concrete Paving Association No. 13, 1972, 19 pp, 5 Figs, 2 Phot, Refs

3A 207484

TRACKWORK STUDY-VOLUME I-TRACKWORK PRACTICES OF NORTH AMERICAN RAPID TRANSIT SYSTEMS-FINAL REPORT

A SUMMARY IS PRESENTED OF THE TRACKWORK PRACTICES OF SEVEN NORTH AMERICAN RAIL TRANSIT PROPERTIES: BOSTON, CHICAGO, CLEVELAND, NEW YORK, PHILADELPHIA, SAN FRANCISCO AND TORONTO. RESPONSES TO QUESTIONNAIRES SENT TO THE PROPERTIES COVERED CONSTRUCTION STANDARDS FOR RAIL, RAIL WELDS, TRACK GAUGE, RAIL FASTENINGS, SUPPORT SPACING, RAIL ANCHORAGE, TIES, ROADBED AND BALLAST SECTIONS, SPECIAL TRACKWORK AND TRACT APPURTENANCES. THE PROPERTIES ALSO REPORTED THEIR TRACK MAINTENANCE CRITERIA FOR RAIL WEAR, TIE LIFE, AND BALLAST CLEANING, AS WELL AS TEST INSTALLATIONS AND RECOMMENDATIONS FOR IMPROVING TRACKWORK. /AUTHOR/

Dunn, RH
Washington Metro Area Transit Authority Nov. 1967, 149 pp

ACKNOWLEDGMENT: NTISNTIS PB 204 212, 3C26226248

3A 207708

FATIGUE TESTS OF PLATES AND BEAMS WITH STUD SHEAR CONNECTORS

THE PRIMARY OBJECTIVE OF THE TESTS REPORTED IN THIS PAPER WAS TO STUDY THE EFFECT OF SHEAR CONNECTORS ON THE FATIGUE LIFE OF COMPOSITE CONSTRUCTION UNDER CIRCUMSTANCES WHERE THE CONNECTORS ARE ATTACHED TO THE TENSION FLANGE AND TO STUDY THE INFLUENCE OF FLANGE MATERIAL ON THIS BEHAVIOR. TO STUDY THESE TWO PROBLEMS WORK WAS UNDERTAKEN ON SEVERAL DIFFERENT MATERIALS WITH VARYING CHEMICAL COMPOSITIONS AND WITH DIFFERENT STRENGTH LEVELS. THE PROGRAM INCLUDED A RATHER EXTENSIVE SERIES OF TESTS ON FLAT PLATE SPECIMENS FABRICATED FROM TWO DIFFERENT MATERIALS. FOR THE DIFFERENT TYPES OF MATERIALS STUDIED, ONE OR MORE STUD SHEAR CONNECTORS WERE ATTACHED IN A SINGLE LINE TRANSVERSE TO THE DIRECTION OF STRESS. ANOTHER VARIABLE, INTENDED TO PERMIT A STUDY OF THE EFFECT OF STUD SPACING, WAS THE WIDTH OF THE PLATE. IN ONE SERIES OF TESTS THE WELDING PROCEDURE USED TO APPLY THE STUDS WAS ALTERED. FLAT PLATE FATIGUE TESTS WERE CONDUCTED ON STRESS CYCLES OF COMPLETE REVERSAL, ZERO-TO-TENSION AND PARTIAL TENSION-TO TENSION. A FEW SUPPLEMENTARY TESTS WERE CONDUCTED TO INVESTIGATE THE EFFECT OF GEOMETRY IN THE REGION OF THE CONNECTION BETWEEN THE PLATE AND THE STUDY SHEAR CONNECTOR. THE SECOND PHASE OF THE PROGRAM WAS CARRIED OUT ON NINE BEAM SPECIMENS, WHICH WERE DIVIDED INTO THREE GROUPS OF THREE GROUPS OF THREE BEAMS EACH. ALL BEAMS WERE LOADED IN SUCH A MANNER THAT THE FLANGE TO WHICH THE STUD SHEAR CONNECTORS WERE ATTACHED WAS SUBJECTED TO A TENSILE STRESS. ONE GROUP OF BEAMS WAS TESTED WITHOUT ANY STRESS APPLIED TO THE SHEAR CONNECTORS, THE OTHER TWO SERIES OF BEAM TESTS USED DIFFERENT LOADING METHODS TO STUDY BENDING OF THE BEAM AND FLEXING OF THE STUD SIMULTANEOUSLY. THE RESULTS OF THE INVESTIGATION ARE REPORTED IN THE FORM OF S-N DIAGRAMS FOR THE VARIOUS PARAMETERS INVESTIGATED. A COMPARISON BETWEEN THE FLAT PLATE TESTS AND THE BEAM TESTS IS INCLUDED, ALONG WITH A DISCUSSION OF SUPPLEMENTARY INFORMATION OBTAINED DURING THE CONDUCT OF THE TESTS. THIS INFORMATION IS CONCERNED PRIMARILY WITH

THE EFFECTIVENESS OF THE REINFORCING STEEL IN THE CONCRETE, STRAIN DISTRIBUTION THROUGH THE DEPTH OF THE STEEL BEAM, AND METALLURGICAL INVESTIGATIONS TO STUDY THE INFLUENCE OF THE STRUCTURE IN THE HEAT-AFFECTED ZONE. ON THE BASIS OF THE TESTS RESULTS SOME SUGGESTIONS ARE MADE FOR THE UTILIZATION OF STUD SHEAR CONNECTORS IN REGIONS OF NEGATIVE MOMENT.

Stallmeyer, JE Munse, WH Selby, KA *Highway Research Record, Hwy Res Board* 1965

3A 207713

TESTS EVALUATING PUNCHING SHEAR RESISTANCE OF PREFABRICATED COMPOSITE BRIDGE UNITS MADE WITH INVERTED STEEL T-BEAMS

DESIGN INFORMATION IS DEVELOPED FOR A SPECIAL TYPE OF PREFABRICATED COMPOSITE SUPERSTRUCTURE UNIT FOR BRIDGE SPANS IN THE 30-TO 70-FT RANGE. THESE STEEL AND CONCRETE UNITS CONSIST OF SPAN-LENGTH, 7-IN. THICK REINFORCED CONCRETE SLABS 6 TO 10 FT WIDE. THE WEBS OF A PAIR OF INVERTED T-SHAPED STEEL BEAMS ARE EMBEDDED IN EACH SLAB. HORIZONTAL STEEL STUDS WELDED AT INTERVALS TO THE BEAM WEBS ACT AS SHEAR CONNECTORS. TO EVALUATE THE RESISTANCE OF TWO PARTICULAR PREFABRICATED UNITS TO PUNCHING SHEAR AND TO DEVELOP GENERAL DESIGN INFORMATION FOR DETERMINING SAFE STUD SPACINGS, TESTS WERE CONDUCTED ON TWO 10-FT WIDE BY 5 1/2-FT LONG SPECIMENS REPRESENTING A SECTION OF A TYPICAL BRIDGE. THE STUDS WERE SPACED AT 4-IN. INTERVALS IN ONE SPECIMEN AND AT 10-IN. INTERVALS IN THE OTHER. BOTH SPECIMENS WERE SUPPORTED AND LOADED SO THAT THEY WOULD BE SUBJECTED TO PUNCHING SHEAR. BOTH SPECIMENS FAILED IN A SIMILAR MANNER AT LOADS THAT WERE ABOUT FIVE TIMES GREATER THAN THE MAXIMUM WHEEL LOAD /INCLUDING 30 PERCENT FOR IMPACT/ SPECIFIED BY AASHO FOR H20 OR H20-S16 TYPE TRUCKS. THE MODE OF FAILURE APPEARED TO BE A COMBINATION OF TENSION AND BOND FAILURE IN THE CONCRETE RATHER THAN A PUNCHING-TYPE FAILURE. A METHOD OF DETERMINING THE SAFE SPACING OF STUDS FOR RESISTING COMBINED PUNCHING AND HORIZONTAL SHEAR WAS DEVELOPED AND WAS BASED ON THE CONSERVATIVE ASSUMPTION THAT THE STUDS CARRY ALL THE PUNCHING SHEAR. IT WAS ALSO ASSUMED THAT THE INTENSITY OF THE PUNCHING SHEAR WAS PROPORTIONAL TO THE DEFLECTION OF THE SLAB NEAR THE WEB, AND THAT A CONSERVATIVE APPROXIMATION OF THIS RELATIONSHIP IS THAT THE SHEAR INTENSITY VARIES PARABOLICALLY-FROM ZERO TO MAXIMUM SHEARING STRESS TO ZERO-OVER AN 8-FT LENGTH. THIS PROCEDURE PERMITS THE MAXIMUM VERTICAL SHEAR PER STUDY TO BE CALCULATED AND THEREBY MAKES IT POSSIBLE TO USE CONVENTIONAL PROCEDURES IN DESIGNING THESE PREFABRICATED SUPERSTRUCTURE UNITS.

Mcdermott, JF *Highway Research Record, Hwy Res Board* 1965

3A 207714

SUBSTRUCTURE INFLUENCE ON DYNAMIC STRESS RESPONSE OF SUPERSTRUCTURES IN COMPOSITE BRIDGES-AN EXPERIMENTAL STUDY

THE VIRGINIA COUNCIL OF HIGHWAY INVESTIGATION AND RESEARCH HAS CONDUCTED A STUDY OF THE DYNAMIC STRESS RESPONSE AND VIBRATION CHARACTERISTICS OF TWO HIGHWAY BRIDGES WITH SIMPLY SUPPORTED COMPOSITE SPANS. A TEST VEHICLE, SIMULATING AN H20 -S16-44 STANDARD LOADING, MADE RUNS ON THE BRIDGES. BOTH BRIDGES HAD IDENTICAL 66-FT 5-IN. SPANS, BUT ONE HAD HIGHER AND LESS STIFF PIERS THAN THE OTHER. COMPARISON OF THE DATA INDICATES THAT THE STIFFNESS OF THE SUBSTRUCTURE HAS AN INFLUENCE ON THE RESPONSE OF THE SUPERSTRUCTURE TO DYNAMIC LOADING. /AUTHOR/

Kinnier, KH Mckeel, WT *Highway Research Record, Hwy Res Board* 1965

3A 207716

SIMPLIFIED DESIGN CHECK OF THERMAL STRESSES IN COMPOSITE HIGHWAY BRIDGES

A SIMPLE FORMULA INTENDED FOR USE AS A DESIGN CHECK OF THERMAL STRESSES IN SIMPLY SUPPORTED COMPOSITE HIGHWAY BRIDGES IS DESCRIBED. IT IS BASED ON A SERIES OF FIELD TESTS OF VARIOUS BRIDGES RANGING IN SPAN FROM 47 FT 3 IN. TO 71 FT 5 IN. THE FORMULA RELATES THE THERMAL STRESS AT THE BOTTOM OF THE GIRDER TO THE TEMPERATURE DIFFERENCE BETWEEN THE TOP AND BOTTOM OF THE SLAB AND THE DEPTH OF THE BRIDGE. /AUTHOR/

Zak, W *Highway Research Record, Hwy Res Board* 1965

3A 207717

FABRICATION OF ORTHOTROPIC DECK SECTIONS FOR PORT MANN BRIDGE

THOUGH IN USE IN MANY PARTS OF EUROPE FOR SOME YEARS, ORTHOTROPIC BRIDGE DECKING IS COMPARATIVELY NEW ON THIS CONTINENT. HIGH LABOR COST AS COMPARED TO EUROPEAN WAGE SCALES HAS INHIBITED ITS USE IN NORTH AMERICA. PRODUCTION LINE METHODS AND EQUIPMENT HAVE BEEN ABLE TO ACHIEVE EFFICIENCY AND ECONOMY IN THIS FIELD, BRINGING ORTHOTROPIC DECK CONSTRUCTION INTO COMPETITION IN LONG-SPAN BRIDGE DESIGN AND CONSTRUCTION. /AUTHOR/

Smylie, RG *Highway Research Record, Hwy Res Board* 1966

3A 207728

MINIMUM REQUIRED SHEAR CONNECTORS BETWEEN SLABS AND STEEL STRINGERS IN COMPOSITE CONSTRUCTION BRIDGES

THE STUDY WAS UNDERTAKEN IN ORDER TO DETERMINE IF SATISFACTORY COMPOSITE ACTION OF A CONCRETE SLAB ON STEEL BEAMS COULD BE OBTAINED WITH A LESSER NUMBER OF SHEAR CONNECTORS THAN REQUIRED BY AASHO SPECIFICATIONS. TWO ALTERNATIVE APPROACHES WERE USED: THE ELIMINATION OF SHEAR CONNECTORS AT THE ENDS OF THE BEAM OUTSIDE THE CENTRAL PORTION OF THE SPAN WHERE THE MOMENT CAPACITY OF THE STEEL STRINGER ALONE WAS EXCEEDED, AND CONVERSELY, THE PROVISION OF SHEAR CONNECTORS ONLY NEAR THE ENDS OF THE SPAN TO RETARD END SLIPPAGE SUFFICIENTLY TO FURNISH COMPOSITE ACTION THROUGHOUT THE SPAN. THREE TEST BEAMS INCORPORATING EACH OF THE ABOVE TWO CONCEPTS WERE LOADED STATICALLY AT 2 POINTS NEAR MIDSPAN ALONG WITH 3 CONTROL BEAMS DESIGNED IN ACCORDANCE WITH AASHO SPECIFICATIONS. THE LOADING WAS INCREASED FROM ZERO TO THREE INCREMENTS WITHIN THE ELASTIC RANGE IN TURN AND THENCE TO ULTIMATE. THE RESULTS ARE PRESENTED IN TERMS OF OBSERVED DEFLECTION, STRAIN AND SLIP AT THE VARIOUS LOAD LEVELS. IT WAS CONCLUDED THAT THE PERFORMANCE OF THE BEAMS WITH SHEAR CONNECTORS AT THE SPAN ENDS ONLY COMPARED FAVORABLY WITH THAT OF THE CONTROL BEAMS. IT WAS POINTED OUT, HOWEVER, THAT THE TEST PROGRAM WAS LIMITED TO STATIC TESTS AND THAT FATIGUE LOADING EFFECTS ON SIMILAR SPECIMENS SHOULD BE INVESTIGATED. /BPR/

Uyanik, ME Bramer, CR Robinson, JC
North Carolina State University June 1964

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4330001 65)1C27020549, 1C27020059

3A 207729

AN EXPERIMENTAL INVESTIGATION OF THE BEHAVIOR OF COMPOSITE PRESTRESSED TILE BEAMS AND SLAB
A SERIES OF EXPERIMENTAL STUDIES WERE CONDUCTED TO OBSERVE THE STRUCTURAL BEHAVIOR OF PRETENSIONED, PRESTRESSED CONCRETE BEAMS STATICALLY LOADED INDIVIDUALLY AND AS COMPONENTS OF A SLAB SPAN WITH A

CONCRETE TOPPING CAST IN-SITU. THE PRESTRESSED BEAMS WERE COMPOSED OF HOLLOW STRUCTURAL CLAY TILE UNITS MORTARED END TO END WITH A PRETENSIONED STRAND RUNNING LENGTHWISE THROUGH THE VOIDS. THE VOIDS THEN SERVED AS A FORM FOR THE ADDITION OF CONCRETE TO CREATE AN INTEGRAL BEAM. ALL TEST BEAMS WERE WITHOUT CONCRETE TOPPING AND FIVE WERE DESIGNED WITHOUT END BLOCKS FOR INDIVIDUAL TESTS. THESE DEVELOPED CRACKING AND SEPARATION WITH THE TRANSFER OF PRESTRESS. TEN BEAMS WERE INCORPORATED IN THE COMPOSITE SLAB AND WERE CAST WITH END BLOCKS AS WERE TWO OTHER SPECIMENS INTENDED FOR A STUDY OF PRESTRESS LOSSES. INDIVIDUAL BEAM TESTS CONSISTED OF PURE FLEXURE AND FLEXURE SHEAR LOADINGS RESULTING IN FAILURES THAT WERE SUDDEN AND BRITTLE. THEORETICAL MOMENT CAPACITY WAS DEVELOPED BUT ALL BEAMS TESTED IN FLEXURE-SHEAR FAILED TO DEVELOP THE THEORETICAL SHEAR CAPACITY CALCULATED FROM THE ACI CODE, POSSIBLY DUE TO CRACKING DEVELOPED AT TRANSFER DUE TO LACK OF END BLOCKS. THE SLAB SPAN CONSISTING OF TEN BEAMS PLACED SIDE-BY-SIDE WITH A 3-5/8 INCH REINFORCED DECK ADDED WITHOUT SHEAR CONNECTORS, BEHAVED ELASTICALLY BEFORE THE CRACKING LOAD AND EVIDENCED GOOD TRANSVERSE LOAD DISTRIBUTION. THE SYSTEM STUDIED WAS CONCLUDED TO HAVE MERIT AS A STRUCTURAL METHOD WITH PROPER END ANCHORAGE. FURTHER STUDY OF THE PRESTRESSED TILE UNITE BEHAVIOR UNDER REPEATED LOADING IS NEEDED BEFORE CONSIDERATION FOR BRIDGE MEMBERS.

Zia, P Byrd, EM
North Carolina State University June 1964

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4610002 65)

3A 207748

ULTIMATE SHEAR STRENGTH OF PRESTRESSED CONCRETE BEAMS WITH WEB REINFORCEMENT

THE REPORT BEGINS WITH A GOOD SUMMARIZATION OF THE BACKGROUND, SCOPE AND OBJECTIVES OF THE TOTAL STUDY AND OF THE PREVIOUS WORK AT LEHIGH UNIVERSITY AND ELSEWHERE ON THE SHEAR STRENGTH OF PRESTRESSED CONCRETE BEAMS. THE OBJECTIVE OF THE PHASE OF THE STUDY COVERED IN THE SUBJECT REPORT IS THE EVALUATION OF STATIC ULTIMATE STRENGTH FROM TESTS OF 23 SIMPLY SUPPORTED PRECAST PRESTRESSED I-BEAMS. THE BEAM SPAN WAS DIVIDED INTO THREE REGIONS IN WHICH DIFFERENT AMOUNTS OF WEB REINFORCEMENT WERE PROVIDED IN ORDER TO PERMIT TWO SUBSEQUENT TESTS ON UNFAILED PORTIONS OF THE BEAM AFTER INITIAL FAILURE IN THE CENTRAL REGION FREED THE END THIRDS FOR FURTHER TESTS. THE PRINCIPAL VARIABLES STUDIED WERE THE AMOUNT OF WEB REINFORCEMENT AND THE SHEAR SPAN TO EFFECTIVE DEPTH RATIO. OTHER FACTORS WERE HELD CONSTANT. THE BEAMS WERE DESIGNED TO BE REPRESENTATIVE OF MEMBERS USED IN PENNSYLVANIA AND THE SIZE AND TYPE OF PRESTRESSING STRAND WAS THE SAME AS USED IN FULL SIZED BEAMS. BASED ON THE TEST RESULTS A SPECIFICATION WAS PROPOSED GOVERNING THE DESIGN OF WEB REINFORCEMENT FOR PRESTRESSED BRIDGE BEAMS. A METHOD IS PROPOSED FOR EVALUATING THE SHEAR STRENGTH UNDER COMBINED DISTRIBUTED AND CONCENTRATED LOADS WHERE THE CONCENTRATED LOADS MAY BE MOVING LOADS. IT WAS FOUND THAT THE ULTIMATE SHEAR STRENGTH OF THE TEST BEAMS COULD BE CLOSELY PREDICTED AS THE SUM OF THE SHEAR CAUSING INCLINED CRACKING PLUS THE SHEAR CARRIED BY THE STIRRUPS WHICH ARE CROSSED BY AN IDEALIZED INCLINED CRACK. /AUTHOR/

Hanson, JM Hulsbos, CL
Lehigh University Apr. 1965

ACKNOWLEDGMENT:

3A 207755

A STUDY OF DETERIORATION IN CONCRETE BRIDGE DECKS THIS STUDY INCLUDES /A/ A DETAILED SURVEY OF DETERIORATION OF 620 BRIDGE DECKS THROUGHOUT MISSOURI, /B/ OBSERVATION OF CONSTRUCTION PROCEDURES AND TESTING OF FRESH CONCRETE ON BRIDGE DECKS, /C/ ANALYSES OF CORES TAKEN FROM SOUND AND DETERIORATED AREAS OF BRIDGE DECKS. THE MAJOR FINDINGS FROM THIS STUDY WERE: 1. FRACTURE PLANE AND SURFACE MORTAR DETERIORATION ARE THE MOST SERIOUS TYPES OF BRIDGE DECK DETERIORATION IN MISSOURI. 2. FRACTURE PLANE IS ASSOCIATED WITH /A/ A BUILT-IN PLANE OF WEAKNESS OCCURRING IN THE PLANE OF THE TOP MAT OF REINFORCING STEEL, /B/ USE OF DE-ICING SALTS, /C/ SURFACE CRACKING, AND /D/ DEPTH OF COVER OVER THE TOP STEEL. 3. SURFACE MORTAR DETERIORATION IS ASSOCIATED WITH AN EXCESSIVE AMOUNT OF MIXING WATER, AN INSUFFICIENT AMOUNT OF ENTRAINED AIR, THE USE OF DE-ICING SALT, AND THE SEVERITY OF THE FROST ACTION. /BPR/

Missouri State Highway Commission

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4640002 65)

3A 207762

HORIZONTAL SHEAR CONNECTION IN COMPOSITE CONCRETE BEAMS UNDER REPEATED LOADING
RESULTS OF AN INVESTIGATION INTO FATIGUE STRENGTH OF THE JOINT IN CONCRETE COMPOSITE MEMBERS ARE PRESENTED. TWENTY-THREE MEMBERS WERE TESTED IN FATIGUE. TWENTY-TWO OF THE PRECAST BEAMS WERE I-BEAMS OR INVERTED T-BEAMS WITH A RELATIVELY NARROW JOINT AND A RECTANGULAR SLAB PLACED ON THEM, THE TWENTY-THIRD BEAM WAS A BOX-BEAM WITH A RELATIVELY WIDE JOINT BUT WITH THE SAME TYPE OF SLAB ON ITS TOP. THE THREE PRINCIPAL VARIABLES WERE THE AMOUNT OF JOINT REINFORCEMENT, THE ROUGHNESS OF THE JOINT AND THE RATIO OF SHEAR SPAN TO EFFECTIVE DEPTH. PARTICULAR ATTENTION WAS GIVEN TO THE RELATIONSHIP BETWEEN DIAGONAL TENSION CRACKING AND CRACKING IN THE HORIZONTAL JOINT. ATTENTION WAS ALSO FOCUSED ON THE RELATIONSHIP BETWEEN THE DEVELOPMENT OF CRACKING AND SLIP AT THE JOINT AND THE LOSS OF COMPOSITE ACTION. SEVERAL OF THE TEST BEAMS FAILED IN FLEXURE OR IN DIAGONAL TENSION BUT MOST FAILED IN THE JOINT, SOME DURING THE FATIGUE TESTING, AND SOME DURING THE SUBSEQUENT STATIC TEST TO FAILURE. INFORMATION WAS GAINED ABOUT THE INFLUENCE OF THE DIAGONAL TENSION CRACKING ON THE JOINT FAILURE AND ABOUT THE MECHANISM OF JOINT FAILURE. A CRITERION OF JOINT FAILURE HAS BEEN DEFINED SO THAT THE FLEXURAL CAPACITY OF THE COMPOSITE BEAM IS ESSENTIALLY EQUAL TO THAT OF A CORRESPONDING MONOLITHIC BEAM. THIS IMPLIES NO EXTENSIVE LOSS OF COMPOSITE ACTION. AN ALLOWABLE JOINT SHEAR STRESS FOR CONCRETE COMPOSITE BEAMS UNDER FATIGUE LOADING HAS BEEN DEVELOPED ON THE BASIS OF THE TESTS RESULTS. EQUATIONS AS FUNCTIONS OF THE THREE PRINCIPAL VARIABLES ARE RECOMMENDED. /AUTHOR/

Badoux, JC Hulsbos, CL
Lehigh University Hpr-1/1/, AUG65

ACKNOWLEDGMENT:

3A 207806

RIGID CULVERTS UNDER HIGH FILLS--TRACTIONS ON THE BARREL AND IN THE SOIL
THE FORCES ACTING ON THE BARREL OF A RIGID CULVERT DUE TO THE DEAD LOAD OF A HIGH FILL DEPEND UPON THE CONSTRUCTION METHOD, THE PRESENCE OF HETEROGENEOUS INCLUSIONS OF ORGANIC MATERIAL, THE MATERIAL OF THE EARTH'S CRUST, THE FILL PROPERTIES AND FILL AND CULVERT GEOMETRIES. THESE FEATURES ARE ACCOUNTED FOR BY THE FINITE-ELEMENT METHOD FOR OBTAINING

APPROXIMATE SOLUTIONS TO LINEAR ELASTICITY PROBLEMS. THE ANALYTICAL METHODS ARE APPLIED TO AN ACTUAL EMBANKMENT OVER A RIGID CULVERT THE BARREL OF WHICH WAS INSTRUMENTED WITH PRESSURE METERS. THE ANALYTICAL RESULTS FOR TWO CONDITIONS OF THE EARTH'S CRUST, VARIOUS FILL PROPERTIES AND FOR A HAY BLOCK DELIBERATELY PLACED ABOVE THE CROWN OF THE CULVERT /AS IN THE ACTUAL CONSTRUCTION/ ARE COMPARED WITH THE RECORDED PRESSURES. IT IS CONCLUDED THAT GIVEN A PROPER DESCRIPTION OF THE MATERIAL PROPERTIES, IN PARTICULAR THE RATIO OF FILL HAY MODULUS, AN ACCURATE DISTRIBUTION OF BARREL PRESSURE MAY BE OBTAINED. /AUTHOR/

Brown, CB
California Division Highways, California University, Berkeley Hpr-1/4/

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4615192 66)

3A 207843

PERFORMANCE OF COMPOSITE LIGHTWEIGHT CONCRETE DECKS ON STEEL STRINGERS
RESULTS ARE PRESENTED OF A FIELD AND ANALYTICAL STUDY INTO THE CAUSES OF CRACKING OF LIGHTWEIGHT CONCRETE BRIDGE SLABS IN LOUISIANA. THE FIELD STUDY INVOLVED THE DETERMINATION OF THE PRESENT CONDITION OF 389 SIMPLY SUPPORTED LIGHTWEIGHT CONCRETE BRIDGE SLABS BUILT COMPOSITELY WITH STEEL STRINGERS. THIS INCLUDED A CRACK SIZE AND DISTRIBUTION STUDY AND A DETERMINATION OF REINFORCEMENT EMBEDMENT DEPTH. AVAILABLE CONSTRUCTION RECORDS WERE REVIEWED, CLIMATIC CONDITIONS TO WHICH THE STRUCTURES HAD BEEN SUBJECTED WERE STUDIED ALONG WITH THE TRAFFIC HISTORY OF EACH BRIDGE. THE ANALYTICAL STUDIES ATTEMPTED TO RELATE DESIGN CRITERIA, DYNAMIC BEHAVIOR OF THE STRUCTURE AND CONCRETE SHRINKAGE TO THE PRESENT CONDITION OF THE BRIDGE. SOME OF THE CONCLUSIONS PRESENTED WERE: (1) THERE APPEARS TO BE NO REASONABLE RELATIONSHIP BETWEEN SLAB DETERIORATION AND MOST OF THE VARIABLES INVOLVED IN DESIGN AND CONSTRUCTION. (2) IF THE CONCRETE COVER WAS LESS THAN 3/4 INCHES, THE CRACKS TENDED TO COINCIDE WITH REINFORCEMENT ORIENTATION. IF THE COVER WAS LARGER, NO RELATIONSHIP BETWEEN CRACKS AND REINFORCEMENT ORIENTATION EXISTED, (3) SHRINKAGE STRAINS AS ANALYTICALLY DETERMINED ARE AS GREAT AS THE APPROXIMATE TENSILE STRENGTH OF THE CONCRETE, (4) THE DYNAMIC BEHAVIOR ANALYSIS POINTED TO THE SUPPOSITION THAT FOR SOME SPAN LENGTH AND LOADING COMBINATIONS, CRACK PROPAGATION IS CAUSED MAINLY BY OSCILLATIONS DUE TO MOVING VEHICLES. /BPR/

Turner, HT Aguilar, RJ
Louisiana State Univ & Agr & Mech Coll, Louisiana Department Highways 1965

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4641126 67)1C27020252, PB 176 067, 1C27021019

3A 207902

STUDY OF A PRECAST-PRESTRESSED MODEL BRIDGE SLAB
A HALF-SCALE CONCRETE COMPOSITE MODEL BRIDGE SLAB WAS STUDIED TO EVALUATE THE STRUCTURAL PERFORMANCE OF A 36-FOOT LONG, TWO-LANE, HIGHWAY BRIDGE SPAN. THE PROPOSED COMPOSITE MEMBER IS COMPOSED OF A PRESTRESSED CONCRETE CHANNEL, AN INTERIOR VOID FORM, AND A TOP SLAB OF CAST-IN-PLACE CONCRETE. A THEORETICAL ANALYSIS OF THE LOAD DISTRIBUTION BEHAVIOR OF AN ORTHOTROPIC PLATE BASED ON THE GUYON-MASSONNET DISTRIBUTION THEORY IS PRESENTED. APPLICATION OF THE THEORY TO THIS PARTICULAR BRIDGE SYSTEM TOGETHER WITH A SAMPLE CALCULATION IS PRESENTED IN AN APPENDIX. AN 18-FOOT LONG, 12 FT. 6 IN. WIDE MODEL BRIDGE SPAN CONSISTING OF FIVE PRESTRESSED CHANNELS AND A CAST-IN-PLACE TOP SLAB WAS CON-

STRUCTURED FOR THE PURPOSE OF EXPERIMENTAL VERIFICATION OF THE ANALYTICAL ANALYSIS. TWO SERIES OF TESTS WERE CONDUCTED IN THIS STUDY. IN THE FIRST SERIES OF TESTS A SINGLE CONCENTRATED LOAD WAS APPLIED TO A GRID OF 30 LOAD POINTS. THE LOAD DISTRIBUTION BEHAVIOR WAS STUDIED IN TERMS OF THE DISTRIBUTION PATTERN OF THE MEASURED DEFLECTIONS. IN THE SECOND SERIES OF TESTS A SIMULATED S16 TRAILER LOAD WAS APPLIED TO THE TWO-LANE MODEL BRIDGE SLAB. THE WHEEL LOAD DISTRIBUTION, THE ULTIMATE BEHAVIOR OF THE SYSTEM, AND THE FAILURE MODE WERE INVESTIGATED. COMPLETE COMPOSITE ACTION COMPRESSION CRUSHING OF THE TOP SLAB IN THE VICINITY OF THE LOAD LINE. /AUTHOR/

Salmons, JR Mokhtari, S
Missouri University, Columbia, Missouri State Highway Commission,
Bureau of Public Roads /US/ 1968

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4613892 69)HRIS 021446, HRIS 27021380, HRIS 27021956, 3C27021653, PB 183 620

3A 207904 STATIC BEHAVIOR OF CONTINUOUS-COMPOSITE-BOLTED BEAMS

A FURTHER INVESTIGATION IS DESCRIBED OF THE USE OF HIGH STRENGTH BOLTS FOR A MORE RIGID CONNECTION BETWEEN A CONCRETE SLAB AND A STEEL BEAM. THIS INVESTIGATION COVERS THE BEHAVIOR OF THE NEGATIVE MOMENT REGION OF CONTINUOUS-COMPOSITE MEMBERS LOADED TO FAILURE. EACH OF THE THREE MEMBERS TESTED CONSISTED OF A SIMPLY-SUPPORTED SPAN CONTINUING INTO A CANTILEVER. LOAD-DEFLECTION CURVES, STRAIN PROFILES, AND SLIP DISTRIBUTION CURVES WERE USED IN INVESTIGATING THE COMPOSITE BEHAVIOR OF THE MEMBERS. PREDICTED LOADS WERE COMPARED WITH THE ACTUAL LOADS OBTAINED. SIX TENSION-PUSHOUT SPECIMENS WERE ALSO INVESTIGATED. LOAD-SLIP CURVES WERE DETERMINED AND COMPARED WITH THOSE OBTAINED FROM THE COMPOSITE MEMBERS. FOLLOWING ARE SOME OF THE CONCLUSIONS MADE FROM THIS INVESTIGATION: (1) BECAUSE OF THE NATURE OF THE LOAD-SLIP PER BOLT DATA FOR THE COMPOSITE MEMBERS, A CONCLUSION FOR THE VALIDITY OF USING TENSION PUSHOUTS TO PREDICT CONNECTOR BEHAVIOR IN A MEMBER CAN NOT BE JUSTIFIED, (2) FOR THOSE MEMBERS WITH CONNECTORS OVER THEIR NEGATIVE MOMENT REGIONS, THERE WAS PRACTICALLY NO SLIP AT THEIR WORKING LOADS, (3) SIMPLE ULTIMATE STRENGTH THEORY CAN BE USED TO SATISFACTORILY PREDICT THE ULTIMATE CAPACITY IN THE NEGATIVE MOMENT REGION OF MEMBERS WITH CONNECTORS OVER THE NEGATIVE MOMENT REGIONS, AND (4) THE ELIMINATION OF CONNECTORS OVER THE NEGATIVE MOVEMENT REGION OF THE COMPOSITE MEMBER REDUCED THE WORKING THE FIRST YIELDING LOADS OF THAT MEMBER BY APPROXIMATELY 15%. /AUTHOR/

Dallam, LN Gaudini, P
Missouri University, Columbia, Missouri State Highway Commission,
Bureau of Public Roads /US/ 1969

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4622332 69)HRIS 27022093, 3C27021687

3A 207911 DOUBLE PLATED STEEL BRIDGE DECKS

FOUR SPECIAL COMPOSITE TEST PANELS WERE FABRICATED AND TESTED. THESE TEST PANELS CONSISTED OF TWO THIN PARALLEL STEEL PLATES HELD TOGETHER BY A GROUP OF THIN STUDS WELDED TO THE PLATES. THE SPACE BETWEEN THE PLATES WAS FILLED WITH AN EXPANDING CEMENT-LIGHTWEIGHT CONCRETE. TWO TEST PANELS WERE TESTED IN FLEXURE, AND TWO IN DIRECT COMPRESSION. THE OBJECT OF THIS PILOT STUDY WAS TO SEE HOW SUCH SANDWICH PANELS BEHAVED UNDER LOAD. RESULTS SHOWED THAT THE ULTIMATE CAPACITY OF THE PANELS

WAS 50 PERCENT GREATER THAN COMPARABLE REINFORCED CONCRETE BEAMS. HOWEVER, CRACKS APPEARED EARLY IN THE TESTS. /BPR/

Zuk, W
Virginia Highway Research Council, Virginia Department Highways,
Bureau of Public Roads /US/ Apr. 1969

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4613432 69)PB-184 953, 1C27021757

3A 207936 STUDY OF A PROPOSED PRECAST-PRESTRESSED COMPOSITE BRIDGE SYSTEM

THE RESEARCH EFFORTS ON MISSOURI COOPERATIVE RESEARCH PROJECT NO. 67-1, "STUDY OF PRECAST-PRESTRESSED COMPOSITE SLABS" ARE SUMMARIZED. A PARTICULAR TYPE OF PRECAST-PRESTRESSED COMPOSITE BOX BRIDGE DECK SYSTEM IS PROPOSED FOR USE IN HIGHWAY BRIDGE CONSTRUCTION ON PRIMARY AND SECONDARY ROADWAYS. THE BASIC CONCEPT AND DESIGN PROCEDURE, AS WELL AS AN EVALUATION OF THE STRUCTURAL PERFORMANCE AND AN ECONOMIC EVALUATION OF THE PROPOSED SYSTEM, ARE SUMMARIZED. IN ADDITION TO THESE SUMMARIES DESIGN RECOMMENDATIONS FOR THE PROPOSED SYSTEMS ARE MADE. /BPR/

Salmons, JR
Missouri University, Columbia, Missouri State Highway Commission,
Bureau of Public Roads /US/ 67-1

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4613892 70)REPORT PENDING, HRIS 27021380, HRIS 27021446, 1C27022013, HRIS 27021653

3A 207938 COMPOSITE BRIDGE STRINGERS-FINAL REPORT

A SUMMARY IS GIVEN OF THE RESULTS OF AN EXTENSIVE RESEARCH PROGRAM ESTABLISHED TO DETERMINE THE BEHAVIOR AND EFFICIENCY OF SHEAR CONNECTORS IN THE DESIGN OF COMPOSITE BRIDGE MEMBERS. FIVE PREVIOUS DETAILED REPORTS PLUS A BIBLIOGRAPHY HAVE BEEN ISSUED AND ARE LISTED. ITEMS OF PARTICULAR INTEREST TO DESIGNERS ARE THE RESULTS OF STUDIES OF STUD SHEAR CONNECTORS IN LIGHTWEIGHT CONCRETE AND THE EFFECT OF HAUNCHES ON COMPOSITE DESIGN. DESCRIPTIONS OF THE PUSHOUT TESTS, LOAD SLIP CURVES AND STUD SHEAR CONNECTOR CAPACITY CURVES ARE INCLUDED. COMPARISON OF TEST RESULTS WITH 1967 DESIGN PRACTICE INDICATES THAT DESIGN IS MORE CONSERVATIVE THAN NECESSARY. /BPR/

Baldwin, JW
Missouri University, Columbia, Missouri State Highway Commission,
Bureau of Public Roads /US/ 63-2

ACKNOWLEDGMENT: Bureau of Public Roads /US/REPORT PENDING, 1C27022050

3A 208029 A REPORT ON BRIDGE GIRDER WEBS SUBJECTED TO HORIZONTAL LOADS

IN CONSTRUCTION OF PLATE GIRDERS, WHEN NO GROUND SUPPORTED FALSEWORK IS USED, METAL BRACKETS BOLTED TO THE WEB OF THE EXTERIOR GIRDERS ARE USED TO SUPPORT CONSTRUCTION LOADS. THE OBJECTIVE OF THIS STUDY WAS TO INVESTIGATE THE WEB STRESSES AND DEFLECTIONS WHICH OCCUR AS A RESULT OF USING TEMPORARY CONSTRUCTION BRACKETS. FOUR BRACKET TYPES WERE STUDIED EXPERIMENTALLY UNDER IDEAL CONDITIONS; A MATHEMATICAL SOLUTION WAS ESTABLISHED FOR A SIMPLIFIED BRACKET TO PREDICT THE STRUCTURAL BEHAVIOR OF THE WEB UNDER LATERAL LOADS; AND FINALLY, WEB STRESSES AND DEFLECTIONS DUE TO TEMPORARY BRACKET LOADS WERE DETERMINED FOR AN ACTUAL BRIDGE UNDER CONSTRUCTION. SUCH STRESSES

WERE COMPARED WITH LABORATORY TESTS TO AID IN ACCURATELY DETERMINING THE BEHAVIOR OF A GIRDER WEB WHEN SUBJECTED TO HORIZONTAL LOADING. /AUTHOR/

Shoukry, Z
South Dakota Department Highways, South Dakota State Univ,
Brookings, Federal Highway Administration /US/ Study No 646 (68)

ACKNOWLEDGMENT: Federal Highway Administration (40s1-142)REPORT PENDING, 2C27022792

3A 208050

SELF-STRESSED SANDWICH BRIDGE DECKS

PRESENTED IS AN ENTIRELY NEW TYPE OF BRIDGE DECK, CONSISTING OF AN UNREINFORCED LIGHTWEIGHT CONCRETE SLAB MADE OF EXPANDING CEMENT SANDWICHED BETWEEN TWO THIN PLATES OF STEEL. THE EXPANDING CORE SERVES TO PRESTRESS THE PANEL. LABORATORY TESTS WERE CONDUCTED ON THE CONCRETE TO DETERMINE PREDICTABLE RELATIONSHIPS FOR EXPANSION. LABORATORY TESTS WERE ALSO CONDUCTED ON TEN SMALL SCALE PANELS, SOME LOADED WITH A CONCENTRATED LOAD AND OTHERS WITH A UNIFORMLY DISTRIBUTED LOAD. INSTRUMENTATION WAS INSTALLED TO MEASURE STRAINS AND DEFLECTIONS. MATHEMATICAL THEORIES WERE ALSO DEVELOPED TO PREDICT BOTH THE PRESTRESSING AND EXTERNAL LOAD BEHAVIOR OF THE PANELS. A SATISFACTORY CORRELATION WAS FOUND BETWEEN THE TEST RESULTS AND THE THEORY. A COMPARATIVE STUDY OF THE PROPOSED SANDWICH PANELS AND STANDARD REINFORCED CONCRETE SLABS INDICATED THAT THE PROPOSED SANDWICH PANELS ARE SUBSTANTIALLY STRONGER AND STIFFER THAN CONCRETE SLABS USING THE SAME QUANTITY OF CONCRETE AND STEEL. /AUTHOR/

Zuk, W Sinha, R
Virginia Highway Research Council Nov. 1971

ACKNOWLEDGMENT: Federal Highway Administration NTIS PB 207841, 2C27022929

3A 208058

PART III: CONDITION OF 249 FOUR-YEAR-OLD BRIDGE DECKS

249 BRIDGE DECKS IN PENNSYLVANIA, WHICH ARE OVER 30 FEET IN LENGTH AND WERE BUILT IN 1966 WERE EXAMINED FOR SIGNS OF DETERIORATION. EVIDENCE OF FRACTURE PLANES, SPALLS, CRACKS, SURFACE MORTAR DETERIORATION, AND MINOR EVIDENCE OF DETERIORATION WERE EVALUATED. THIS DETERIORATION WAS CORRELATED WITH ALL POSSIBLE FACTORS WHICH WERE BELIEVED TO INFLUENCE SUCH DETERIORATION, SUCH AS: STRUCTURAL STIFFNESS, DEPTH OF STEEL, SUPERSTRUCTURE TYPE, CONSTRUCTION PRACTICES, FLEXURAL STRENGTH OF THE CONCRETE, RETARDER USE, NUMBER OF SALT APPLICATIONS PER YEAR, FORM TYPE, SPAN LENGTH, MAXIMUM PLACEMENT TEMPERATURE, ANTISKID MATERIAL, AVERAGE DAILY TRAFFIC, DEICING CHEMICAL TYPE, FINISHING MACHINE, AND AGGREGATE SOURCES. THREE PRIMARY CONCLUSIONS AND FINAL RECOMMENDATIONS WERE ADVANCED: (1) BOTH EXCELLENT AND POOR QUALITY BRIDGE DECKS CAN BE CONSTRUCTED USING PRESENT PRACTICES AND SPECIFICATIONS. IT APPEARS THAT SPECIFIC PRACTICES AND SPECIFIC MATERIALS CAUSE DETERIORATION. (2) DIFFERENT CONTRACTORS PRODUCE DECKS OF WIDELY DIFFERENT QUALITIES. THIS SUGGESTS THAT SOME CONSTRUCTION PRACTICES ARE BETTER THAN OTHERS IN REDUCING OR ELIMINATING THE THREE PRINCIPAL FORMS OF DETERIORATION. THE PRIME EXAMPLE OF THIS IS THE RECURRENT RELATIONSHIP WE OBSERVED BETWEEN FRACTURE PLANES AND SPALLS AND SHALLOW REINFORCING STEEL. (3) ALTHOUGH STAY-IN-PLACE (SIP) FORMED DECKS HAVE FAR FEWER CRACKS THAN CONVENTIONALLY FORMED DECKS, THEY EXHIBIT SOMEWHAT MORE MORTAR DETERIORATION (PRIMARILY EVIDENCED BY WEAR). /PSU/

Cady, PD Carrier, RE Bakr, TA Theisen, JC
Pennsylvania State University, Pennsylvania Department Transp Dec.
1971, 153 pp

ACKNOWLEDGMENT: Federal Highway Administration REPORT PENDING, 2C27022979

3A 208082

EVALUATION OF A PRESTRESSED PANEL, CAST-IN-PLACE CONCRETE BRIDGE

A RELATIVELY NEW TYPE OF BEAM AND SLAB BRIDGE WHICH MAKES USE OF PRECAST, PRESTRESSED PANELS AS PART OF THE SLAB WAS INVESTIGATED. IN THIS TYPE OF BRIDGE CONSTRUCTION, THE PANELS ARE PLACED TO SPAN BETWEEN THE BEAMS AND SERVE AS FORMS FOR THE CAST-IN-PLACE PORTION OF THE DECK. THEY REMAIN IN PLACE TO BECOME AN INTEGRAL PART OF THE CONTINUOUS STRUCTURAL SLAB. COMPOSITE ACTION IS OBTAINED IN THE STRUCTURE BY BONDING THE PRESTRESSED ELEMENTS TOGETHER WITH THE CAST-IN-PLACE PORTION OF THE DECK. THIS TYPE OF STRUCTURE INCORPORATES UNPROVEN STRUCTURAL DETAILS-- THE BONDING OF CONCRETE AT THE INTERFACES AND THE INCLUSION OF PANEL BUTT JOINTS. THIS STUDY EXPERIMENTALLY AND THEORETICALLY INVESTIGATED THE ABILITY OF THIS TYPE OF STRUCTURE TO DISTRIBUTE WHEEL LOADS IN A SATISFACTORY MANNER AND TO BEHAVE AS A COMPOSITE UNIT. A FULL-SCALE, SIMPLE SPAN, PRESTRESSED PANEL TYPE BRIDGE WAS STRUCTURALLY TESTED IN THE LABORATORY. THE BRIDGE WAS SUBJECTED TO CYCLIC APPLICATIONS OF DESIGN LOADS AND FINALLY TO STATIC FAILURE LOAD. IT PERFORMED SATISFACTORILY UNDER ALL LOAD CONDITIONS. ON THE BASIS OF INFORMATION DEVELOPED IN THIS STUDY, IT WAS CONCLUDED THAT THE USE OF PRESTRESSED PANELS IS A SUITABLE METHOD OF HIGHWAY BRIDGE CONSTRUCTION. /FHWA/

Buth, E Furr, HL Jones, HL
Texas Transportation Institute, Texas State Department of Highways &
Public Transp, Federal Highway Administration /US/ Intrm Rept Sept.
1972, 151 pp

ACKNOWLEDGMENT: Federal Highway Administration FHWA S0098, REPORT PENDING, 2C27023258

3A 208125

LOAD DISTRIBUTION IN A COMPOSITE STEEL BOX GIRDER BRIDGE

FIELD TESTS WERE PERFORMED TO ASSESS THE BEHAVIOR OF A STEEL BOX GIRDER BRIDGE HAVING A COMPOSITE, CONCRETE, ROADWAY DECK SLAB. THE STRUCTURE WAS INSTRUMENTED AT ONE MIDSPAN CROSS-SECTION AND A SECTION NEAR THE SUPPORT OF SPAN 20, ONE OF THE SIMPLE APPROACH SPANS, TO PERMIT STUDIES OF BENDING AND SHEAR STRAIN DISTRIBUTIONS. LIVE LOAD WAS APPLIED WITH A SIMULATED AASHO DESIGN TRUCK AND A DOUBLE GOOSE-NECK, LOWBED HAULER BALLASTED TO A GROSS LOAD OF 220,000 POUNDS. THEORETICAL ANALYSES WERE PERFORMED WITH A FINITE ELEMENT PROGRAM CALLED FINPLA. LIVE LOAD MEMBRANE STRAINS WERE ACCURATELY PREDICTED BY THE PROGRAM, BUT FIBER STRAINS, ESPECIALLY IN THE TRANSVERSE DIRECTION, WERE GREATLY INFLUENCED BY PLATE WARPAGE AND INITIAL, LOCAL, DEAD LOAD DEFLECTIONS. MEASURED DEAD LOAD STRAINS WERE LARGER THAN THEORETICAL AND MAY HAVE BEEN INFLUENCED IN SOME DEGREE BY FALSEWORK. DEAD AND LIVE LOAD DEFLECTIONS WERE APPROXIMATED BY THE THEORETICAL ANALYSIS, BUT THE PROGRAM OVER-ESTIMATED THE TORSIONAL STIFFNESS OF THE SUPERSTRUCTURE. LIVE LOAD STRAINS WERE NEGLIGIBLY CHANGED BY THE ADDITION OF CONCRETE BARRIER RAILINGS. LIVE LOAD SHEAR STRESSES NEAR THE SUPPORT WERE CORRECTLY PREDICTED BY THE PROGRAM ON THE UNLOADED SIDE, BUT THE MEASURED STRESSES DIFFERED IN MAGNITUDE AND VERTICAL DISTRIBUTION ALONG THE WEB

FROM THOSE PREDICTED BY THE PROGRAM ON THE LOADED SIDE; HOWEVER, THE STRUCTURE HAD BEEN MATHEMATICALLY MODELLED FOR ACCURATE PREDICTION ON MID-SPAN STRAINS RATHER THAN SHEAR STRESSES. /FHWA/

Davis, RE Castleton, GA
California Department Transportation, California Department Public Works, Calif Business & Transportation Agency Res Rpt, June 1973

ACKNOWLEDGMENT: Federal Highway Administration FHWA S0205, NTIS PB 229 948/AS, 1C27023618

3A 208166

BRITISH IDEAS INFLUENCE WORLD BRIDGE BUILDING
NEW CONCEPTS IN BRIDGE DESIGN DEVELOPED BY BRITISH ENGINEERS HAVE RESULTED IN LONGER, MORE ECONOMIC SPANS. THE EXTENSIVE USE OF WELDED STEEL BOX GIRDERS IN SPANS AND IN TOWERS AS WELL AS AN AERODYNAMIC DESIGN HAS DECREASED THE WEIGHT OF THE BRIDGES WHILE INCREASING STABILITY IN SUSPENSION BRIDGES. A RELATIVELY NEW CONCEPT IN THE CABLE CANTILEVER BRIDGE ARE COMPOSITE STRUCTURES OF STEEL AND CONCRETE WHICH WERE FOUND TO BE THE MOST PRACTICAL BUILDING MATERIALS. /CGRA/

Ripley, JG *Engineering and Contract Record /Can/* June 1965

3A 208177

JURY URGES NEW BRIDGE FALSEWORK SPECS
IMPROVED FALSEWORK SPECIFICATIONS, ENGINEERED TO A STANDARD PROVINCIAL CODE, HAVE BEEN RECOMMENDED AS A RESULT OF A CORONERS INQUEST INTO THE COLLAPSE OF PARTIALLY BUILT, 217-FT-LONG CENTRAL PORTION OF THE HERON ROAD BRIDGE IN OTTAWA. A FIVE-MAN CORONERS JURY ALSO RECOMMENDED IMPROVED CONTRACTOR-CONSULTANT LIAISON AND BETTER TRAINING FOR SAFETY INSPECTORS. THREE FACTORS, THE JURY SAID, CONTRIBUTED TO THE FAILURE: /1/ LACK OF EXPERIENCE ON THE PART OF THE CONTRACTOR IN FALSEWORK ON A PROJECT OF THIS SIZE, /2/ TOO GREAT A DEPENDENCE ON ASSUMED SIMILARITIES BETWEEN THE ROUGE RIVER BRIDGE NEAR TORONTO AND THE HERON ROAD BRIDGE. THE ROUGE RIVER BRIDGE WAS MENTIONED SEVERAL TIMES IN TESTIMONY BY THE CONTRACTORS ENGINEERS, AND /3/ INADEQUATE DIAGONAL BRACING IN THE LONGITUDINAL DIRECTION. /CGRA/

Inglis, F *Heavy Construction News /Canada/* Dec. 1966

ACKNOWLEDGMENT: Canadian Good Roads Association

3A 208179

ALBERTA CUTS ERECTION TIME IN HALF BY PRECASTING PIER, DECK UNITS FOR BRIDGE
THIS REPORT OUTLINES THE USE OF PRECAST, PRESTRESSED COMPONENTS FOR PIER AND DECK CONSTRUCTION, FOR A 288-FT. LONG STRUCTURE /OVERPASS/ ON HIGHWAY 16 NEAR EDMONTON. ONSITE CONSTRUCTION TIME WAS REDUCED TO ABOUT HALF THAT OF CONVENTIONAL METHODS. COST WAS COMPARABLE WITH CONSTRUCTION OF STANDARD OVERPASS BRIDGES OF THE SAME SPAN RANGE. /CGRA/

Hayter, R *Heavy Construction News /Canada/* Jan. 1967

ACKNOWLEDGMENT: Canadian Good Roads Association

3A 208188

SEVEN GIANT TUNNEL SECTIONS ARE FLOATED OUT OF DRYDOCK
THE LOUIS-HIPPOLYTE LAFONTAINE TUNNEL IS THE LARGEST PRESTRESSED PRECAST CONCRETE STRUCTURE IN THE WORLD. THE TUNNEL ITSELF IS 4,560 FT LONG AND IT FORMS PART OF A 3.5 MI. BRIDGE-TUNNEL COMBINATION THAT CROSSES THE ST. LAWRENCE RIVER AT THE EAST END OF MONTREAL ISLAND. THE ENTIRE PROJECT WILL COST \$60 MILLION, OF WHICH THE TUNNEL ALONE ABSORBS \$42 MIL-

LION. THE TUNNEL WILL CARRY 6 LANES OF TRAFFIC AND IS ONE OF THE LAST REMAINING LINKS IN THE TRANS-CANADA HIGHWAY. THE ARTICLE DEALS WITH THE CONSTRUCTION AND PLACING OF THE SEVEN 360-FT LONG TUNNEL ELEMENTS EACH WEIGHING 32,000 TONS. /CGRA/

Caplan, B *Engineering and Contract Record /Can/* July 1965

ACKNOWLEDGMENT: Canadian Good Roads Association

3A 208190

THE LOUIS HIPPOLYTE LAFONTAINE BRIDGE TUNNEL COMPLEX

THE TRANS-CANADA HIGHWAY CROSSING OF THE ST. LAWRENCE RIVER BETWEEN THE CITIES OF MONTREAL AND JACQUES-CARTIER IS DISCUSSED. CHOICE OF LOCATION AND LAY-OUT OF THE CROSSING COMPLEX, TUNNEL CHARACTERISTICS AND GEOMETRIC DESIGN STANDARDS, TYPICAL CROSS-SECTIONS, SHAPE, TUNNEL DIMENSIONS, CONSTRUCTION OF THE UNDERWATER ELEMENTS, DREDGING AND PLACING OF PREFABRICATED UNITS, AS WELL AS SPECIAL FEATURES OF THE TUNNEL SECTIONS ARE DISCUSSED. /CGRA/

Branchaud, A *Engineering Journal /Canada/* Apr. 1967

ACKNOWLEDGMENT: Canadian Good Roads Association

3A 208201

COMPOSITE STEEL-CONCRETE MULTI-BOX GIRDER BRIDGES

A DISCUSSION OF BACKGROUND STUDIES OUT OF WHICH EVOLVED THE "CRITERIA FOR DESIGN OF STEEL-CONCRETE COMPOSITE BOX GIRDER HIGHWAY BRIDGES" IS GIVEN, AS WELL AS THE RESULTS OF DESIGN STUDIES ON SEVERAL BRIDGES USING THE CRITERIA. THE TYPE OF BRIDGE UNDER CONSIDERATION IS OF MODERATE LENGTH (UP TO 350 FEET) AND CONSISTS OF RECTANGULAR OR TRAPEZOIDAL SECTION STEEL GIRDERS MADE COMPOSITE WITH A REINFORCED CONCRETE DECK SLAB. /CGRA/

Fountain, RS
Canadian Inst Steel Constr, Toronto Feb. 1968

ACKNOWLEDGMENT: Canadian Good Roads Association

3A 208214

PIERS SHAPE-UP FOR NEW CROSSING OF N.B.S. SAINT JOHN RIVER

A BRIEF DESCRIPTION IS PRESENTED OF THE DESIGN AND METHODS BEING USED IN THE CONSTRUCTION OF THE BURTON BRIDGE WHICH WILL CROSS THE ST. JOHN RIVER 15 MILES BELOW THE CITY OF FREDERICTON, NEW BRUNSWICK. THE BRIDGE WAS FIRST DESIGNED FEATURING A CABLE-TAYED ORTHOTROPIC DECKED SUPERSTRUCTURE, BUT LATER THE DESIGN WAS CHANGED IN ORDER TO COPE WITH UNDERSIRABLE WIND-BEHAVIOR CHARACTERISTICS. /CGRA/

Heavy Construction News /Canada/ Aug. 1969

ACKNOWLEDGMENT: Canadian Good Roads Association

3A 208258

ULTIMATE STRENGTH DESIGN FOR HIGHWAY BRIDGES
AN ULTIMATE STRENGTH DESIGN METHOD FOR HIGHWAY BRIDGES IS PRESENTED. HIGHWAY BRIDGES HAVE VARIABLE LIVE LOAD CAPACITY, AND THE SMALLER BRIDGES CONTROL HIGHWAY SYSTEM CAPACITY. IT IS DEMONSTRATED THAT THE PRESENT MINIMUM CAPACITY IS 2.0 LIVE LOADS. A LOWER BOUND LOADING OF 1.5 DEAD LOADS PLUS 2.0 LIVE LOADS IS ADVOCATED FOR ALL COMMON BRIDGES. THIS LOADING IS APPLIED TO CONCRETE DECKS, REINFORCED CONCRETE GIRDERS, PRESTRESSED GIRDERS, COMPOSITE STEEL GIRDERS, TRUSSES, AND SUBSTRUCTURES. THESE HAVE INTERMEDIATE GRADE REINFORCING STEEL AND A36

STRUCTURAL STEEL. CONCRETE GIRDER BRIDGES CAN BE COMPLETELY DESIGNED USING EXISTING SPECIFICATIONS. DEVELOPMENT WORK REMAINS TO BE DONE ON STEEL GIRDER BRIDGES AND TRUSSES. THE PROPOSED DESIGN METHOD OFFERS CONSISTENT SERVICE RATINGS AND MATERIAL ECONOMICS IN ALL COMMON BRIDGE TYPES. THE SAVINGS ARE ESTIMATED TO BE 4 PER CENT OF THE NATIONAL BRIDGE BUDGET. /AUTHOR/

Payne, HL Caldwell, LH *Am Soc Civil Engr J Structural Div* Oct. 1965

ACKNOWLEDGMENT: Highway Res Abstracts Hwy Res Board

3A 208263

RECENT DEVELOPMENTS IN HIGHWAY BRIDGE DESIGN AND CONSTRUCTION

RECENT ADVANCES IN THE METHODS OF DESIGN AND CONSTRUCTION OF CONCRETE AND STEEL HIGHWAY BRIDGES IN GREAT BRITAIN AND ABROAD ARE PRESENTED. BASIC REQUIREMENTS OF GOOD DESIGN AND PROGRESS IN COMPUTER PROCEDURES ARE DISCUSSED RESEARCH WORK CARRIED OUT BY THE ROAD RESEARCH LABORATORY, BRITISH WELDING RESEARCH ASSOCIATION AND CEMENT AND CONCRETE ASSOCIATION AND AT VARIOUS UNIVERSITIES ON COMPOSITE CONSTRUCTION, CRACK CONTROL OF CONCRETE, BEHAVIOR OF BEARINGS AND EXPANSION JOINTS, STRENGTH OF PARAPETS, FATIGUE EFFECTS, PROTECTIVE TREATMENT OF STEEL AND DE-ICING OF BRIDGE DECKS IS VERY BRIEFLY DESCRIBED. /AUTHOR/

Kerensky, OA *Inst Hwy Engineers Journal, London /UK/* July 1966

ACKNOWLEDGMENT: Highway Res Abstracts Hwy Res Board

3A 208306

PREFABRICATED COMPOSITE HIGHWAY BRIDGE UNITS WITH INVERTED STEEL T-BEAMS

A PREFABRICATED BRIDGE UNIT CONSISTING OF A CONCRETE DECK CONNECTED TO TWO STEEL INVERTED T-BEAMS BY STUDS WAS DEVELOPED TO MEET THE CURRENT NEED OF HIGHWAY ENGINEERS FOR A LOW-COST PREFABRICATED SHORT-SPAN BRIDGE UNIT THAT CAN BE RAPIDLY ERECTED. A MAIN FEATURE OF THESE PREFABRICATED COMPOSITE BRIDGES IS THAT, UNLIKE CONVENTIONAL COMPOSITE BEAM BRIDGES, THE STEEL BEAMS IN THESE UNITS HAVE NOT TOP FLANGES. ANOTHER ADVANTAGE IS THAT MOST OF THE CONCRETE SHRINKAGE OCCURS BEFORE ERECTION, AND PRE-ERECTION SHRINKAGE CRACKS PARALLEL TO THE LONGITUDINAL AXIS OF EACH UNIT WOULD BE UNLIKELY. THUS, PREFABRICATION GREATLY REDUCES THE POSSIBILITY OF SHRINKAGE CRACKS PARALLEL TO THE LONGITUDINAL AXIS OF THE BRIDGE IN FINISHED STRUCTURE. DESIGNS ARE PRESENTED FOR UNITS WITH INVERTED STEEL T-BEAMS HAVING SEVERAL DIFFERENT UNITS WIDTHS AND DIFFERENT SPANS. IT APPEARS THAT UNITS WOULD BE BOTH STRUCTURALLY ADEQUATE AND ECONOMICAL.

Mcdermott, JF *Highway Research Record, Hwy Res Board* 1967

3A 208320

CORROSION-RESISTANT STEEL IN HIGHWAY BRIDGES

COST STUDIES INDICATE THAT CORROSION-RESISTANT HIGH STRENGTH LOW ALLOY STEELS HAVE DEFINITE ECONOMIC POSSIBILITIES FOR USE IN SHORT AND MEDIUM LENGTH HIGHWAY BRIDGES. A NICKEL-COPPER TYPE OF HIGH STRENGTH LOW ALLOY STEEL SHOULD BE USED DUE TO ITS BETTER RESISTANCE TO ATMOSPHERIC CORROSION. ANALYTICAL COST COMPARISONS ARE MADE OF THE SUPERSTRUCTURES OF TYPICAL SHORT SPAN CONCRETE SLAB AND ROLLED WIDE FLANGE STEEL STRINGER HIGHWAY BRIDGES FABRICATED FROM NICKEL-COPPER HIGH STRENGTH LOW ALLOY STEEL WITH THOSE FABRICATED FROM ASTM A7 AND A373 STEELS. COST COMPARISONS ARE MADE FOR WELDED I-SECTION STRINGERS WITH CONCRETE DECK FOR SHORT AND MEDIUM LENGTH HIGHWAY BRIDGES. THESE STRUC-

TURES ARE DESIGNED IN ACCORDANCE WITH STANDARD PRACTICE AND SPECIFICATIONS. COST COMPARISONS ARE MADE OF THE USE OF HIGH STRENGTH STEELS IN FORMS FOR HIGHWAY BRIDGES INDEPENDENT OF STANDARD DESIGN SPECIFICATIONS. A PRECAST HIGH STRENGTH CONCRETE DECK IS DESIGNED TO ACT INTERGRALLY WITH A ONE OR A THREE CELL STEEL BOX GIRDER. A DESIGN PROCEDURE IS PRESENTED FOR THE COMPOSITE BOX SUPERSTRUCTURE. /ASCE/

Am Soc Civil Engr J Highway Div Apr. 1967

3A 208328

PILE FOUNDATIONS IN DISCONTINUOUS PERMAFROST AREAS

THE DESIGN AND INSTALLATION OF PILES IN AREAS OF WARM PERMAFROST PRESENT MANY UNUSUAL PROBLEMS. DESIGN CONSIDERATIONS AND CONSTRUCTION METHODS AND CONTROLS TO MINIMIZE DISTURBANCE OF THE DELICATE THERMAL BALANCE OF WARM PERMAFROST ARE INCLUDED IN AN EVALUATION OF PILE INSTALLATION TECHNIQUES. THE IMPORTANCE OF ADEQUATE SITE INVESTIGATIONS AND PROPER CONSTRUCTION INSPECTION AND CONTROL IS EMPHASIZED. PRECONSTRUCTION TEMPERATURE INFORMATION IS USED WITH CLIMATOLOGICAL RECORDS AND THEORETICAL METHODS TO PREDICT THE FREEZING AND/OR THAWING THAT WILL BE EXPERIENCED UNDER THE STRUCTURE. NATURAL AND ARTIFICIAL FREEZEBACK OF PILES ARE DISCUSSED IN TERMS OF CONSTRUCTION SCHEDULES, INSTALLATION METHODS, AND THE VOLUMETRIC HEAT CAPACITY OF THE PERMAFROST. /AUTHOR/

Crory, FE *Crrrel Special Reports, Army Dept /US/* Mar. 1967

3A 208406

AN INVESTIGATION OF THE EFFECTIVE CONCRETE SLAB WIDTH FOR COMPOSITE CONSTRUCTION

A DESCRIPTION IS GIVEN OF AN EXPERIMENTAL INVESTIGATION FOR DETERMINING THE EFFECTIVE WIDTH OF A CONCRETE SLAB ACTING COMPOSITELY WITH A SERIES OF THREE ROLLED STEEL BEAMS. THE PROGRAM WAS CONDUCTED BY THE DEPARTMENT OF CIVIL ENGINEERING AT VANDERBILT UNIVERSITY UNDER THE SPONSORSHIP OF THE AMERICAN IRON AND STEEL INSTITUTE. THE OBJECTIVE OF THE PROGRAM WAS TO DETERMINE ACTUAL EFFECTIVE SLAB WIDTHS AND COMPARE THEM WITH ALLOWABLE VALUES AS SPECIFIED BY THE 1963 EDITION OF THE AISC SPECIFICATION FOR THE DESIGN, FABRICATION, AND ERECTION OF STEEL FOR BUILDINGS. THE SPECIFICATION STATES THAT THE EFFECTIVE SLAB WIDTHS IS TO BE COMPUTED BY THE SMALLEST OF THE FOLLOWING CRITERIA: (A) THE TOTAL EFFECTIVE WIDTH SHALL BE TAKEN AS NOT MORE THAN ONE-FOURTH THE SPAN OF THE BEAM. (B) THE EFFECTIVE PROJECTION BEYOND THE EDGE OF THE BEAM BLANGE SHALL NOT BE MORE THAN ONE-HALF THE CLEAR DISTANCE TO THE ADJACENT BEAM. (C) THE EFFECTIVE PROJECTION BEYOND THE EDGE OF THE BEAM FLANGE SHALL NOT BE MORE THAN EIGHT TIMES THE SLAB THICKNESS. FROM A REVIEW OF THE LITERATURE, ONLY ONE EXPERIMENTAL AND ANALYTICAL INVESTIGATION, CONDUCTED BY MACKEY AND WONG OF THE UNIVERSITY OF HONG KONG, COULD BE FOUND WHERE A CONCRETE SLAB WAS COMMON TO SEVERAL BEAMS AND WHERE THE EFFECTIVE SLAB WIDTH WAS OF PRIMARY INTEREST. ALTHOUGH THE TEST PROGRAM CONDUCTED BY MACKEY AND WONG WAS LIMITED IN SCOPE, THEY CONCLUDED THAT THE EFFECTIVE WIDTH IS MUCH LARGER THAN CURRENTLY RECOMMENDED FOR DESIGN. THE TEST PROGRAM AT VANDERBILT REINFORCED THESE CONCLUSIONS.

Hagood, TA Guthrie, L Hoadley, PG
American Institute Steel Construction Jan. 1968

3A 208434

CONTINUOUS INTEGRAL DECK CONSTRUCTION: A RATIONAL APPROACH TO PLACING STRUCTURAL DECK ON THREE-SPAN CONTINUOUS BRIDGE UNITS

ESTABLISHMENT OF STRUCTURAL CONCRETE SLABS ON THREE-SPAN CONTINUOUS STRUCTURES IS USUALLY ACCOMPLISHED BY SEGMENTAL PLACEMENT. THIS RESULTS IS DIFFICULTY IN OBTAINING PROPERLY CONSTRUCTED, SMOOTH RIDING SURFACES. WHEN COMPOSITE DESIGN AND CONSTRUCTION WAS ADOPTED, THE SEGMENTAL PRACTICE INTRODUCED OTHER UNDESIRABLE SIDE EFFECTS. A REQUEST WAS RECEIVED TO PLACE THE STRUCTURAL SLAB WITH INTEGRAL WEARING COURSE ON THE THREE-SPAN CONTINUOUS UNITS ON THE BRUCKNER EXPRESSWAY IN THE BRONX, NEW YORK. THIS IS A DIVIDED STRUCTURE WITH AN OVER-ALL WIDTH OF 94 FEET. EACH STRUCTURE HAS A MINIMUM TRAVELWAY OF 37 1/2 FEET. THERE IS AN 11-FOOT MALL BETWEEN THE TRAVELWAYS AND EACH THREE-SPAN CONTINUOUS UNIT IS APPROXIMATELY 210 FEET LONG. A FIELD RESEARCH PROGRAM WAS ESTABLISHED SO THAT DATA COULD BE OBTAINED RELATIVE TO DEFLECTION OF THE STRINGERS (THEORETICAL VS. ACTUAL), LOCATION OF THE REINFORCING STEEL TOGETHER WITH THE REQUIRED COVER, AND CONTROLLED ADDITION OF THE RETARDING ADMIXTURE, AS WELL AS A COMPLETE PHYSICAL REPORT OF THE CONCRETE PLACED FOR THIS OPERATION. THE RESULTS OBTAINED HAVE BEEN SIGNIFICANT IN THAT THIS STRUCTURE, WHICH IS 1 MILE LONG, HAS EXHIBITED MINIMAL MINUTE CRACKING IN BUT A FEW OF THE MANY THREE-SPAN CONTINUOUS UNITS. THE RIDING QUALITY OF THIS STRUCTURES IS EXCEPTIONAL SINCE THE AVERAGE FINAL FIELD PROFILE VARIES FROM THE THEORETICAL PROFILE BY ONLY 0.020 FEET.

Britton, HB *Highway Research Board Bulletin* 1962

3A 208466

CREEP IN PRESTRESSED LIGHTWEIGHT CONCRETE

A PROCEDURE, USING THE RATE-OF-CREEP METHOD, IS DEVELOPED FOR PREDICTING CREEP STRAINS, CAMBER, AND PRESTRESS LOSS IN PRETENSIONED, PRESTRESSED CONCRETE HIGHWAY BRIDGE BEAMS. THE PROCEDURE USES SHRINKAGE DATA AND CREEP PER PSI DATA, BOTH EXPRESSED AS FUNCTIONS OF TIME, DEVELOPED FROM SMALL CONCRETE SPECIMENS. NON-LOADED PRETENSIONED PRESTRESSED LIGHTWEIGHT CONCRETE BEAMS 5 X 8 IN. IN SECTION, 8 FT. LONG, WERE USED TO TEST THE PROCEDURE. CREEP AND PRESTRESS LOSSES TAKEN FROM THE BEAMS WERE COMPARED WITH VALUE PREDICTED BY USING THE PROCEDURE DEVELOPED IN THE PAPER. THE METHOD WAS EXTENDED TO ACCOMODATE PRECAST PRESTRESSED BEAMS WITH CAST-IN-PLACE REINFORCED CONCRETE SLABS, AND LABORATORY BEAMS WERE TESTED TO VERIFY THE PROCEDURES. A FULL SIZE HIGHWAY BEAM AND SLAB WERE INSTRUMENTED IN FIELD INSTALLATION TO CHECK OUT TECHNIQUES PROPOSED FOR USE IN A FULL SIZE HIGHWAY BRIDGE INSTALLATION. A FULL SIZE HIGHWAY BRIDGE USING PRECAST PRESTRESSED BEAMS AND CAST-IN-PLACE SLABS WAS INSTRUMENTED FOR PURPOSES OF TESTING THE PREDICTION METHOD. DATA FROM BEAMS HAS BEEN COLLECTED FOR APPROXIMATELY ONE YEAR. THE SLAB WAS BEING READIED FOR PLACING AT THE TIME OF WRITING. CREEP, SHRINKAGE, CAMBER, AND PRESTRESS LOSSES WERE TAKEN BY MEASUREMENTS OF STRAIN AND ELEVATIONS FROM THE BRIDGE BEAMS. PREDICTED CREEP, CAMBER, AND PRESTRESS LOSS BASED ON DATA FROM SMALL SPECIMENS ARE COMPARED WITH DATA DEVELOPED FROM MEASUREMENTS WITH THE 10IN. MECHANICAL STRAIN GAGE AND AN ENGINEERS LEVEL. REASONABLE AGREEMENT IS REACHED BETWEEN PREDICTIONS AND MEASUREMENTS. PRESTRESS LOSSES IN LIGHTWEIGHT FULL SIZE BRIDGE BEAMS ARE APPROXIMATELY 23% AND FOR NORMAL WEIGHT, APPROXIMATELY 14% AT 300 DAY AGE. /AUTHOR/

Furr, HL Sinno, R

Texas Transportation Institute, Texas State Department of Highways & Public Transp Oct. 1967

3A 208498

LATERAL DISTRIBUTION OF LOAD IN MULTIBEAM BRIDGES
A SUMMARY IS PRESENTED OF RESEARCH CONDUCTED ON THE LATERAL DISTRIBUTION OF LOAD IN MULTIBEAM BRIDGES. THIS TYPE OF BRIDGE IS CONSTRUCTED FROM PRECAST RECTANGULAR BEAMS MADE OF EITHER REINFORCED OR PRESTRESSED CONCRETE. THESE BEAMS ARE PLACED SIDE BY SIDE ON THE ABUTMENTS AND THE INTERACTION BETWEEN THE BEAMS IS DEVELOPED BY CONTINUOUS LONGITUDINAL SHEAR KEYS AND LATERAL BOLTS THAT MAY OR MAY NOT BE PRESTRESSED. THE INVESTIGATION INCLUDED A FIELD TEST, A THEORETICAL STUDY, AND A SERIES OF TESTS ON A LARGE-SCALE MODEL BRIDGE. THE THEORY OF ORTHOTROPIC PLATES WAS USED TO ANALYZE THE MULTI-BEAM BRIDGE. THE BENDING STIFFNESS IN THE LONGITUDINAL DIRECTION WAS CONSIDERED DIFFERENT FROM THE BENDING STIFFNESS IN THE LATERAL DIRECTION. THE STIFFNESS IN THE LATERAL DIRECTION IS DEPENDENT ON THE EFFICIENCY OF THE SHEAR KEYS AND LATERAL BOLTS. MEASURED DEFLECTION FROM TESTS WERE COMPARED WITH THE THEORETICAL CALCULATIONS. THE THEORY IS SHOWN TO YIELD A SOLUTION FOR THE DEFLECTION DISTRIBUTION WHICH AGREES VERY CLOSELY WITH THE EXPERIMENTAL RESULTS.

Hulsbos, CL *Highway Research Board Bulletin* 1962

3A 208589

SELF-ANCHORED PRESTRESSED CONCRETE SUSPENSION BRIDGES WITH PARABOLIC CABLES

THE CONCEPT OF THE PRESTRESSED CONCRETE SUSPENSION BRIDGE WITH PARABOLIC CABLES AND VERTICAL SUSPENDERS IS EXPUNDED. A SPECIMEN OF 100 M SPAN IS DESCRIBED. IT PROVED TO BE VERY ECONOMICAL. METHODS OF CONSTRUCTION OF THE SUPERSTRUCTURE OF SUCH BRIDGES AND METHODS OF PRESTRESSING THEM ARE REVIEWED. A DESIGN FOR A BRIDGE OF 350 M SPAN IS OUTLINED. IT WAS SUBMITTED IN A COMPETITION AND ALSO TURNED OUT TO BE VERY ECONOMICAL. THE ECONOMY OF PRESTRESSED CONCRETE SUSPENSION BRIDGE WITH TRIANGULAR SYSTEM OF SUSPENDERS IS PRESENTED. /RRL/A/

Vandepitte, D *Suspension Bridges Symposium /Portugal/* Nov. 1966

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 208672

CONCRETE SLABS WITH PARTIALLY EMBEDDED STEEL-BEAM SUPPORTS

AN INVESTIGATION INTO A SYSTEM OF CONSTRUCTION WHICH PREVIOUSLY COULD NOT BE USED BY THE STRUCTURAL DESIGNER BECAUSE OF LACK OF KNOWLEDGE OF ITS BEHAVIOR IS DESCRIBED. TESTS WERE MADE WHICH SIMULATED REINFORCED CONCRETE SLABS SUPPORTED ON UNENCASED STEEL BEAMS AT VARIOUS LEVELS OF EMBEDMENT FROM 0 TO 80% OF THE EFFECTIVE SLAB DEPTH. THE RESULTS ARE PRESENTED IN THE FORM OF SIMPLE EQUATIONS AND CAN BE APPLIED WITH CONFIDENCE TO SLABS NOT EXCEEDING 150 MM DEPTH AND 3 M SPAN. /RRL(A)/

Doncaster, AA Horsley, PD *Inst Civil Engineers Proc, London /UK/* Feb. 1970

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 208699

PERFORMANCE EVALUATION OF A PARTIALLY PRESTRESSED RIGID FRAME CONCRETE BRIDGE

THE CASCADE ORCHARDS BRIDGE IS A CONTINUOUS PARTIALLY PRESTRESSED RIGID FRAME CONCRETE BRIDGE. IT IS CONSTRUCTED FROM CAST-IN-PLACE CONCRETE BOX GIRDS.

ERS AND PRECAST, PRESTRESSED CONCRETE GIRDERS FIELD POST-TENSIONED FOR STRUCTURAL CONTINUITY. A DESCRIPTION OF THE STRUCTURE, DESIGN CRITERIA, AND CONSTRUCTION PROCEDURES INTRODUCES A SUMMATION OF FIELD OBSERVATION AND MEASUREMENT RESULTS ABOUT THE IN-SERVICE PERFORMANCE OF THIS BRIDGE. THE STRUCTURE'S RESPONSE TO LOADS AFFIRMS THE APPLICABILITY OF THE AVAILABLE DESIGN KNOWLEDGE TO A PARTIALLY PRESTRESSED AND REINFORCED CONCRETE STATICALLY INDETERMINATE BRIDGE SYSTEM. /RRL/

Grant, A Clark, JH
Intl Symp Concr Bridge Des Proc /Can/ 1969

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 208701
CONTINUOUS PRECAST PRESTRESSED CONCRETE BRIDGE STRINGERS

A METHOD OF STANDARDIZING THE DESIGN OF PRECAST BRIDGE STRINGERS IS PRESENTED ALONG WITH THEORETICAL DESIGN AND CONSTRUCTION PROCEDURES FOR DEVELOPING CONTINUITY IN MULTISPAN PRECAST PRESTRESSED CONCRETE BRIDGES. EMPHASIS HAS BEEN PLACED ON THE IMPORTANCE OF STANDARDIZING THE DESIGN OF PRECAST CONCRETE UNITS TO REDUCE FABRICATION COST AND INCREASE PRODUCT QUALITY. CURRENT PRACTICE OF THE ILLINOIS DIVISION OF HIGHWAYS FOR DEVELOPING CONTINUITY IN MULTISPAN BRIDGES IS DESCRIBED. THE DESIGN INCORPORATES MILD STEEL REINFORCEMENT IN THE BRIDGE DECK, STEEL DOWEL BARS AND A CONCRETE DIAPHRAGM BETWEEN STRINGERS. ADDITIONAL METHODS THAT HAVE BEEN STUDIED INCLUDE POST-TENSIONING AND MECHANICAL STEEL CONNECTING PLATES. /RRL/A/

Jacobsen, FK
Intl Symp Concr Bridge Des Proc /Can/ 1969

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 208765
AN EXPERIMENT STUDY OF THE USE OF HIGH-STRENGTH FRICTION GRIP BOLTS AS SHEAR CONNECTORS IN COMPOSITE BEAMS

EXPERIMENTS WERE CONDUCTED ON THE USE OF THE HIGH STRENGTH FRICTION-GRIP BOLT TO PROVIDE THE SHEAR CONNECTION BETWEEN THE CONCRETE SLAB AND STEEL BEAM IN COMPOSITE CONSTRUCTION. STATIC PUSH-OUT TESTS WERE MADE TO DETERMINE THE STRENGTH OF SUCH CONNECTORS. TESTS WERE ALSO MADE ON BEAMS, SOME WITH PRECAST AND OTHERS WITH CAST-IN-SITU SLABS USING THEM. THE RESULTS SHOW THAT THE HIGH-STRENGTH FRICTION-GRIP BOLT CAN BE USED AS AN EFFICIENT CONNECTOR IN COMPOSITE CONSTRUCTION. /RRL(A)/

Marshall, WT Nelson, HM Banerjee, HK *Structural Engineer* /UK/
Apr. 1971

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 208835
VIBRATION AND DEFLECTION OF ROLLED-BEAM AND PLATE-GIRDER BRIDGES

OBSERVATIONS ARE REPORTED ON THE VIBRATION AND DEFLECTION CHARACTERISTICS ON AN EIGHT-SPAN PLATE GIRDER BRIDGE CONSISTING OF FIVE SIMPLE SPANS AND THREE SPANS OF CONTINUOUS BEAM DESIGN, AND A CONTINUATION OF THE VIBRATION AND DEFLECTION STUDIES ON THE FENNVILLE BRIDGE, WHICH WAS PREVIOUSLY REPORTED. THE LATTER BRIDGE CONSISTS OF SIX SIMPLE SPANS OF ROLLED BEAM CONSTRUCTION WITH CONCRETE DECKING. ONE OF THESE SPANS WAS BUILT WITH COMPOSITE CONSTRUCTION. THREE TYPES OF LOADING WERE USED--NORMAL COMMERCIAL TRUCK TRAFFIC WITH A MINIMUM OF CONTROL, CONTROLLED TESTING WITH TWO-AXLE TRUCKS, AND CONTROLLED TESTING WITH A SPECIAL

THREE-AXLE TRUCK WITH AXLE SPACING IDENTICAL TO THAT FOR H20-S16 BRIDGE LOADING. OBSERVATIONS ARE REPORTED ON THE FREQUENCY OF VIBRATION, THE AMPLITUDE AND DURATION OF VIBRATION, AND THE DEFLECTION FOR THESE SPANS UNDER SIMILAR LOADING CONDITIONS. THE LATERAL DISTRIBUTION OF THE VIBRATION AND DEFLECTION AMONG THE LONGITUDINAL BEAMS IS SHOWN FOR SEVERAL ROLLED BEAM SPANS. A METHOD IS PRESENTED FOR CALCULATING THE NATURAL FREQUENCY OF A HIGHWAY SPAN WHICH CHECKS THE OBSERVATIONS WITHIN APPROXIMATELY THREE PERCENT. THE OCCURRENCE OF APPRECIABLE VIBRATION IS CORRELATED WITH THE TYPE, GROSS WEIGHT, AXLE SPACING, AND SPEED OF THE VEHICLE CAUSING VIBRATION. OTHER FACTORS INFLUENCING VIBRATION ARE DISCUSSED--FOR EXAMPLE, THE EFFECT OF VEHICLE SEQUENCE ON VIBRATIONS AND THE EFFECT OF INDUCED IMPACT. THE DIFFERENCES IN BEHAVIOR OF THE VARIOUS SPANS ARE CORRELATED WITH PRESENT DESIGN CRITERIA, THAT IS, DESIGN LIVE LOAD PLUS IMPACT DEFLECTION AND DEPTH TO SPAN LENGTH RATIOS. /AUTHOR/

Foster, GM Oehler, LT *Highway Research Board Bulletin* 1956

3A 208903
RECENT DEVELOPMENTS IN PRECASTING OF HIGHWAY BRIDGES AND STRUCTURES

THE IMPORTANCE OF PRECASTING IS EMPHASIZED IN BRIDGE CONSTRUCTION. TWO DIFFERENT SYSTEMS OF PRECASTING ARE DESCRIBED: (1) COMBINING PRECAST STRINGERS WITH CAST-IN-PLACE FLOOR SLABS RESULTING IN T BEAM SPANS, (2) THE FIELD ASSEMBLY OF PRECAST BEAMS OR STRINGERS AND FLOOR SLAB PANELS SEPARATELY WHICH ARE WELDED TOGETHER WITH CONCRETE TO FORM AN INTEGRAL STRUCTURE. EXAMPLES ARE GIVEN OF THESE TWO SYSTEMS. THE USE OF PRECAST MEMBERS IN CULVERTS AND TUNNEL LINING IS ALSO DISCUSSED. RECOMMENDATIONS REGARDING PRECASTING AND A DISCUSSION ON THE ADVANTAGES OF PRECASTING HIGHWAY BRIDGES AND STRUCTURES IS INCLUDED. EXPERIENCE IN PRECASTING BRIDGES HAS SHOWN THAT THE METHOD RESULTS IN SAVING OF TIME, LABOR, AND MONEY.

Mcminn, RB *Highway Research Board Bulletin* Aug. 1951

3A 208939
CORROSION AND CORROSION PROTECTION OF TENDONS IN PRESTRESSED CONCRETE BRIDGES

THE RESULTS OF AN EXTENSIVE STATE-OF-THE-ART SURVEY ARE REPORTED. ALTHOUGH THE CORROSION OF PRESTRESSING STEEL IS NOT A COMMON PROBLEM, IT HAS OCCASIONALLY CAUSED SERIOUS DAMAGES AND FAILURES. CORROSION OF TENDONS IS CAUSED MOSTLY BY IMPROPER CONSTRUCTION TECHNIQUES INCLUDING HANDLING, STORAGE AND SHIPPING, AND TO A LESSER DEGREE, BY IMPROPER DESIGN. HIGH QUALITY, DENSE, AND IMPERVIOUS CONCRETE OR GROUT CAN FURNISH PERMANENT CORROSION PROTECTION IN MOST ENVIRONMENTS TO WHICH A HIGHWAY BRIDGE IS EXPOSED, PROVIDED THAT CERTAIN REQUIREMENTS ARE SATISFIED. RECOMMENDED CORROSION PREVENTING MEASURES OF A CIVIL ENGINEERING CHARACTER ARE DISCUSSED IN DETAIL. /AUTHOR/

Szilard, R *Am Concrete Inst Journal & Proceedings* Jan. 1969

3A 208960
SHEAR TRANSFER IN REINFORCED CONCRETE

A STUDY OF SHEAR TRANSFER IN REINFORCED CONCRETE IS PRESENTED (THAT IS, THE TRANSFER OF SHEAR ACROSS A PLANE, SUCH AS AT THE INTERFACE BETWEEN A PRECAST BEAM AND A CAST-IN-PLACE SLAB). THIRTY-EIGHT PUSH-OFF SPECIMENS WERE TESTED, SOME WITH, SOME WITHOUT A PRE-EXISTING CRACK ALONG THE SHEAR PLANE. THE SHEAR-FRICTION THEORY WAS FOUND TO GIVE A CONSERVATIVE ESTIMATE OF THE SHEAR TRANSFER STRENGTH OF INITIALLY CRACKED CONCRETE. A METHOD IS PRESENTED

FOR THE CALCULATION OF SHEAR TRANSFER STRENGTH IN INITIALLY UNCRACKED CONCRETE, BASED ON THE ZIA ENVELOPE TO MOHR CIRCLES REPRESENTING FAILURE CONDITIONS FOR CONCRETE. /AUTHOR/

Hofbeck, JA Ibrahim, IO Mattock, AH *Am Concrete Inst Journal & Proceedings* Feb. 1969

3A 209017

FLOATING CAISSON FOUNDATIONS

DESIGNS ARE PRESENTED OF TWO FOUNDATIONS FOUNDED UPON A NEW FLOATING CAISSON TYPE FOUNDATION. THE STRUCTURES BUILT IN THIS WAY IN THE NEW YORK CITY AREA ARE PIER 57 AND THE NYACK-TARRYTOWN BRIDGE. ABOUT 85 PERCENT OF THE LOAD OF THE PIER AND 65 PERCENT OF THE LOAD OF THE BRIDGE ARE CARRIED BY BUOYANCY. GEOLOGIC PROFILES AND FLOATING CAISSON FOUNDATIONS STRUCTURES ARE PRESENTED. DETAILS OF THE ACTUAL CONSTRUCTION PROCESS ARE REVIEWED. THE FINISHED PIER CONSISTS OF A GROUND LEVEL PLUS TWO UPPER FLOORS. THE CONSTRUCTION OF A FLOATING PIER ELIMINATED THE NEED FOR LONG EXPENSIVE PILES FOR THE FINGER PORTION. THIS METHOD PRODUCED AN EFFICIENT, HIGH-CAPACITY, MODERN PIER CONSTRUCTED ON POOR FOUNDATION MATERIALS FOR ABOUT THE SAME AMOUNT OF MONEY AS WOULD BE REQUIRED FOR A SIMILAR PIER ON REASONABLY GOOD FOUNDATION MATERIALS. THE DESIGN HAS BEEN MADE OF SEVERAL PROJECTS ON WHICH IT WAS FOUND ECONOMICAL TO PUT ATTACHMENTS NEAR THE FOOT OF STEEL PILES IN ORDER TO INCREASE THEIR BEARING CAPACITY. THE DESIGN OF ATTACHMENTS FOR SUCH PROJECTS IS DESCRIBED. A VERY LARGE SAVING IN COST WAS PROVIDED BY DESIGNING THE PILES TO DEVELOP THEIR BEARING CAPACITY IN THE STRATIFIED SILT AND SAND LAYER OVERLYING THE DEEP CLAY DEPOSIT.

Lowe, J *Highway Research Board Special Reports* 1960

3A 209021

PHASE I REPORT ON AN EVALUATION OF BRIDGE VIBRATION AS RELATED TO BRIDGE DECK PERFORMANCE

A SERIES OF FIELD TESTS WAS CONDUCTED ON 11 TYPICAL HIGHWAY BRIDGES IN TENNESSEE TO DETERMINE THE INFLUENCE OF BRIDGE VIBRATION ON BRIDGE DECK PERFORMANCE. THE THEORETICAL FREQUENCIES AND STATIC DEFLECTIONS DUE TO THE CONTROL LOAD WERE COMPUTED FOR EACH BRIDGE. A WILD THEODOLITE WAS USED TO VISUALLY OBSERVE THE AMOUNT OF DEFLECTION CAUSED BY THE CONTROL LOAD. THE CONTROL LOAD WAS A SCALES TRUCK WITH A GROSS LOAD OF ABOUT 36,000 POUNDS. THE TRUCK WAS DRIVEN OVER THE BRIDGE AT CRAWL SPEED, 20 MPH AND 40 MPH. A COMPUTER PROGRAM WAS DEVELOPED FOR THE STATIC DEFLECTION CALCULATIONS AND THE COMPUTATION OF THE NATURAL FREQUENCIES OF VIBRATION AND ASSOCIATED MODAL SHAPES FOR ANY BRIDGE. THE PROGRAM USES A FINITE DIFFERENCE TECHNIQUE TO FORMULATE THE CHARACTERISTIC EQUATIONS. ONE BRIDGE WAS INSTRUMENTED WITH FOIL STRAIN GAGES AT FIVE LOCATIONS TO CHECK THE GAGING TECHNIQUE AND DETERMINE THE STRAINS CREATED IN THE BRIDGE DUE TO NORMAL TRAFFIC. TRANSVERSE CRACKING WAS MORE EVIDENT ON THE BRIDGES SUBJECTED TO HIGHER VOLUMES OF TRAFFIC. THE CONTINUOUS SPAN STEEL BRIDGES DISPLAYED THE MOST CRACKING THAT COULD BE ASSOCIATED WITH TRAFFIC INDUCED VIBRATIONS. VARIABLES WHICH DETERMINE THE INFLUENCE OF BRIDGE VIBRATION ON BRIDGE DECK PERFORMANCE ARE CONSTRUCTION METHODS, SELECTION AND HANDLING OF MATERIALS AND MIX DESIGN. BRIDGES WITH HIGHER FREQUENCIES GENERALLY HAD THE LEAST AMOUNT OF CRACKING. THE HIGHER FUNDAMENTAL FREQUENCIES ARE ASSOCIATED WITH CONCRETE AND PRESTRESSED BRIDGES.

Goodpasture, DW Goodwin, WA
Tennessee Department of Highways May 1969

3A 209038

HIGH STRENGTH BOLT SHEAR CONNECTORS-PUSHOUT TESTS

STATIC PUSHOUT TESTS ARE PRESENTED OF CONCRETE-STEEL SPECIMENS USING HIGH STRENGTH BOLTS AS SHEAR CONNECTORS. THE BOLTS WERE EMBEDDED IN NORMAL WEIGHT CONCRETE AND PRETENSIONED BY THE TURN-OF-NUT METHOD AFTER THE CONCRETE HAD AGED 28 DAYS. THE LENGTH OF BOLT EMBEDDED WAS 4 IN. (10.16 CM) WITHIN A 6 IN. (15.24 CM) SLAB. STANDARD STEEL WASHERS WERE SPOT WELDED UNDER THE HEADS OF THE BOLTS PRIOR TO INSTALLATION. TWELVE SPECIMENS WERE TESTED, FOUR EACH WITH BOLT DIAMETERS OF 1/2, 5/8, AND 3/4 IN. (1.27, 1.59, AND 1.90 CM). TEST RESULTS SHOW VERY LITTLE SLIP BETWEEN THE SLAB AND STEEL BEAM UNTIL FRICTION IS OVERCOME. THE BOLTS EXHIBITED A GREATER USEFUL CAPACITY AND ULTIMATE STRENGTH THAN COMPARABLE STUDS. /AUTHOR/

Dallam, LN *Am Concrete Inst Journal & Proceedings* Sept. 1968

3A 209109

TURKISH PROGRESS: THE JOINING OF EAST AND WEST

THE PROPOSED BOSPORUS BRIDGE WILL BE THE FOURTH LARGEST SUSPENSION BRIDGE IN THE WORLD, WITH A TOTAL SPAN OF 1,074 MILES. IT WILL LINK CONTINENTAL EUROPEAN AND ASIAN PARTS OF TURKEY. THE BRIDGE SUPERSTRUCTURE USES A CONTINUOUS BOX STIFFENING GIRDER OF AERODYNAMIC CROSS-SECTION. THIS FEATURE, PLUS THE TRIANGULATED SUSPENDER SYSTEM, WILL ALLOW FOR SUBSTANTIAL SAVINGS OVER OTHER DESIGNS OF OPEN TRUSS CONSTRUCTION. THE 25-M WIDE DECK ON TOP OF THE BOX GIRDER WILL CARRY SIX TRAFFIC LANES AND TWO PEDESTRIAN WALKS. THE BOX GIRDERS WILL BE ASSEMBLED IN 18-M LONG UNITS WEIGHING 145 TONS, FLOATED OUT, AND LIFTED ONTO POSITION WITH TACKLE SUPPORTED FROM THE MAIN SUSPENSION CABLES. THE APPROACH VIADUCTS BETWEEN THE ANCHORAGES AND THE TOWERS WILL BE OF COMPOSITE STEEL AND REINFORCED CONCRETE CONSTRUCTION. THE BRIDGE IS DESIGNED TO RESIST EARTHQUAKE BEDROCK ACCELERATION EQUAL TO 0.1 G. PREFORMED PARALLEL WIRE STRANDS ARE BEING USED FOR THE SUSPENDERS. THE HANGERS SUPPORTING THE DECK FROM THE MAIN CABLES WILL BE SINGLE SPIRAL STRANDS OF HIGH TENSILE STEEL WIRE, WITH A MINIMUM BREAKING LOAD OF 280 TONS. THEY ARE PLACED AT AN ANGLE TO THE PERPENDICULAR, WHICH ENABLES THEM TO DAMP HORIZONTAL MOVEMENTS AND ABSORB SOME WIND FORCES. BOTH TOWERS FOR THE BRIDGE ARE LOCATED ON SHORE. THE SINGLE CELL CONSTRUCTION OF THE TOWERS ALLOWS THE INCLUSION OF AN ELEVATOR IN EACH LOWER PORTION. THE BRIDGE IS TO BE A TOLL BRIDGE AND IS EXPECTED TO CARRY SOME 7.5 MILLION VEHICLES BY THE YEAR 1973.

World Construction Nov. 1969

3A 209171

A METHOD OF LAYING LOW VOLTAGE HEATING ELEMENTS IN A BRIDGE SURFACING

IN THE CONSTRUCTION OF LOW-VOLTAGE ROAD HEATING INSTALLATIONS WITH STEEL MESH HEATING ELEMENTS, ENGINEERING PROBLEMS ARISE BECAUSE OF THE DIFFICULTY IN SECURING THESE ELEMENTS TO THE ROD BASE. SECURITY IS NECESSARY IN ORDER TO PREVENT DISTORTION BY ROAD LAYING MACHINERY AND BY THE THERMAL EXPANSION DUE TO THE APPLICATION OF HOT ASPHALT. THIS PROBLEM IS ACCENTUATED ON BRIDGES BECAUSE OF THE PRESENCE OF A WATERPROOF MEMBRANE ON THE BRIDGE DECK WHICH SHOULD NOT BE PUNCTURED IN SECURING THE HEATING ELEMENTS. A METHOD OF INCORPORATING A LOW-VOLTAGE HEATING GRID IN A BRIDGE SURFACING USING STEEL STRIP HEATING ELEMENTS LAID BENEATH A MASTIC WATERPROOFING MEMBRANE IS DESCRIBED. /AUTHOR/

Williamson, PJ
Road Research Laboratory /UK/ 1969

3A 209240
CONCRETE MASONRY STRUCTURES--DESIGN AND CONSTRUCTION

RECOMMENDATIONS ARE PROVIDED FOR THE DESIGN AND CONSTRUCTION OF REINFORCED AND NONREINFORCED CONCRETE MASONRY STRUCTURES. USING UNITS MANUFACTURED TO ASTM SPECIFICATIONS. THE MANUFACTURING PROCESS ITSELF IS NOT DISCUSSED, AND MORTARLESS MASONRY AND CONSTRUCTION USING RESIN-TYPE ADHESIVES BETWEEN THE UNITS ARE NOT COVERED. DESIGN RECOMMENDATIONS BASED ON THE WORKING STRESS METHOD GIVE ALLOWABLE STRESSES FOR BOTH REINFORCED AND NONREINFORCED MASONRY. CONSTRUCTION RECOMMENDATIONS INCLUDE CHAPTERS ON MATERIALS AND THE SPECIFICATIONS; MORTAR AND GROUT; PREFERRED CONSTRUCTION PRACTICES; DETERMINATION OF MASONRY STRENGTH; INSPECTION; CONNECTIONS TO EMBEDDED AND ADJOINING CONSTRUCTION; AND REINFORCING BAR DETAILS. DESIGN CHAPTERS DEAL SEPARATELY WITH REINFORCED WALLS AND COLUMNS AND NONREINFORCED WALLS AND COLUMNS. SHEAR, BOND, AND ANCHORAGE PROVISIONS ARE GIVEN FOR REINFORCED MASONRY. RECOMMENDATIONS FOR CONTROL OF WALL MOVEMENTS ARE MADE, AND CONSTRUCTION OF MASONRY VENEERS, SCREEN WALLS, AND FENCES IS DESCRIBED. NEARLY 200 TERMS RELATING TO MASONRY DESIGN AND CONSTRUCTION APPEAR IN THE APPENDIX. /AUTHOR/

Mackintosh, A *Am Concrete Inst Journal & Proceedings* May 1970

3A 209258
CONCRETE BEAMS WITH PRESTRESSED REINFORCEMENT

TESTS ON SIX RECTANGULAR BEAMS REINFORCED WITH VARIOUS AMOUNTS OF DEFORMED STEEL BARS AND PRECAST PRESTRESSED CONCRETE PRISMS ARE REPORTED. METHODS ARE SUGGESTED FOR COMPUTING THE MOMENT CAUSING CRACKING OF THE IN SITU CONCRETE AND THAT CAUSING CRACKING OF THE PRESTRESSED REINFORCEMENT. AFTER CRACKING OF PRESTRESSED REINFORCEMENT, AND UP TO COMMENCEMENT OF YIELD OF NONPRESTRESSED TENSION REINFORCEMENT, FLEXURAL ANALYSIS COULD BE DONE USING SAME ASSUMPTIONS OF CLASSIC WORKING STRESS DESIGN BY ASSOCIATING TO THE COMBINED AREA OF STRAND AND DEFORMED BARS A PSEUDO MODULUS OF ELASTICITY HIGHER THAN THAT OF ORDINARY STEEL. DURING THAT STAGE IT WAS FOUND THAT FOR SIMILAR BEAMS WITH EQUAL TOTAL AREAS OF TENSION REINFORCEMENT, THE RATIO BETWEEN THEIR MAXIMUM CRACK WIDTHS WAS PRACTICALLY EQUAL TO THE INVERSE OF THEIR RESPECTIVE PSEUDO MODULI. STRAIN HARDENING EFFECTS SHOULD BE TAKEN INTO CONSIDERATION IN ESTIMATING ULTIMATE MOMENT CAPACITY OF BEAMS REINFORCED WITH SUCH COMPOSITE REINFORCEMENT. /ASCE/

Bishara, A Almeida, FN *Am Soc Civil Engr J Structural Div* July 1970

3A 209354
CONCRETE BOX-GIRDER BRIDGES AS SANDWICH PLATES

A RELATIVELY SIMPLE, ACCURATE METHOD FOR THE COMPLETE DETERMINATION OF INTERNAL MOMENTS, SHEARS, AND DEFLECTIONS IN CONCRETE BOX GIRDER BRIDGES WITH STATICALLY APPLIED EXTERNAL VERTICAL LOADS HAS BEEN DEVELOPED AND IS DESCRIBED. THE METHOD OF ANALYSIS USED IS BASED ON THE CONCEPT OF REPLACING THE ACTUAL STRUCTURE BY AN EQUIVALENT UNIFORM PLATE WHICH MODELS THE BEHAVIOR OF THE ACTUAL STRUCTURE. THE OBJECTIVES OF THE STUDY, WHICH ARE ANALYZED IN DETAIL, ARE A DISCUSSION OF THE BASIS AND APPLICABILITY OF THE ANALYSIS OF BOX GIRDER BRIDGES BY SANDWICH PLATE THEORY; PRESENTATION AND SOLU-

TION OF THE GOVERNING EQUATIONS FOR THE BOUNDARY CONDITIONS AND LOADINGS CONSIDERED; THE DEVELOPMENT OF PROCEDURES FOR COMPUTING GOVERNING STIFFNESS PARAMETERS; AND PRESENTATION OF RESULTS DERIVED FOR A SAMPLE STRUCTURE AND COMPARISON OF PREDICTED BEAM BENDING MOMENTS WITH CORRESPONDING QUANTITIES MEASURED IN A FULL SCALE FIELD TEST BRIDGE. /AUTHOR/

Arendts, JG Sanders, WW *Am Soc Civil Engr J Structural Div* Nov. 1970

3A 209434
WELDED BRIDGES

WELDED BRIDGES CONSTRUCTED IN THE UNITED STATES, CANADA, AND IN FOREIGN COUNTRIES ARE REVIEWED, PARTICULARLY VARIOUS PRACTICES IN SPECIFYING STEEL MATERIALS, DETAILS OF DESIGN, AND METHOD OF CONSTRUCTION. THE RESULTS OF GERMAN FATIGUE TESTS ON WELDED BEAMS, FATIGUE PRACTICES IN GIRDERS AND STRINGERS OF RIVETED BRIDGES, AND THE REPAIRS THAT WERE MADE BY WELDING ARE PRESENTED.

Grover, L *Welding Journal American Welding Soc*

ACKNOWLEDGMENT: Highway Research Board Proceedings

3A 209453
COMPOSITE CONSTRUCTION FOR I-BEAM BRIDGES

A COMPOSITE BRIDGE IS DESCRIBED CONSISTING OF LONGITUDINAL STEEL I BEAMS SUPPORTING A REINFORCED-CONCRETE SLAB CONNECTED TO THE BEAMS IN SUCH A MANNER THAT THE BRIDGE ACTS SIMILARLY TO A MONOLITHIC STRUCTURE. THREE SUBJECTS ARE TREATED: (1) THE BEHAVIOR OF COMPOSITE STEEL AND CONCRETE T BEAMS, (2) THE FUNCTION AND ACTION OF THE SHEAR CONNECTION BETWEEN THE CONCRETE SLAB AND THE STEEL I BEAMS, AND (3) THE BEHAVIOR OF COMPOSITE I-BEAM BRIDGES OF BOTH SIMPLE AND CONTINUOUS SPANS. PARTICULAR ATTENTION IS GIVEN TO THE DIFFERENCES BETWEEN COMPOSITE AND NONCOMPOSITE CONSTRUCTION. IT IS SHOWN THAT THE COMPOSITE STRUCTURE IS TOUGHER THAN ITS NONCOMPOSITE COUNTERPART BUT THAT THIS GREATER TOUGHNESS WILL BE REALIZED FULLY ONLY IF THE SHEAR CONNECTION IS CAPABLE OF PROVIDING GOOD INTERACTION BETWEEN THE STEEL BEAMS AND THE CONCRETE SLAB AT ALL STAGES OF LOADING UP TO THE ULTIMATE CAPACITY OF THE STRUCTURE. CRITERIA FOR THE DESIGN OF SUCH COMPOSITE T BEAMS AND THEIR SHEAR CONNECTIONS ARE ALSO DISCUSSED. /AUTHOR/

Viest, IM Siess, CP *Highway Research Board Proceedings* 1953

3A 209468
PROBLEMS IN FABRICATION AND ERECTION OF HIGH-STRENGTH STEELS

THE TYPES OF BRIDGE STRUCTURES ON WHICH HIGH-STRENGTH STEELS HAVE BEEN USED AND AN OUTLINE OF THE TYPES OF STEELS SUITABLE FOR HIGH-STRENGTH PURPOSES IS DISCUSSED. THE MAIN DIFFERENCES IN FABRICATION BETWEEN THESE STEELS AND ORDINARY CARBON STEEL ARE COVERED AND ALSO THE DIFFERENCES IN ERECTION. PROCESSES TO BE OBSERVED IN DESIGN TO ASSURE THAT PROPER DETAILING OF HIGH-STRENGTH STEEL MEMBERS IS ACCOMPLISHED ARE MENTIONED. /AUTHOR/

Ball, EF *Highway Research Board Proceedings* 1957

3A 209504
INDUSTRIALIZED BRIDGE BUILDING

SEVERAL TYPES OF PREFABRICATED BRIDGE SYSTEMS ARE DESCRIBED. THE UNIT MODULE CONSTRUCTION CONSISTS OF CLIPPING ON PRECAST DECK PANELS COMPLETE WITH FULL ROADWAY WIDTH AND CURBS. ANOTHER TYPE OF BRIDGE USING PRECAST, PRESTRESSED COMPONENTS, INCLUDING PINS, IS CALLED LINEAR COMPONENT CONSTRUCTION. THE

DECK MEMBERS ARE EITHER T OR INVERTED U SHAPE, SPANNING BETWEEN SUPPORTS, FOR SHORT SPAN BRIDGES UP TO 50 FEET, EXTRUDED PRESTRESSED CONCRETE SECTIONS CAN BE INCORPORATED INTO THE STRUCTURE. FOR MEDIUM AND LONG SPAN BRIDGES, PREFABRICATED CONCRETE MODULES USUALLY AS FULL WIDTH HOLLOW BOX SECTIONS ARE USED AS SPANNING ELEMENTS. A MOBILE, DEMONSTRABLE, REUSABLE ERECTION TRUSS OF STEEL IS USED FOR PLACING PRECAST CONCRETE UNITS. THE SLIP LAUNCHING TECHNIQUE MEANS THAT THE BRIDGE CAN BE ASSEMBLED ADJACENT TO THE SPAN ON ROLLERS AND THEN SLID ONTO ITS PINS. ALTHOUGH THIS SYSTEM HAS BEEN USED ONLY FOR STEEL STRUCTURES, IT CAN BE ADAPTED FOR PRESTRESSED CONCRETE SPANS AS WELL. /AUTHOR/

Zuk, W *Constructor* Apr. 1971

3A 209549

ORTHOTROPIC SANDWICH PLATES

A DYNAMIC RELAXATION SOLUTION IS PRESENTED FOR THE SMALL DEFLECTION BEHAVIOR OF RECTANGULAR ORTHOTROPIC AND ISOTROPIC SANDWICH PLATES OF UNIFORM OR VARYING CROSS SECTION AND SUBJECTED TO ANY SYSTEM OF NORMAL LOADING. THE NECESSARY THEORY FOR THE TREATMENT OF ANY ADDITIONAL IN-PLANE LOADING IS ALSO INCLUDED. ANY COMBINATION OF SIMPLY SUPPORTED FIXED OR FREE EDGES MAY BE SPECIFIED AND ADVANTAGE MAY BE TAKEN OF SYMMETRY ABOUT EITHER OR BOTH CENTER LINES WHEN IT EXISTS. THE ACCURACY OF THE METHOD HAS BEEN VERIFIED BY COMPARISON WITH EXISTING SOLUTIONS. THE DYNAMIC RELAXATION COMPUTER PROGRAM IS USED TO OBTAIN THE SOLUTIONS FOR A NUMBER OF NORMALLY LOADED PLATES, BOTH ORTHOTROPIC AND ISOTROPIC, FOR WHICH SOLUTIONS BY OTHER METHODS ARE ALREADY AVAILABLE. THE PRESENT SOLUTIONS HAVE BEEN SHOWN TO BE IN EXCELLENT AGREEMENT WITH THE EXISTING ONES. THE APPLICATION OF THE SANDWICH PLATE ANALOGY TO THE SOLUTION OF CERTAIN OTHER PLATES OR PLATE-LIKE STRUCTURES UNDERGOING APPRECIABLE VERTICAL SHEARING DEFORMATIONS, VIZ. HOMOGENEOUS THICK PLATES AND MULTICELL AND VOIDED BRIDGE DECKS, IS THE DISCUSSED. /AUTHOR/

Basu, AK Dawson, JM *Inst Civil Engineers Proc, London /UK/* 1970

3A 209570

DESIGN AND CONSTRUCTION OF NEWPORT BRIDGE

THE EAST PASSAGE CROSSING OF NARRAGANSETT BAY WAS FORESTALLED BY U.S. NAVAL OPERATIONS UNTIL 1964, WHEN A SUITABLE SITE BECAME AVAILABLE WITH THE REQUIREMENT THAT MINIMUM CLEARANCES OF 1600 FT HORIZONTAL AND 205 FT VERTICAL WERE MAINTAINED. THIS CONDITION, PLUS ESTHETIC REQUIREMENTS, DEMANDED A SUSPENSION BRIDGE. A CENTRAL GORGE IN THE ALINEMENT NECESSITATED PILE DRIVING AT GREAT DEPTHS (100 FT AND 140 FT) FOR THE MINIMUM SPAN LENGTH. HOWEVER, A LONGER MAIN SPAN LENGTH WAS FOUND MORE EXPENSIVE. ROCK WAS LOCATED A MINUS 220 FT FOR THE WEST TOWER PIER AND MINUS 432 FT FOR THE EAST, AND MODIFIED POTOMAC-TYPE FOOTINGS WERE SELECTED. PILE CUTOFF WAS ACCOMPLISHED USING A SATURATION DIVING UNIT. FOOTING FORMS WERE DESIGNED WITH VARIABLE BUOYANCY FOR CONTROLLED LOWERING. OF THE REMAINING PIERS, SOME WERE CONSTRUCTED ON PILES OR IN THE DRY; AND OTHERS ON CAISSONS DRILLED INTO ROCK, THE TECHNIQUE USED FOR THE WEST ANCHORAGE. SIGNIFICANT FEATURES OF THE BRIDGE SUPERSTRUCTURE INCLUDE SHOP-FABRICATED PARALLEL-WIRE CABLES, A UNIQUE CABLE ANCHORAGE, PLASTIC RATHER THAN WIRE CABLE WRAPPING, AND A NEW CONCRETE DECK CURING-PROTECTIVE COMPOUND. /ASCE/

Hedefine, A Mandel, HM *Am Soc Civil Engr J Structural Div* Nov. 1971

HRIS 27 220692, 1P27220691

3A 209571

NEWPORT BRIDGE SUPERSTRUCTURE

THE SUPERSTRUCTURE OF THE NEWPORT BRIDGE EMBODIES ADVANCED FEATURES RELATING PRINCIPALLY TO AERODYNAMIC STABILITY, CABLES, CABLE ANCHORAGES, AND CABLE WRAPPING. WIND TUNNEL TESTS WERE CONDUCTED ON TWO BRIDGE MODELS, THE ORIGINAL DESIGN AND A DESIGN INCORPORATING DECK VENTILATION SLOTS. THE MODIFIED MODEL SHOWED SIGNIFICANTLY BETTER AERODYNAMIC STABILITY, AND WAS CHOSEN FOR THE FINAL DESIGN. IN OTHER TESTS, THIS MODEL ALSO DEMONSTRATED THE BENEFICIAL AERODYNAMIC EFFECT OF ADDING A MEDIAN BARRIER TO THE BRIDGE ROADWAY. FOUR BARRIER CONFIGURATIONS WERE TESTED, WITH THE TALLEST YIELDING THE BEST RESULTS. THE CABLES ARE WRAPPED IN A UNIQUE PLASTIC WRAPPING RATHER THAN BEING CONVENTIONALLY WIRE WRAPPED, WHILE THE CONCRETE DECK RECEIVED A NEW COATING THAT SERVES SIMULTANEOUSLY AS A CURING COMPOUND CORROSION. IN ADDITION, THE SUBSTANTIALLY ALL-WELDED CRUCIFORM TOWERS WERE DESIGNED WITH ESTHETIC CONSIDERATIONS UPPERMOST. /ASCE/

Hedefine, A Silano, LG *Am Soc Civil Engr J Structural Div* Nov. 1971

HRIS 27 220691, 1P27220692

3A 209655

A CONCEPT OF PRE-ENGINEERED, PRE-FABRICATED, PRESTRESSED MODULAR AND MULTI-MODULAR SEALING SYSTEMS FOR OUR MODERN BRIDGES AND STRUCTURES, WITH DISCUSSION AND CLOSURE

HEAVY DUTY SEAL CONFIGURATIONS, CAPABLE OF EXTENDING THE SERVICE LIFE OF BRIDGES, ARE NEEDED TO ALLEVIATE THE PROBLEM OF RISING CONSTRUCTION COSTS AND TO MAKE REPAIRS LESS COSTLY AND DANGEROUS. THE SIMILARITY OF BRIDGE JOINT ENVIRONMENTS, WHETHER THE BRIDGE BE OF SUSPENSION, CONTILEVER, STEEL ARCH, CONTINUOUS TRUSS, CABLE STAY, CONCRETE ARCH, CONTINUOUS PLATE, ORTHOTROPIC, OR BOX GIRDER DESIGN MAKE A SYSTEMS APPROACH FEASIBLE. SINGLE MODULE, MODULAR, AND MULTI-MODULAR SEALING SYSTEMS. SYSTEMS ARE DISCUSSED IN RELATION TO A NUMBER OF PROBLEMS. HEAVY JOINT STRUCTURES, IMPROVED EMBEDMENT PRACTICES, AND ARMORED JOINTS ARE MOST EFFICIENT IN THE LONG RUN. UPWARD AND DOWNWARD VERTICAL FORCES, ROTATION, DEFLECTION AND HORIZONTAL THRUST MOVEMENTS ARE ANALYZED TO PROVIDE SOLUTIONS FOR SEAL SHAPES. WEB, TOP, AND SIDE MINIMUMS, DEPTH TO WIDTH RATIOS, PRESSURE GENERATION REQUIREMENTS AND SPECIFICATION STANDARDS ARE PRESENTED AND ANALYZED. FURTHER CONSIDERATIONS ARE: PLACEMENT TECHNIQUES, CONSTRUCTION PRACTICES, TEMPERATURE ADJUSTMENTS TO THE JOINT, SNOW REMOVAL REQUIREMENTS, DESIGN OF SKEWED STRUCTURES, AND STRONGER BEARING DEVICES, SUCH AS THOSE INCORPORATING FLUOROCARBONS.

Watson, SC Haylock, NC DISCUSSER *Australian Road Research Board Proc* Vol. 5 1970, pp 70-112, 37 Fig, 47 Phot, 2 Ref

3A 209659

DEVELOPMENT LENGTH OF STRANDS IN PRESTRESSED PANAL SUBDECKS

THIS REPORT DESCRIBES THE RESULTS OF FIELD AND LABORATORY STUDIES OF PRESTRESSED CONCRETE PANELS OF THE TYPE PROPOSED FOR USE AS A NEW METHOD OF HIGHWAY BRIDGE CONSTRUCTION. TWENTY PANELS, UTILIZING TWO DIFFERENT STRAND SIZES, CONCRETE TYPES AND PANEL LENGTHS WERE CONSIDERED. STUDY OBJECTIVES INCLUDED THE DETERMINATION OF THE DEVELOPMENT LENGTH OF THE PRESTRESSING STRANDS SHORTLY AFTER FABRICATION AND THE EFFECT OF CYCLIC LOADING ON THIS DEVELOPMENT LENGTH. CHANGES IN PANEL STIFFNESS AS A RESULT OF FATIGUE LOADING WERE ALSO MONITORED. TEST RESULTS SHOWED THAT AN AVERAGE OF 22 IN. OF

DEVELOPMENT LENGTH WAS REQUIRED FOR 3/8 IN. DIAMETER, 7-WIRE STRANDS PRETENSIONED WITH A FORCE OF 13M75 KIPS. AN AVERAGE DEVELOPMENT LENGTH OF 34 IN. WAS REQUIRED FOR 1/2 IN. DIAMETER STRANDS PRETENSIONED WITH A FORCE OF 27.50 KIPS. CYCLIC LOADING WAS FOUND TO HAVE NEGLIGIBLE EFFECT ON STRAND DEVELOPMENT LENGTH OR ON PANEL STIFFNESS.

Jones, HL Furr, HL
Texas Transportation Institute Dec. 1970, 63 pp, 27 Fig, 4 Tab, 11 Ref

3A 209691

SHORT-TIME DEFLECTIONS OF BEAMS UNDER SINGLE AND REPEATED LOAD CYCLES

A SIMPLE AND EFFICIENT DESIGN PROCEDURE FOR PREDICTING THE ENTIRE SHORT-TIME LOAD DEFLECTION CURVE (OR A SINGLE POINT, SUCH AS AT MAXIMUM LOAD) UNDER REPEATED LOAD CYCLES INTO CRACKING RANGE IS PRESENTED. THIS INCLUDES THE LOADING, RECOVERY, AND RELOADING PARTS OF THE LOAD DEFLECTION CURVE. THE "I-EFF (EFFECTIVE MOMENT OF INERTIA) CONCEPT" ADOPTED BY ACI 318071 FOR PREDICTING DEFLECTIONS OF REINFORCED BEAMS IS EXTENDED TO BOTH PRESTRESSED AND REINFORCED BEAMS UNDER REPEATED LOAD CYCLES (INCLUDING VARYING LOAD LEVELS) INTO THE CRACKING RANGE. THE RELIABILITY OF THE PROCEDURE IS INDICATED BY COMPARISONS BETWEEN COMPUTER RESULTS AND EXPERIMENTAL DATA OF THIS STUDY FOR 15 PRESTRESSED CONCRETE BEAMS (NINE NOM-COMPOSITE AND SIX COMPOSITE), AND WITH DATA IN THE LITERATURE FOR REINFORCED CONCRETE BEAMS. /AUTHOR/

Kripanarayanan, KM Branson, DE *Am Concrete Inst Journal & Proceedings* Vol. 69 No. 2, Feb. 1972, pp 110-17, 5 Fig, 2 Tab, 12 Ref

3A 209763

INVESTIGATION OF CORROSION IN THE STEEL H-PILES SUPPORTING THE RICHMOND-SAN RAFAEL BRIDGE

THE SUBSTRUCTURE OF THE RICHMOND-SAN RAFAEL BRIDGE WAS CONSTRUCTED IN 1953 TO 1956. THE PIERS ARE SUPPORTED ON PILES DRIVEN TO BED ROCK OR DEEP GRAVEL BEDS TO TIP ELEVATIONS AS MUCH AS 250 FT. BELOW MEAN SEA LEVEL. DETAILS ARE GIVEN OF CONSTRUCTION. BACKFILL WAS DEFERRED UNTIL THE ACTION OF THE TIDAL CURRENTS ON THE NEW CONSTRUCTION COULD BE STUDIED. AN EARLY CORROSION STUDY WAS MADE. IN 1969 AND 1970, SOME OF THE STEEL BARS CUT FROM STEEL PILE SEGMENTS SUSPENDED UNDER THE RICHMOND-SAN RAFAEL BRIDGE PIERS WERE RECOVERED, WASHED, CALIPERED AND WEIGHTED DISCLOSING LOSS OF SECTION AS HIGH AS 15%. TWO PIERS WERE INSPECTED; ONE WAS PIER 57 ON WHICH BACKFILL HAD PERIODICALLY REQUIRED REPLENISHMENT OVER THE 15-YEAR PERIOD. THE OTHER WAS PIER 27 ON WHICH NO FURTHER BACKFILL HAD BEEN PLACED FOLLOWING THE ORIGINAL CONTRACT IN 1956. AT PIER 27, VERY LITTLE, IF ANY, LOSS OF METAL WAS FOUND ON THE PILES. AT PIER 57, LOSS OF SECTION OF 7.5% WAS RECORDED AS ALMOST UNIFORM FROM THE CONCRETE TO THE BOTTOM OF THE LENGTH EXPOSED. THIS PIER HAD STOOD UNBACKFILLED FOR ABOUT A YEAR AFTER COMPLETION. FROM THE FINDINGS, WHICH BRIEFLY SHOWED NO LOSS AT PIER 27 AND CONSIDERABLE LOSS AT PIER 57, FROM THE DIFFERENCE IN UNDERLYING MATERIAL, AND FROM THE DIFFERENCE IN EXPOSURE BEFORE BACKFILLING, A POSITIVE EFFORT TO DETERMINE THE PRESENT RATE OF METAL LOSS, IF ANY, AT PIER 57 APPEARED NECESSARY. THREE TYPES OF DEVICES WERE INSTALLED: A PERMANENT ULTRASONIC PROBE, A STRAIN GAUGE INSTRUMENTED BOLT, AND A VIBRATING WIRE STRAIN GAUGE. THE PRINCIPAL FINDINGS FROM THE INSTALLATION COULD BE OF GREAT IMPORTANCE IN FURTHER STUDIES OF FOUNDATION PILE CORROSION PROBLEMS. THE APPLICATION OF CATHODIC PROTECTION TO THE STEEL FOUNDATION PILES OF THE RICHMOND-SAN RAFAEL BRIDGE IS EXTREMELY COMPLEX AND POSSIBLY NOT FINAN-

CIALLY FEASIBLE. HOWEVER, INFORMATION OBTAINED FROM THIS TEST PROGRAM AND FROM RELATED TEST PROGRAMS AND STUDIES WILL SERVE TO DEVELOP CONSTRUCTION PROCEDURES THAT WILL MINIMIZE CORROSION LOSSES AT MODERATE OR LOW COST. THE PROVEN ECONOMIES OF THIS METHOD OF PIER CONSTRUCTION ARE SUCH THAT MORE PROTECTIVE OR POSITIVE BACKFILL PROCEDURES OR MATERIALS MAY BE EMPLOYED WITHOUT PRICING THIS CONSTRUCTION METHOD OUT OF USE. /DOT/

Balala, B *Materials Protection & Performance* Vol. 11 No. 9, Sept. 1972, pp 30-2

3A 209785

DESIGN AND CONSTRUCTION OF PRESTRESSED CONCRETE CURVED RAILWAY BRIDGE CONSISTING OF PRECAST CONCRETE BLOCKS

THE YONESHIRO-GAWA RAILWAY BRIDGE BETWEEN TOMINE AND FATATSUI STATIONS IS THE FIRST CURVED, PRESTRESSED CONCRETE BRIDGE CONSTRUCTED BY THE JAPANESE NATIONAL RAILWAYS. IT CONSISTS OF THREE CONTINUOUS SPANS, EACH 56.3 M LONG; OVERALL BRIDGE LENGTH IS 337.8 M. THE CURVED SECTION HAS A RADIUS OF 800 M. THE TOPICS COVERED ARE ROUTE SELECTION AND EXECUTION, GIRDER DESIGN, SUPPORT DESIGN (INCLUDING A SPECIALLY DESIGNED OIL DAMPER SYSTEM), CONSTRUCTION, AND LOAD TESTS. SINCE A MAJOR PART OF THE WORK HAD TO BE CARRIED OUT DURING THE WINTER, PRECAST CONCRETE BLOCKS WERE ASSEMBLED ON TEMPORARY STAGINGS. IT IS CONCLUDED THAT THE METHOD SUFFERS FROM THE DISADVANTAGE THAT CONSIDERABLE TIME IS REQUIRED TO INSTALL THE STAGINGS, WHICH MEANS THAT THE SCHEDULE MUST BE RIGOROUSLY OBSERVED. HOWEVER, IT ALSO HAS A NUMBER OF ADVANTAGES, PARTICULARLY IN COLD WEATHER.

Kondo, T Miyazaki, S
Intl Assoc Bridge & Struct Eng /Switz/ May 1972, pp 567-75, 8 Fig, 1 Tab

3A 209806

DEMOUNTABLE PRECAST CONCRETE BRIDGE

DEMOUNTABLE BRIDGES ARE BECOMING INCREASINGLY IMPORTANT FOR THE IMMEDIATE RELIEF OF HEAVY TRAFFIC CONGESTION BEFORE LONG-TERM ROAD SCHEMES HAVE BEEN RESOLVED. BUT THE VIABILITY OF THESE STRUCTURES DEPENDS ON THE EASE WITH WHICH COMPONENTS CAN BE REUSED ON A DIFFERENT SITE. THE SYSTEM MUST OFFER AN OPTIMUM RANGE OF SPAN VARIATIONS USING A MINIMUM NUMBER OF COMPONENT TYPES. THE BRUDERMUHL BRIDGE IN MUNICH (W. GERMANY), RECENTLY ERECTED TO EASE CONGESTION IN CONNECTION WITH THE OLYMPIC GAMES, IS OF PARTICULAR INTEREST BECAUSE ITS PRECAST CONCRETE STRUCTURE CAN BE DEMOUNTED FOR REUSE ON A DIFFERENT SITE. THE 190-METER-LONG STRUCTURE WAS BUILT IN ONLY EIGHT WORKING DAYS BY USING THE DYWIDAG METHOD OF PRECAST CONCRETE CONSTRUCTION. THE SYSTEM USES TRANSVERSE PRESTRESSING TO ACHIEVE A POSITIVE CONNECTION BETWEEN THE PRECAST BEAMS WITHOUT THE NEED FOR IN SITU CONCRETE WORK. BRIDGE CHARACTERISTICS AND THE ASSEMBLY OF SUPERSTRUCTURE COMPONENTS ARE DESCRIBED.

Precast Concrete /UK/ Vol. 3 No. 9, Sept. 1972, pp 537-40, Photos

3A 209897

IMPLEMENTATION PACKAGE FOR CAMBER AND DEFLECTION BEHAVIOR OF PRESTRESSED CONCRETE BEAMS

TO EVALUATE DESIGN PARAMETERS FOR LOCAL CONDITIONS TO BE USED IN THE PREDICTION OF TIME-DEPENDENT DEFORMATIONS, PRACTICAL DESIGN PROCEDURES FOR COMPUTING THE DEFLECTION OF PRESTRESSED CONCRETE MEMBERS ARE PRESENTED. SHORT-TIME AND LONG-TIME DEFLECTIONS OF NON-COMPOSITE AND COMPOSITE PRE-

STRESSED CONCRETE BEAMS ARE INCLUDED. EVALUATION PARAMETERS SUCH AS CONCRETE STRENGTH, MODULUS OF ELASTICITY, SHRINKAGE AT ANY TIME, AND CREEP ARE SUMMARIZED AS ARE THE STANDARD CONDITIONS. CAMBER AND DEFLECTION ARE DISCUSSED AND A MATHEMATICAL MODEL OF DEFLECTIONS IS PRESENTED. THE INFLUENCE OF NON-PRESTRESSED REINFORCEMENT AND COMPOSITE PRESTRESSED CONCRETE BEAMS ARE DETAILED. THE LOSS OF PRESTRESS IS DISCUSSED. SIMPLY SUPPORTED PRESTRESSED CONCRETE BEAMS WERE USED TO INVESTIGATE THE CAMBER, DEFLECTION, CAMBER RECOVERY, AND DEFLECTION RECOVERY BEHAVIOR IN ORDER TO ASSESS THE TIME DEPENDENT CHARACTERISTICS. SHRINKAGE AND CREEP TEST RESULTS ARE PRESENTED. TYPICAL CAMBER AND DEFLECTION HISTORY ARE GRAPHICALLY REPRESENTED AND MATHEMATICAL EXPRESSIONS WHICH MODEL DEFLECTION BEHAVIOR ARE PROPOSED. THE DERIVATION OF SHRINKAGE WARPAGE FOR REINFORCED CONCRETE MEMBER WITH ECCENTRIC TENSIONING REINFORCEMENT IS PRESENTED IN AN APPENDIX WHICH ALSO INCLUDES A DISCUSSION OF LOSS OF PRESTRESS ACCORDING TO AASHO.

Hawaii Department of Transportation Aug. 1972, 32 pp, 13 Fig, 3 Tab, 9 Ref

3A 209966

CONCRETE IN MARITIME WORKS

MARITIME CONSTRUCTION PRESENTS PROBLEMS THAT ARE NOT ENCOUNTERED INLAND. IN DISCUSSING THE PERFORMANCE OF MARITIME STRUCTURES, VARIOUS TYPES OF DAMAGES THAT OFTEN OCCUR ARE DESCRIBED AND IT IS POINTED OUT THAT THE CHOICE AND PROPORTIONING OF MATERIALS, AS WELL AS THE DESIGNING OF MARITIME WORKS CAN MINIMIZE THESE DAMAGES. A DETAILED ACCOUNT IS GIVEN OF EXPANSION JOINTS, WHICH ARE THE CAUSE OF MOST OF THE MAINTENANCE WORK THAT HAS TO BE DONE ON SEA WALLS. CONSTRUCTION METHODS BOTH ABOVE AND UNDER WATER ARE PRESENTED, AS WELL AS METHODS FOR REPAIR WORK. IT IS CONCLUDED THAT FUNDAMENTALLY, CONCRETE CONSTRUCTION IN MARITIME WORKS IS SIMILAR TO CONSTRUCTION ON DRY LAND, BUT GREATER CARE HAS TO BE TAKEN, AND MORE ATTENTION PAID TO DETAILS, AT EVERY STAGE OF THE WORK. THE KEY TO SUCCESS IS OFTEN TO BE FOUND IN FOLLOWING THREE MAIN PRINCIPLES: 1. MAKING ALLOWANCE FOR THE INHERENTLY DIFFICULT WORKING CONDITIONS BY PLANNING EVERYTHING IN DETAIL BEFOREHAND AND MAKING SURE THAT THE WORK PROCEEDS AS SMOOTHLY AS POSSIBLE. THIS APPLIES NOT ONLY TO THE CONTRACTOR BUT ALSO TO THE DESIGNER, WHO MUST CONSIDER SEQUENCE AND METHODS OF CONSTRUCTION WHEN THE WORK IS BEING DESIGNED. 2. PAYING PARTICULAR ATTENTION TO THE QUALITY OF MATERIALS AND WORKMANSHIP. 3. PROTECTING THE WORK FROM DAMAGE, AS FAR AS POSSIBLE, DURING THE VULNERABLE PERIOD SOON AFTER IT HAS BEEN CARRIED OUT.

Allen, RT
Cement & Concrete Assoc, London /UK/ 1972, 14 pp, 9 Fig, 1 Tab, 22 Ref

3A 209994

MODERN CONCEPTS IN PRESTRESSED CONCRETE BRIDGE DESIGN

A GENERAL REVIEW IS MADE OF THE STATE-OF-THE-ART IN PRESTRESSED CONCRETE BRIDGE DESIGN. THREE BRIDGE BEAM TYPES ARE DESCRIBED AND A COMPARISON IS MADE REGARDING THEIR PERFORMANCE AND COSTS. CONSTRUCTION TECHNIQUES, WHICH PLAY AN IMPORTANT PART IN THE ECONOMY OF BRIDGES AND ARE OF INTEREST BECAUSE OF SAFETY AND AESTHETICS, ARE ALSO REVIEWED, WITH EXAMPLES AND ILLUSTRATIONS BEING GIVEN. A DISCUSSION IS GIVEN OF A RECENT PROJECT, THE WALT DISNEY WORLD MONORAIL, WHICH HAS EXPLOITED SOME OF THE LATENT POTENTIAL OF PRESTRESSED CONCRETE.

Anderson, AR *Am Assoc State Highway Officials Proc* Dec. 1971, pp 192-217, 19 Fig, 18 Phot

3A 209999

THE VENTILATION OF ROAD TUNNELS, PAPER 1. A GENERAL APPROACH TO THE PROBLEM

THE PAPER EXAMINES THE COMPOSITION AND SOURCE OF MAJOR AIR POLLUTANTS IN ROAD TUNNELS AND THEIR EFFECT ON THE HEALTH AND BEHAVIOR OF ROAD-USERS AND MAINTENANCE WORKERS, AND ON THE GENERAL OPERATION OF ROAD TUNNELS. THE METHODS OF VENTILATION IN USE AND THE IMPLICATIONS OF SUCH VENTILATION ON THE PHYSICAL AND ECONOMIC ASPECTS OF TUNNEL CONSTRUCTION ARE ALSO DISCUSSED. /TRRL/

Constant, J *Tunnels & Tunnelling /UK/* Vol. 4 No. 3, May 1972, pp 213-23, 5 Fig, 15 Tab, 15 Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 210010

PRECAST PRESTRESSED SEGMENTAL RAILWAY BRIDGE IN AUSTRALIA

IN THE LAST DECADE MOST HIGHWAY GRADE SEPARATION STRUCTURES CONSISTED OF SIMPLE SPAN I-BEAMS WITH A CAST-IN-PLACE DECK SLAB. TYPICALLY, THE SPANS WERE SUPPORTED BY TWO END ABUTMENTS, A CENTRAL PIER, AND A PAIR OF INTERMEDIATE SHOULDER PIERS. HOWEVER, WITH THE NEW EMPHASIS ON SAFETY, THE TWO INTERMEDIATE PIERS ARE NO LONGER PERMITTED. THIS NEW REGULATION, COUPLED WITH THE NEED FOR LONGER SPANS, MEANS THAT THE STANDARD AASHO-PCI TYPES III AND IV BEAMS CANNOT BE USED. NEVERTHELESS, IT IS STILL POSSIBLE TO USE THE AASHO-PCI BEAMS ON LONGER SPANS IF THE BEAMS ARE USED AS SEGMENTS TO BE SPLICED AND POST-TENSIONED TOGETHER AT THE CONSTRUCTION SITE. THE AUTHOR PRESENTS A DESIGN PROCEDURE FOR DESIGNING SUCH LONG-SPAN PRECAST SEGMENTAL BRIDGES. TWO FULLY-WORKED NUMERICAL EXAMPLES ARE PRESENTED TO SHOW THE APPLICATION OF THE DESIGN METHOD AND SEVERAL TABLES AND CHARTS ARE INCLUDED TO FACILITATE THE DESIGN PROCESS. /AUTHOR/

Prestressed Concrete Institute Journal Vol. 18 No. 5, Sept. 1973, pp 105-14, 9 Fig

3A 210021

STRETCHED-OUT AASHO-PCI BEAMS TYPES III AND IV FOR LONGER SPAN HIGHWAY BRIDGES

A METHOD OF INCREASING THE SPAN CAPABILITY OF AASHO-PCI STANDARD I-BEAMS FOR HIGHWAY BRIDGES HAS BEEN INVESTIGATED AND DEMONSTRATED TO BE TECHNICALLY FEASIBLE. WITH A MODERATE AMOUNT OF MODIFICATION TO EXISTING FORMWORK, BEAM SECTIONS COMBINED WITH STRIPS OF DECKS CAN BE PRECAST IN SEGMENTS OF CONVENIENT LENGTH FOR TRUCK TRANSPORTATION FROM A PLANT TO THE CONSTRUCTION SITE. TWO-WAY SEGMENTAL CONSTRUCTION, WITH MAIN TENDONS FOR LONGITUDINAL POST-TENSIONING AND SMALLER TENDONS TENSIONED IN THE DECK SLAB, CAN PRODUCE A STRUCTURE EQUIVALENT TO MONOLITHIC CONCRETE CONSTRUCTION. /DOT/

Anderson, AR *Prestressed Concrete Institute Journal* Vol. 18 No. 5, Oct. 1973, pp 32-49

3A 210067

INVESTIGATION ON THE USE OF DEEP HAUNCHES IN COMPOSITE CONSTRUCTION

THIS PAPER REPORTS THE RESULTS OF AN EXPLORATORY INVESTIGATION ON THE USE OF COMPOSITE CONSTRUCTION WITH DEEP STEEP-SIDED HAUNCHES. VARIOUS TYPES OF PUSH-OFF TESTS WERE CARRIED OUT, TOGETHER WITH BEAM TESTS. THE RESULTS INDICATE THAT THE LOAD CARRYING CAPACITIES OF STUDS IN DEEP HAUNCHES ARE LOWER THAN

THOSE IN THE NORMAL TYPE OF COMPOSITE CONSTRUCTION, BUT THAT NEVERTHELESS, THE METHOD IS A FEASIBLE FORM OF CONSTRUCTION AND APPEARS TO OFFER SOME ECONOMY. /AUTHOR/

Taylor, R Plum, DR Papasozomenos, AG *Inst Civil Engineers Proc, London /UK/* Vol. 47 Sept. 1970, pp 43-54, 15 Fig, 1 Tab, 3 Phot

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/IRRD 202 415, 3C27234746

3A 210116

TUNNELLING IN THE USA

THE AUTHORS GIVE AN ACCOUNT OF TOURS IN THE U.S.A. DURING WHICH THEY VISITED TUNNELLING EQUIPMENT MANUFACTURES, RESEARCH ESTABLISHMENTS AND TUNNELLING SITES. A DISCUSSION IS INCLUDED ON ASPECTS OF TUNNEL DESIGN AND METHODS OF CONSTRUCTION THAT WERE SEEN DURING THE TOURS.

Glover, EF O'reilly, MP *Tunnels & Tunneling /UK/* Vol. 3 No. 6, Nov. 1971, pp 431-7, 11 Fig, 1 Tab, 4 Phot

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 210126

STRUCTURAL ELEMENTS OF UNDERGROUND PARKING GARAGES

THE AUTHOR DISCUSSES THE DEMANDS MADE ON AN UNDERGROUND PARKING STRUCTURE, AND REFERS TO THE PROBLEMS OF GROUND WATER, EARTH PRESSURE, LOADS FROM TRAFFIC, SUPPORTS, AND FIRE RESISTANCE. SOME CONSTRUCTION METHODS ARE DESCRIBED IN DETAIL: THE OPEN CONSTRUCTION METHOD, THE CAISSON METHOD, THE WELL METHOD AND THE GALLERY CONSTRUCTION METHOD.

Strassen, Dusseldorf /Germany/ Vol. 69 No. 9, Sept. 1971, pp 507-10, 9 Fig

3A 210154

UNDERWATER TUNNEL IN ARGENTINA AS A ROAD LINK BETWEEN SANTA FE AND PARANA

THE 2400 M LONG TUNNEL CONSISTS OF 36 TUBES EACH 65.45 M IN LENGTH, AND HAVING AN INTERNAL DIAMETER OF 9.20 M AND A WALL THICKNESS OF 0.5 M. THE TUBES CONTAIN THE 7.5 M WIDE CARRIAGEWAY AND THE VENTILATION CHANNELS. DETAILS ARE GIVEN OF THE FLOATING INTO PLACE OF THE TUNNEL SECTIONS, AND THE DESIGN OF THE VENTILATION AND LIGHTING SYSTEMS. /TRRL/

Tiefbau /Germany/ Vol. 14 No. 4, Apr. 1972, pp 296-302, 17 Fig, 3 Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 210174

STRUCTURAL BEHAVIOR OF A REINFORCED CONCRETE BOX GIRDER BRIDGE

THE CONSTRUCTION INSTRUMENTATION AND TESTING OF A LARGE, REINFORCED BOX GIRDER MODEL ARE DESCRIBED. THE SYSTEM OF DATA ACQUISITION AND METHODS OF DATA REDUCTION ARE TREATED, AND PERTINENT DATA FROM IMPORTANT LOADING CASES DEALING WITH DEFLECTIONS, LONGITUDINAL MOMENTS AT THE INSTRUMENTED SECTIONS, AND THE DISTRIBUTION OF THE MOMENTS AMONG THE GIRDERS ARE TABULATED. COMPARISONS ARE MADE WITH RESULTS OBTAINED FROM AN ANALYSIS BASED ON THE FOLDED PLATE EQUATIONS, AND GENERAL CONCLUSIONS ARE DRAWN FROM THE RESULTS. /AUTHOR/

Houwkamp, JG Scordelis, AC Wasti, ST *Devel Bridge Design & Constr Proc /UK/* 1971, pp 318-33, 6 Fig, 4 Tab, 2 Phot, 4 Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 210177

SOME CONSIDERATIONS IN THE DESIGN OF COMPOSITE BRIDGES

THE BACKGROUND TO THE BRITISH CODE OF PRACTICE ON COMPOSITE CONSTRUCTION IS OUTLINED. SOME UNSOLVED QUESTIONS ARE RAISED IN RELATION TO REVISIONS TO THE CODE. TOPICS DISCUSSED INCLUDE: DECK ANALYSIS, ULTIMATE LOAD DESIGN, LONGITUDINAL SHEAR STRENGTH, SHEAR CONNECTORS, AND COMPOSITE COLUMNS ATTENTION IS DRAWN TO THE POSSIBILITY OF UNFORESEEN SIDE EFFECTS WHEN THE BASIS OF DESIGN IS CHANGED. /TRRL/

Chapman, JC *Devel Bridge Design & Constr Proc /UK/* 1971, pp 356-70, 3 Fig, 15 Phot, 12 Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 210180

THE SELECTION OF BOX BEAM ARRANGEMENTS IN BRIDGE DESIGN

MANY DIFFERENT ARRANGEMENTS OF BOX BEAMS ARE POSSIBLE IN BRIDGE CONSTRUCTION AND A LOGICAL CLASSIFICATION SYSTEM IS PROPOSED. FACTORS AFFECTING THE PROPORTIONING OF BOX BEAM BRIDGES ARE REVIEWED IN THE LIGHT OF PRACTICAL REQUIREMENTS OF PRESTRESSED CONCRETE AND COMPOSITE CONSTRUCTION. THE APPLICATION OF THESE IDEAS IS ILLUSTRATED BY SOME RECENT DESIGNS. MULTICELLULAR PRECAST CONCRETE DECKS ARE DISCUSSED CRITICALLY IN AN ATTEMPT TO FURTHER DESIGN IDEAS IN THIS FIELD. SOME PROPOSED COMPOSITE HIGHWAY BRIDGES IN SOUTH WALES INCORPORATE ADVANCED FEATURES AND THESE ARE DESCRIBED. THE PAPER CONCLUDES THAT SPECTACULAR BOX BEAM DESIGNS ARE FEASIBLE. /AUTHOR/

Lee, DJ *Devel Bridge Design & Constr Proc /UK/* 1971, pp 400-26, 18 Fig, 6 Phot, 6 Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 210199

STUDIES ON PRECAST REINFORCED-LIGHTWEIGHT CONCRETE SLABS FOR HIGHWAY BRIDGES

THIS REPORT PRESENTS SOME PRACTICAL STUDIES OF THE DESIGN AND CONSTRUCTION OF PRECAST REINFORCED-LIGHTWEIGHT CONCRETE SLABS THE AIM OF WHICH IS TO DECREASE THE DEAD WEIGHT OF AND TO SHORTEN THE CONSTRUCTION PERIOD FOR LONG-SPAN HIGHWAY BRIDGES. RESULTS OF FIELD INVESTIGATIONS ON THE CONSTRUCTION OF SUCH SLABS, AND THEIR BEHAVIOR ON A HIGHWAY BRIDGE UNDER ACTUAL TRAFFIC LOADINGS ARE ALSO PRESENTED. /AUTHOR/

Tada, Y Ohta, M

Public Works Res Inst, Cm /Japan/ Vol. 140 Mar. 1971, pp 99-132, Figs, Tabs, 13 Phot, 6 Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/IRRD 201 421, 3C27301421

3A 210218

INTERRELATION BETWEEN DESIGN AND METHODS OF CONSTRUCTION FOR ELEVATED HIGHWAYS

THE INTERACTION BETWEEN DESIGN AND CONSTRUCTION IS PART OF THE PROCESS OF THE DEVELOPMENT OF NEW CONSTRUCTION FORMS. IF THIS PROCESS IS TO FUNCTION PROPERLY, MORE ATTENTION SHOULD BE PAID TO THE FEEDBACK FROM CONSTRUCTION TO DESIGN. VARIOUS CONSTRUCTION SYSTEMS FOR BRIDGES ARE BRIEFLY DESCRIBED VIZ: 1) ON-THE-GROUND, MOVEABLE SCAFFOLDING. 2) CAST-IN-PLACE SPAN-BY-SPAN CONSTRUCTION WITH THE AID OF SUSPENDED, SELF-LAUNCHING FORMWORK CARRIER. 3) CAST-IN-PLACE SEGMENTAL CANTILEVER CONSTRUCTION. 4) PREFABRICATED BEAMS. 5) PRECAST SEGMENTAL CONSTRUCTION SUPPORTED BY SCAFFOLDING.

6) PRECAST SEGMENTAL CANTILEVER CONSTRUCTION. 7) SELF-LAUNCHING PIECEMEAL SYSTEM (GERMAN "TAKT-SCHIEBEVERFAHREN"). IN THE SECTION OF THE STATICALLY DETERMINED SYSTEM, ATTENTION IS PAID TO THE DEVELOPMENT OF A JOINT CONSTRUCTION WHICH WILL NOT INTERRUPT TRAFFIC. THIS CAN HAVE FAVORABLE CONSEQUENCES FOR THOSE SYSTEMS WHICH MAKE USE OF A GREAT NUMBER OF JOINTS. MENTION IS MADE OF SOME SOLUTIONS FOR CONNECTING THE SUPERSTRUCTURE TO CONCENTRATED PIER COLUMNS. THE WRITER IS OF THE OPINION THAT AT PRESENT THERE IS NOT MUCH POINT IN FURTHERING THE DEVELOPMENT OF PRESTRESSING AS FAR AS THE DEVELOPMENT OF BRIDGE CONSTRUCTION IS CONCERNED. /TRRL/

Vannhardt, F
Intl Assoc Bridge & Struct Eng /Switz/, 9th Cong Conf Paper pp 169-83, 2 Fig

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 210219
INTERRELATION BETWEEN DESIGN AND METHODS OF CONSTRUCTION FOR VIADUCTS

IN THE INTRODUCTION, THE DIFFERENT ASPECTS TO BE CONSIDERED FOR THE DESIGN OF A BRIDGE ARE MENTIONED. THE FACTORS THAT CONTRIBUTED TO THE DEVELOPMENT OF THE TECHNIQUE OF BRIDGE-BUILDING DURING THE LAST FEW YEARS ARE DEALT WITH. IT IS SHOWN THAT EFFECTIVE BUILDING COSTS COULD BE LOWERED BY MEANS OF DIRECT COOPERATION OF THE STRUCTURAL ENGINEER WITH THE CONTRACTOR. THE MAIN SECTION DESCRIBES, WITH REFERENCE TO SEVERAL EXAMPLES, MODERN CONSTRUCTION METHODS AND RESULTING PROBLEMS THAT WILL BE DISCUSSED DURING THE CONGRESS. /TRRL/

Menn, C
Intl Assoc Bridge & Struct Eng /Switz/ Conf Paper pp 185-211, 11 Fig, 11 Phot, 14 Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 210224
ENA-SAN TUNNEL PROJECT OF CHUO EXPRESSWAY
A DESCRIPTION IS GIVEN OF THE 8,500M ENA-SAN TUNNEL FORMING PART OF THE CHUO EXPRESSWAY, WHICH, WHEN COMPLETED IN 1974, WILL BE THE SECOND LONGEST ROAD TUNNEL IN THE WORLD. DETAILS ARE GIVEN OF GEOLOGICAL CONDITIONS, EXCAVATION EQUIPMENT AND VENTILATION FACILITIES THAT WILL BE PROVIDED. /TRRL/

Tajima, T
Japan Soc Civil Engrs Journal Vol. 9 1970, pp 103-10, 7 Fig, 2 Tab, 4 Phot

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 210225
GLASSES-TYPE SHIELDING WORKS-AN EXECUTION AT SHIN-OCHANOMIZU STATION OF CHIYODA SUBWAY LINE
THE METHOD USED TO CONSTRUCT AN UNDERGROUND RAILWAY STATION ON THE CHIYODA LINE IN TOKYO IS DESCRIBED. A GLASSES-TYPE SHIELD WAS USED TO JOIN TWO 7.74M DIAMETER CIRCULAR SHIELDS WITH REINFORCED CONCRETE BEAMS AND SLAB TO FORM AN ISLAND PLATFORM 9M WIDE. THE SHIELD CONSISTED OF DUCTILE CAST IRON SEGMENTS WHICH FORMED A CENTRAL SECTION OF HIGH RIGIDITY. DETAILS OF EXCAVATION AND SHIELD CONSTRUCTION ARE GIVEN. /TRRL/

Ichimura, M Watanabe, T
Civil Engineering /Japan/ Vol. 9 1970, pp 111-21, 13 Fig, 3 Tab, 4 Phot

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 210237
"INTERACT" A COMPUTER PROGRAM FOR CONDUCTING STRUCTURAL ANALYSES OF TUNNEL SUPPORT AND LINING SYSTEMS WITH

A COMPUTER PROGRAM HAS BEEN DEVELOPED AND SUCCESSFULLY TESTED ON RECENT TUNNEL PROJECTS IN THE US, TO SOLVE CONSIDERATION OF SUPPORT ROCK INTERACTION PROGRAM MAY BE USED TO PERFORM STRUCTURAL DESIGN ANALYSES OF VARIOUS SHAPED TUNNEL LININGS, INCLUDING SPRAYED CONCRETE AND PRE-CAST CONCRETE LININGS, STEEL ARCHES, AND OTHER SUPPORT SYSTEMS, SUBJECT TO COMPLEX EXTERNAL LOADING. TYPICAL RESULTS OF A SUPPORT-ROCK INTERACTION ANALYSIS RECENTLY CONDUCTED ON A HORSE-SHOE SHAPED TUNNEL SECTION CONFIGURATION OF THE STRAIGHT CREEK VEHICULAR TUNNEL IN COLORADO, US ARE GIVEN IN THE ENCLOSED APPENDIX. /TRRL/

Ueblacker, H *Tunnels & Tunneling* /UK/ Vol. 5 N No. 1, Jan. 1973, pp 29-32, 14 Fig, 3 Tab, 7 Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/IRRD 205 360, 2C27305360

3A 210238
RECOMMENDED PRACTICE FOR GROUTING OF POST-TENSIONED PRESTRESSED CONCRETE

THESE RECOMMENDATIONS COVER THE GROUTING OF POST-TENSIONING RENDONS OF PRESTRESSED CONCRETE MEMBERS. THE REPORT GIVES DETAILS OF DEFINITIONS, MATERIALS, DUCTS, EQUIPMENT, MIXING OF THE GOUT, GROUTING, AND TEMPERATURE CONSIDERATIONS, THE APPENDIX INCLUDES A REPRINT OF U.S. CORPS OF ENGINEERS METHOD CRD-C79-58, "METHOD OF TEST FOR FLOW OF GROUT MIXTURES (FLOW-CONE METHOD)." AFTER MOST SECTIONS, THERE IS AN APPROPRIATE COMMENTARY AS A GUIDE TO THE USE OF THE RECOMMENDED PRACTICE. /TRRL/

Prestressed Concrete Institute Journal Vol. 17n6 Nov. 1972, pp 18-25, 1 Fig

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/IRRD 205 372, 2C27305372

3A 210240
SOFT GROUND TUNNELLING IN GREAT BRITAIN WITH SPECIAL REFERENCE TO THE VICTORIA LINE

THE PAPER DEALS WITH METHODS OF TUNNELLING IN SOFT GROUND CONDITIONS AS EXPERIENCED IN THE CONSTRUCTION OF THE VICTORIA LINE TUNNELS IN LONDON. AN APPRAISAL OF THE TYPES OF TUNNEL LINING IN CURRENT USAGE IS INCLUDED, AND ATTENTION IS DRAWN TO THE IMPACT WHICH EXPANDED LININGS HAVE MADE IN THIS FIELD. MINING METHODS ARE REVIEWED, AND THE POTENTIAL AND LIMITATIONS OF FULLY MECHANIZED MINING BY DIGGER SHIELDS ARE DISCUSSED, TOGETHER WITH SPECIAL TECHNIQUES DEVISED FOR NON-COHESIVE GROUND. IN ADDITION THE ADVANTAGES AND DISADVANTAGES OF THE COMPRESSED AIR METHOD ARE DISCUSSED. /TRRL/

Thompson, DM
The Mining Engineer /UK/ Mar. 1968, pp 334-45, 1 Fig, 4 Phot, 4 Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/IRRD 205 434, 2C27305434

3A 210249
THE SCOPE FOR CHOICE--DEVELOPMENTS IN FOOTBRIDGE AND SUBWAY CONSTRUCTION

FOLLOWING THE PUBLICATION OF DESIGN GUIDES FOR PEDESTRAIN SUBWAYS OR BRIDGES, BY THE DEPARTMENT OF THE ENVIRONMENT, THE ARTICLE DISCUSSES THE DETAILS OF REVISED DESIGN STANDARDS SET OUT IN THESE GUIDES, DEVELOPMENTS IN SUBWAY AND FOOTBRIDGE CONSTRUCTION GENERALLY, AND ALSO PROPRIETARY PRE-CAST SUBWAY SYSTEMS. THE DESIGN OF FOOTBRIDGES USING STEEL, TIMBER OR ALUMINUM CONSTRUCTION MATERIALS IS ALSO DISCUSSED. /TRRL/

Baldwin, PJ *Civil Eng & Public Works Review /UK/* Vol. 68 No. 800, Mar. 1973, pp 237-45, 14 Phot

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/IRRD 205 753, 2C27305753

3A 210325

WEST VIRGINIA ASPHALTIC CONCRETE ROAD TEST

THIS PAPER PRESENTS THE BACKGROUND INFORMATION THAT LED TO THE ASPHALTIC CONCRETE TEST ROAD, AND DESCRIBES IN DETAIL THE PLANNING AND PROGRAMMING THAT PRECEDED CONSTRUCTION. THE PURPOSES OF THE TEST ROAD WERE /1/ TO DETERMINE THE EFFECT OF TEMPERATURE OF ASPHALTIC CONCRETE AT THE TIME OF MIXING AND PLACEMENT ON THE COMPACTION AND PROPERTIES OF THE PAVEMENT, AND /2/ TO CORRELATE PAVEMENT CHARACTERISTICS WITH MIXTURE DESIGN PROPERTIES. THE AUTHORS DESCRIBE IN DETAIL THE PROCEDURES AND PERSONNEL USED TO CONTROL PLANT PRODUCTION AND FIELD OPERATIONS DURING CONSTRUCTION, AND THE EQUIPMENT AND PROCEDURES USED TO COLLECT TEST DATA. THE DATA COLLECTED INCLUDE THE FOLLOWING: TEMPERATURE MEASUREMENTS FROM THE TIME OF MIXING TO COMPLETION OF COMPACTION, THE BULK DENSITY, STABILOMETER AND COHESIOMETER VALUE OF PAVEMENT CORES, NUCLEAR DENSITY, AIR PERMEABILITY, BENKELMAN BEAM DEFLECTIONS, SKID RESISTANCE, AND VISCOSITY TESTS ON RECOVERED ASPHALT. THE TEST ROAD HAS NINETEEN TEST SECTIONS. AT THE TIME THIS REPORT WAS WRITTEN, THE TEST DATA WERE ONLY PARTIALLY ANALYZED, THEREFORE, THE SUMMARIES OF TEST RESULTS THAT ARE PRESENTED ARE GENERALITIES BASED ON INCOMPLETE DATA. /BPR/

Ruth, BE Hughes, RT Steele, GW Schaub, JH
West Virginia University

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4811374 65)

3A 210331

PHYSICAL RESEARCH ON FLEXIBLE PAVEMENT MATERIALS AND CONSTRUCTION METHODS

THE CENTRAL PURPOSE OF THIS RESEARCH PROGRAM, AS INDICATED BY ITS TITLE, WAS TO ENHANCE THE UNDERSTANDING OF LAYERED PAVEMENTS COMPOSED OF BITUMINOUS MATERIALS. TO REALIZE THIS PURPOSE, THE PROGRAM WAS DIVIDED INTO THREE RELATED COMPONENTS OR TOPICS. THE FIRST OF THESE TREATED THE EFFECTS WHICH ASPHALT VISCOSITY EXERTS ON THE BEHAVIOR OF COMPACTED BITUMINOUS MIXTURES. THE SECOND WAS CONCERNED WITH BASIC PROPERTIES OF THE ASPHALT MATERIAL ITSELF, ESPECIALLY AS RELATED TO ADHESION PHENOMENA. THE THIRD COMPONENT, ESSENTIALLY THOUGH NOT EXCLUSIVELY ANALYTICAL IN CHARACTER, CONCENTRATED UPON THE STRUCTURAL BEHAVIOR OF LAYERED SYSTEMS, SEEKING TO ESTABLISH THE STRESSES AND DEFORMATIONS RESULTING FROM LOADS IMPOSED UPON TYPICAL PAVEMENT CONFIGURATIONS. ALSO AS PART OF THIS COMPONENT, A DESIGN METHOD FOR LAYERED PAVEMENTS WAS DEVELOPED FOR USE IN THE COMMONWEALTH OF MASSACHUSETTS, DERIVED FROM THE RESULTS OF THE AASHO TEST ROAD EXPERIMENT. IN THIS REPORT, THE WORK IN EACH OF THESE THREE TOPIC AREAS IS SUMMARIZED AND THE PRINCIPAL RESULTS IDENTIFIED. MORE DETAILED INFORMATION IS AVAILABLE IN THE THIRTEEN RESEARCH REPORTS ISSUED DURING THE PROGRAM. /AUTHOR/

Mcgarry, EJ
Massachusetts Institute Technology Sept. 1965

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4312191 65)

3A 210349

PEEL STRENGTH BEHAVIOR OF VARIOUS ASPHALT-STONE ADHESIVE JOINTS

THE EFFECTS OF METHODS OF JOINT FORMATION, TYPE OF STONE /AGGREGATE/, TYPE OF ASPHALT, AND TEST TEMPERATURES ON ASPHALT-STONE /AGGREGATE/ ADHESION WERE MEASURED BY A PEEL TEST APPLIED TO ADHESIVE JOINT SPECIMENS IN THE FORM OF STONE-ASPHALT-ALUMINUM FOIL SANDWICHES. THE RESEARCHERS CONCLUDED: /1/ EXPOSURE TESTS CONCERNED WITH THE EFFECTS OF WATER ON ASPHALT-STONE ADHESIVE JOINTS REVEAL NO HARMFUL EFFECTS ON JOINT STRENGTH, /2/ AT 140 DEGREES F, PEEL TESTS OF JOINTS FORMED IN AIR SHOW HIGHER PEELING RATES THAN AT 77 DEGREES F AND THE JOINTS FAIL COHESIVELY WITH A MORE SYMMETRICAL RESIDUAL DISTRIBUTION OF ADHESIVE, /3/ AT 77 DEGREES F, PEEL TESTS OF JOINTS FORMED UNDER WATER WITH NO CLAMPED PERIOD REVEAL A LACK OF ADHESION REGARDLESS OF THE TYPE OF STONE OR ASPHALT USED. JOINTS FORMED UNDER THE SAME CONDITION BUT TESTED AT 140 DEGREES F SHOW SOME ADHESION BUT NOT TO THE EXTENT OBSERVED FOR SIMILAR JOINTS FORMED IN AIR, AND /4/ JOINTS FORMED AND CLAMPED UNDER WATER FOR SIXTEEN HOURS INDICATE THAT THE CONTACT INTERVAL IS NOT SUFFICIENT FOR GOOD ADHESION, WHEN TESTED AT 77 DEGREES F AND 140 DEGREES F. /BPR/

Mcgarry, F Desio, P
Massachusetts Institute Technology, Massachusetts Department Public Works June 1966

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4312051 66)PB 174 959, 1C31020596

3A 210406

KENTUCKY ROCK ASPHALT HOT MIX SURFACES

DATA ARE PRESENTED PERTAINING TO THE PROPERTIES OF MATERIALS IN KENTUCKY ROCK ASPHALT MIXTURES, AND OF CONSTRUCTION PRACTICES, COSTS, AND SHORT TIME PERFORMANCE OBSERVATIONS OF PAVEMENTS USING THE MIXTURES. THE ROCK ASPHALT CONTAINS ABOUT 3.8% BITUMENS AND IS CRUSHED TO PASS A 3/8 INCH SCREEN, 85/100 PENETRATION GRADE ASPHALT IS ADDED SO THE HOT-MIX CONTAINS A TOTAL OF BETWEEN 9-10 PERCENT ASPHALT. SOME PROBLEMS WERE ENCOUNTERED WHEN HEATING THE ROCK ASPHALT AND CARE WAS NEEDED TO PREVENT A BUILD-UP OF MATERIAL IN THE PLANT. THE PERFORMANCE OF PAVEMENTS USING THIS MIXTURE IS RATED AS FROM SATISFACTORY TO GOOD UNDER LIGHT TRAFFIC. SKID RESISTANCE, WHICH IS THE PRINCIPAL ADVANTAGE OF THIS MIXTURE, IS RATED HIGH-COEFFICIENTS OF 0.57 TO 0.72. THE REPORT ALSO TRACES THE DEVELOPMENT OF THE SPECIAL PROVISIONS TO THE SPECIFICATIONS WHEN THIS MATERIAL IS TO BE USED. /BPR/

Florence, RL
Kentucky Department Highways, Bureau of Public Roads /US/ Aug. 1968

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4652154 68)PB 180191, 1C31021513

3A 210548

FORMULAS FOR BITUMINOUS BRIDGE SURFACINGS IN GERMANY /IN GERMAN/

THE REQUIREMENTS FOR BRIDGE SURFACINGS ARE ENUMERATED. THE ELEMENTS AND PRINCIPLES OF CONSTRUCTION OF THE BITUMINOUS BRIDGE SURFACINGS USED IN GERMANY ARE DISCUSSED. STANDARD SOLUTIONS APPEAR TO BE AS FOLLOWS. ON CONCRETE BRIDGES, THE CONSTRUCTION METHOD CONSISTS OF THREE PARTS: INSULATION (FIRMLY BONDED TO THE STEEL PLATE), PROTECTIVE LAYER, AND SURFACING. FOR THE INSULATION THE PREFERRED MATERIALS ARE MASTICS OR METAL FOIL, FOR THE PROTECTIVE LAYER MASTIC ASPHALT IS GENERALLY USED AND FOR

THE SURFACING THE USUAL WEARING COURSES ARE USED FOR BITUMINOUS ROAD SURFACES. NEW DEVELOPMENTS MENTIONED ARE A MODE OF CONSTRUCTION WITH BONDING TO CONCRETE BRIDGES AND A PURELY MASTIC METHOD FOR STEEL BRIDGES. PRACTICAL EXPERIENCE HAS SHOWN THAT THE CONDITION OF THE SURFACE, THE DERUSTING OR CLEANING OF THE BRIDGE PLATE, AND WEATHERING DURING CONSTRUCTION ARE VERY IMPORTANT. /FG/RRL/

Zichner, G
Schriftenreihe Der Strabag-bau Ag /Ger/ 1966

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 210561

OIL TREATMENT FOR DUST CONTROL IN SASKATCHEWAN
THE HIGH PROPORTION OF UNPAVED ROADS IN SASKATCHEWAN DEMANDED AN ECONOMICAL, ADEQUATE SURFACE TREATMENT TO CONTROL DUST AND PROVIDE THE ROAD USER WITH IMPROVED RIDING QUALITY. OIL TREATMENT HAS BEEN USED FOR SEVERAL YEARS IN THIS RELATIVELY ARID AREA WHERE PRECIPITATION IS LESS THAN 20 INCHES OF RAIN. OIL TREATMENT IS DEFINED AS A VERY THIN ROAD-MIXED, BITUMINOUS SURFACING APPLIED TO AN OIL PRIMED GRAVEL SURFACED SUBGRADE. SLOW-CURING LIQUID ASPHALTS /SC-1 OR SC-2/ ARE GENERALLY USED IN CONSTRUCTING THIS ONE-INCH THICK SURFACE. THESE OIL-TREATMENT PAVEMENTS HAVE AN AVERAGE LIFE OF 3 TO 5 YEARS AND TRAFFIC VOLUMES OF 100 TO 400 VEHICLES PER DAY. THE TOTAL PAVEMENT CONSTRUCTION COST IS APPROXIMATELY 3000 DOLLARS PER MILE WITH ANNUAL MAINTENANCE COSTS RANGING FROM 100 TO 1500 DOLLARS PER MILE. SUCCESS OF THE OIL TREATMENT DEPENDS UPON THE METHOD OF CONSTRUCTION AND ON PROMPT MAINTENANCE. THE CONSTRUCTION AND MAINTENANCE PROCEDURES ARE DESCRIBED. /CGRA/

Mcmillan, JD *Western Assoc Can Hwy Officials Proc* Apr. 1965

3A 210587

EMULSIFIED ASPHALTS-DEVELOPMENT IN CANADA
EMULSIFIED ASPHALTS ARE MARKETED IN CANADA IN A VARIETY OF GRADES FOR ROAD BUILDING PURPOSES AND MANUFACTURED IN PLANTS ALL OVER THE COUNTRY. IN 1959 CATIONIC EMULSIFIED ASPHALTS WERE EVALUATED IN SASKATCHEWAN, BRITISH COLUMBIA AND ONTARIO. UNTIL THEN ONLY ANIONIC GRADES WERE IN USE. CHANGES IN PRODUCT USAGE AND CONSTRUCTION PRACTICES THAT HAVE TAKEN PLACE SINCE THE INTRODUCTION OF CATIONIC EMULSIONS ARE REVIEWED. /CGRA/

Holberg, AE *Canadian Tech Asphalt Assoc Proc* Nov. 1968

ACKNOWLEDGMENT: Canadian Good Roads Association

3A 210746

THE PERFORMANCE AND COST OF SEALS LAID ON WESTERN AUSTRALIA ROADS DURING THE PERIOD 1934-1958

A DETAILED ANALYSIS HAS BEEN MADE OF THE PERFORMANCE AND COST OF SEALS LAID ON RELATIVELY LIGHTLY TRAFFICKED ROADS IN WESTERN AUSTRALIA, DURING THE PERIOD 1934 TO 1958. MOST OF THE INFORMATION OBTAINED WAS FOR INITIAL SEALS (LAID ON NEWLY CONSTRUCTED OR RECONSTRUCTED ROADS). IN GENERAL, THESE WERE PLACED AS A STAGE CONSTRUCTION TREATMENT IN WHICH A PRIMER SAND SEAL WAS FOLLOWED AT AN INTERVAL OF 3 TO 18 MONTHS, EITHER BY ONE APPLICATION OF BITUMEN AND STONE (SINGLE SEAL) OR BY A DOUBLE APPLICATION OF BITUMEN AND STONE (DOUBLE SEAL). SOME INFORMATION WAS OBTAINED ON SINGLE RESEALS LAID IN THE PERIOD 1950 TO 1955. THE AVERAGE LIFE OF THE INITIAL SINGLE SEALS RANGED FROM SIX AND ONE-HALF YEARS (FOR SAND) TO 17 YEARS (FOR 3/4 TO 1/2 IN. STONE), THE LIFE INCREASING WITH THE SIZE OF THE COVER STONE USED. DOUBLE

SEALING WITH A FIRST STONE APPLICATION SIZE OF 3/4 TO 1/2 IN. INCREASED THE AVERAGE LIFE, OVER THAT OF THE CORRESPONDING SINGLE SEAL, BY ONLY TWO YEARS. ENRICHMENT OF THE SINGLE SEALS (A FOG SPRAY OF DILUTED BITUMEN EMULSION APPLIED TOWARDS THE END OF THE EXPECTED LIFE) EXTENDED THEIR AVERAGE SERVICE PERIOD BY THREE YEARS. COST RATE DATA INDICATE THAT THE CHEAPEST INITIAL SEALING TREATMENT WAS A SINGLE SEAL, WITH EITHER 1/2 TO 3/8 IN. OR 3/8 TO 3/16 IN. SIZED STONE. SUBSEQUENT RESEALING OR ENRICHMENT TREATMENTS SIGNIFICANTLY REDUCE COST RATES. DOUBLE SEALS, WITH OR WITHOUT ADDITIONAL TREATMENT, WERE RELATIVELY COSTLY. SMALL BUT SIGNIFICANT DIFFERENCES IN PERFORMANCE WERE FOUND FOR INITIAL SEALS LAID WITH DIFFERENT TYPES OF CRUSHED ROCK AGGREGATES IN DIFFERENT CLIMATIC ZONES. THE AVERAGE TRAFFIC DENSITY FOR THE RETIRED SEALS RANGED FROM ABOUT 50 TO 600 VEH/DAY, AND BITUMENS FROM MANY DIFFERENT CRUDE SOURCES WERE USED DURING THE INITIAL SEAL LAYING PERIOD UNDER CONSIDERATION. NEITHER FACTOR APPEARS TO HAVE AFFECTED INITIAL SEAL LIFE. THE LIVES OF RESEALS WERE FOUND TO BE SIMILAR TO THOSE LAID IN VICTORIA ON MORE HEAVILY TRAFFICKED ROADS. /AUTHOR/

Baker, GF *Australian Road Research* June 1967

3A 210780

COMPACTION OF DEEP LIFT BITUMINOUS STABILIZED BASE

A STREET CONSTRUCTION PROGRAM WAS CONDUCTED USING BITUMINOUS STABILIZED BASE WHICH IS A HOT-PLANT MIX OF BANK RUN GRAVEL AND ASPHALT CEMENT HAVING A PENETRATION OF 85 TO 100. PAVEMENT TEST CORES FROM A SINGLE FIVE INCH LIFT CONSTRUCTION PROVED TO BE 1 PERCENT BETTER COMPACTED THAN THE CORES FROM PAVEMENT CONSTRUCTED WITH TWO 2-1/2 INCH LIFTS. INDICATIONS WERE THAT TEMPERATURE COULD BE A FACTOR IN OBTAINING THESE DENSITIES. THE TEMPERATURES WERE RECORDED WITH THERMOCOUPLES TO CONFIRM THAT TEMPERATURE ASSISTED THE COMPACTION EFFORT. IN SUBSEQUENT WORK, THE GRADATION OF THE MIX WAS ADJUSTED TO OBTAIN THE DESIRE TO PRESENT VOIDS. RESULTS INDICATE THAT MIXED DESIGN IS IMPORTANT IN SINGLE LIFT CONSTRUCTION. LIFTS OF 12, 15, AND 18 INCHES WERE CONSTRUCTED. TEST RESULTS REVEALED THAT: (1) HOT PLANT MIX STABILIZED BASE CAN BE CONSTRUCTED IN A SINGLE LIFT TO ANY DESIGN DEPTH, (2) THICK LIFTS RETAIN HEAT FOR A LONGER PERIOD OF TIME AND THUS PROVIDE AMPLE TIME FOR ROLLING, (3) HEAVY RUBBER TIRED ROLLERS ARE VERY EFFECTIVE FOR COMPACTING THICK LIFTS, AND (4) THE LAY-DOWN TEMPERATURE OF THE MIX IS IMPORTANT BECAUSE THERE IS A RELATIONSHIP BETWEEN LAY-DOWN TEMPERATURE, THE COMPACTION FORCE AND THE DEPTH OF LIFT. A TEMPERATURE-COMPACTION RELATIONSHIP WAS SUBSTANTIATED INDICATING CONSIDERATION OF: (1) VOLUME-THE DEPTH OF THE LIFT, (2) PRESSURE-THE COMPACTION FORCE AND (3) TEMPERATURE -THE LAY-DOWN TEMPERATURE.

Beagle, CW *Assoc Asphalt Paving Technol Proc* Feb. 1966

3A 210816

BITUMINOUS CONCRETE PAVEMENT INVENTORY IN MAINE CORRELATED TO AASHO ROAD TEST RESULTS

A VISUAL INSPECTION WAS CONDUCTED ON ALL BITUMINOUS CONCRETE SURFACE ROADS IN THE STATE OF MAINE IN 1960. TEN SPECIFIC FEATURES SUCH AS LONGITUDINAL CRACKING, ALLIGATOR CRACKING, RUTTING, DISTORTION, SURFACE DETERIORATION, ETC., WERE MEASURED BY MEANS OF A QUALITATIVE RATING SYSTEM. THESE FEATURES WERE CAREFULLY WEIGHTED IN RESPECT TO THEIR INFLUENCE UPON EITHER THE PAVEMENT OR THE BASE PERFORMANCE. FROM THIS WORK EACH ROAD WAS CLASSI-

FIED AS TO ITS PAVEMENT PERFORMANCE, BASE PERFORMANCE, OR OVER-ALL PERFORMANCE. A STRUCTURAL NOMOGRAPH WAS DEvised THAT TAKES INTO CONSIDERATION THE EFFECTS OF TRAFFIC, TIME AND CLIMATIC CONDITIONS. FIELD OBSERVATIONS AT THE TIME OF THE FIELD SURVEY INDICATED A 24-INCH PAVEMENT STRUCTURE TO BE LESS SUSCEPTIBLE TO ROUGHNESS CAUSED BY FROST ACTION THAN THE 18-INCH PAVEMENT STRUCTURES. THE FIRST SIGN OF PAVEMENT DISTRESS IN NEARLY EVERY CASE OCCURED IN A CUT SECTION. DISTRESS WAS PARTICULARLY EVIDENT IN BOX SECTIONS OF THE ROADWAY. THIS DISTRESS MAY BE CAUSED EITHER BY POOR DRAINAGE OR THE DIFFERENCE IN COMPACTION IN THE SUB-BASE AND SUB- GRADE WHEN GOING FROM FILL TO CUT SECTIONS. A RESURFACED ROAD IS SUPERIOR TO A CONSTRUCTED ROAD SINCE IT HAS A HIGHER STRUCTURAL NUMBER AND TRAFFIC HAS HAD TIME TO ADJUST THE ORIGINAL ROADBED INTO ITS NATURAL POSITION. STAGE CONSTRUCTION IS RECOMMENDED WHENEVER POSSIBLE. THE AASHO ROAD TESTS CONCEPTS AND ITS RESULTS APPEAR TO BE APPLICABLE TO CONDITIONS IN MAINE EXCEPT FOR THE STRUCTURAL NUMBER CONCEPT. THIS CONCEPT REQUIRED A MODIFICATION IN ORDER TO CONFINE THE MAXIMUM AMOUNT OF STRUCTURAL NUMBER VALUES TO THE UPPERMOST PORTION OF THE ROADWAY. THE STRUCTURAL NOMOGRAPH INDICATES THAT A CONSTRUCTED BLACK BASE ROAD IS CHEAP IN VIEW OF THE CONSIDERABLE INCREASE IN AXLE APPLICATIONS OVER THE PERFORMANCE OF GRAVEL BASE ROADS. THIS INDICATES THAT A ROAD WITH A BLACK BASE COSTING 4 TIMES THE PRICE OF GRAVEL BASE IS JUSTIFIED BECAUSE IT CAN HANDLE 8-10 TIMES THE TRAFFIC OF A GRAVEL BASE ROAD.

Rand, D *Assoc Asphalt Paving Technol Proc* Feb. 1965

3A 210820

RECENT DEVELOPMENTS IN ASPHALT TECHNIQUES FOR HYDRAULIC APPLICATIONS IN THE NETHERLANDS

THE USE OF ASPHALTIC MIXTURE FOR HYDRAULIC APPLICATIONS IN THE NETHERLANDS HAS DEVELOPED RAPIDLY SINCE THE GREAT FLOODS IN 1953. IN THE NETHERLANDS, ONLY SAND AND GRAVEL ARE AVAILABLE. BECAUSE OF THEIR IMPERMEABILITY TO WATER, DENSE ASPHALTIC MIXTURES SEEMED VERY SUITABLE FOR DIKE-BUILDING PURPOSES. ASPHALT REVENTMENTS HAVE NOW BECOME A CURRENT FEATURE IN DIKE CONSTRUCTION. SOME OF THE DEVELOPMENTS OF THE LARGE-SCALE APPLICATION IN THE HYDRAULIC FIELD OF ASPHALT MATERIALS ARE DISCUSSED. THE MATERIALS CONSIDERED ARE: LEAN SAND ASPHALT, SAND-MASTIC ASPHALT, NORMAL DENSE ASPHALTIC CONCRETE, AND STONE ASPHALT (BITUMARIN CONCRETE). CONSTRUCTION PRACTICES INVOLVING MIXING, HANDLING AND PLACING OF MIXTURES OF VARIOUS COMPOSITIONS AND PROPERTIES FOR DIFFERENT TYPES OF CONSTRUCTION ARE DESCRIBED.

Kerkhoven, RE *Assoc Asphalt Paving Technol Proc* Feb. 1965

3A 210829

THIN HOT-MIX WEARING COURSES. AN ADVISORY

THE PRACTICABILITY OF THIN HOT-MIX WEARING COURSES HAS BEEN DEMONSTRATED IN MANY AREAS. THESE COURSES MAY BE USED SUCCESSFULLY TO ADD SKID-RESISTANT, DURABLE SURFACES TO NEW AND OLD PAVEMENTS AND TO RENEW PAVEMENT SURFACES WHERE GRADE CHANGES ARE RESTRICTED. THIS ADVISORY WAS PREPARED TO ASSIST ENGINEERS IN WRITING SPECIFICATIONS FOR THIN HOT-MIX ASPHALT WEARING COURSES. IT OUTLINES MATERIALS REQUIREMENTS AND CONSTRUCTION PROCEDURES FOR HIGH-QUALITY WEARING COURSES HAVING EXCELLENT PERFORMANCE CHARACTERISTICS. /AUTHOR/

Asphalt Institute Mar. 1968

3A 210833

SETTING RATE OF ASPHALT CONCRETE

MIXES THAT SHOVE EXCESSIVELY UNDER STEEL WHEEL ROLLERS, DO NOT DENSIFY, OR ARE TENDER TO ANY TYPE OF DISTORTION ARE DEFINED AS 'SLOW SETTING.' AT TIMES, THESE MIXES REMAIN TENDER FOR PROLONGED PERIODS AFTER LAYDOWN. FIELD AND LABORATORY STUDIES SHOW THAT AGGREGATE GRADATION AND ANGULARITY, FILLER CONTENT, MOISTURE, AND COMPACTIVE EFFORT ARE IMPORTANT IN DETERMINING THE SETTING RATE OR TOUGHNESS OF A COMPACTED MIX. CONSTRUCTION AND MIX VARIABLES ARE EXAMINED UNDER CONTROLLED CONDITIONS TO ISOLATE THOSE FACTORS RESPONSIBLE FOR SLOW SETTING. DATA PRESENTED SHOW THAT HIGH-QUALITY, HIGH-STABILITY MIXES COMPACT BETTER WITH INCREASING COMPACTION TEMPERATURE, BUT THAT IN MORE UNSTABLE MIXES INCREASING THE TEMPERATURE RESULTS IN POORER COMPACTION. THE AUTHORS SHOW THE IMPORTANCE OF MINERAL FILLER TO BOTH PAVEMENT DENSITY AND TOUGHNESS. AN OPTIMUM FILLER-TO-ASPHALT RATIO EXISTS FOR MAXIMUM COMPACTION UNDER STEEL WHEEL ROLLERS. IN ADDITION, THE AMOUNT OF MINERAL FILLER IN A MIX WAS FOUND TO INFLUENCE THE SETTING RATE OF AN ASPHALT PAVEMENT. PAVEMENT TOUGHNESS PROVED DEPENDENT ON THE TYPE AND DEGREE OF COMPACTION. PNEUMATIC ROLLING SUBSTANTIALLY IMPROVES PAVEMENT TOUGHNESS. PAVEMENT SETTING IS SHOWN TO BE MUCH FASTER IN A MIX WITH CRUSHED, ANGULAR AGGREGATE RATHER THAN ROUNDED GRAVEL. THE SETTING RATE OF ASPHALT CONCRETE PAVEMENTS IS LARGELY CONTROLLED BY THE CONSTRUCTION PRACTICES AND MATERIAL PROPERTIES INVESTIGATED IN THIS PAPER. SUGGESTIONS ARE GIVEN ON HOW TO ACHIEVE MAXIMUM DENSIFICATION AND PAVEMENT TOUGHNESS. /AUTHOR/

Santucci, LE Schmidt, RJ *Highway Research Board Bulletin* 1962

3A 210882

SURFACE TREATMENT MANUAL

SURFACE TREATMENTS, EXCEPT FOR DESIGN, ARE PRESENTED. TWO QUESTIONS, WHY AND WHEN, ARE ANSWERED ON SEAL COATS. CONSTRUCTION TECHNIQUES AND EQUIPMENT ARE COVERED AND ARE RECOMMENDED FOR CONSTRUCTION ENGINEERS.

American Bitumuls & Asphalt Co 57 pp, 1958

3A 210892

PRACTICAL GRADATION LIMITS FOR NATURAL AGGREGATE BITUMINOUS CONCRETE (NABC)

BECAUSE COUNTY AND MUNICIPAL AGENCIES OFTEN CANNOT AFFORD PREMIUM QUALITY BITUMINOUS CONCRETE TO PRODUCE HEAVY DUTY PAVEMENTS, THE SURFACES OF SIDE ROADS AND LOCAL STREETS CAN DETERIORATE RAPIDLY WHEN SUBJECTED TO HEAVY VEHICLES. THE ANSWER FOR SUCH SURFACES HAS BEEN MIXED-IN-PLACE CONSTRUCTION OR SURFACE TREATMENT. THE ADVOCATES OF PLANT MIX, HOWEVER, FEEL THAT HOT-PLANT-MIX SHOULD REPLACE ROAD- MIX AND TREATMENT WORK IF COSTS CAN BE KEPT LOW ENOUGH. THE AIM IS, OF COURSE, A ROAD BETTER ABLE TO WITHSTAND THE OCCASIONALLY HEAVY AXLE LOADS, SPRING THAWS, AND RAINY SEASONS. TO COMPETE SUCCESSFULLY ON A COST BASIS, THE GRADATION SPECIFICATIONS MUST NOT BE SO RESTRICTIVE THAT LARGE QUANTITIES OF MATERIALS HAVE TO BE RESIZED OR WASTED. THEREFORE, ONE OF THE PURPOSES OF THIS WORK IS TO ESTABLISH OPTIMUM GRADATION CURVES AND ALLOWABLE TOLERANCES FOR NATURAL AGGREGATE BITUMINOUS CONCRETE. ANOTHER PURPOSE IS TO FOSTER THE BETTER UTILIZATION OF LOCAL MATERIALS AND TO ENCOURAGE MUNICIPAL AND COUNTY ENGINEERS AND CONTRACTORS TO UTILIZE BETTER THE WELL-RECOGNIZED ADVANTAGES OF HOT-PLANT- MIX CONSTRUCTION METHODS FOR PROVIDING SUPERIOR AND MORE TROUBLE-FREE PAVEMENTS FOR

STREETS AND SECONDARY ROADS AT REDUCED OVERALL COST.

Hudson, SB
National Asphalt Pavement Association 1958

ACKNOWLEDGMENT: Highway Research Board Bibliography

3A 210896

BITUMINOUS CONCRETE PAVEMENTS IN VIRGINIA-SYMPOSIUM- ASPHALT BOUND BASES
LIMITATIONS ARE DESCRIBED OF SEVERAL BITUMINOUS CONCRETE PAVEMENTS CONSTRUCTED IN VIRGINIA: HEAVY DUTY FLEXIBLE PAVEMENTS CONSTRUCTED WITH WATER BOUND MACADAM BASE WITH A MIXED-IN-PLACED SURFACE COURSE, AND PAVEMENTS CONSTRUCTED USING PENETRATION MACADAM. SUCCESSFUL USE OF HEAVY DUTY BITUMINOUS CONCRETE BASE COURSE CALLED BLACK BASE IS DESCRIBED. FIVE BLACK BASE DESIGNS ARE DISCUSSED FOR THE FOLLOWING TYPES OF HIGHWAYS: SECONDARY ROADS AND MEDIUM TRAFFIC PRIMARY ROADS, MEDIUM TRAFFIC PRIMARY ROADS WITH HIGHER TRUCK TRAFFIC, HEAVY TRAFFIC PRIMARY ROADS, INTERSTATE HIGHWAY SYSTEM DESIGN, AND AN ALTERNATE FLEXIBLE DESIGN FOR INTERSTATE ROUTES. CONSTRUCTION METHODS AND SPECIFICATIONS ARE DISCUSSED. THE ADVANTAGE OF BLACK BASE OVER OTHER TYPES OF FLEXIBLE BASES DESCRIBED ARE (1) EASE OF CONSTRUCTION, (2) COST, AND (3) PERFORMANCE.

Ellison, KE *Assoc Asphalt Paving Technol Proc* 1961

3A 210901

BLACK BASE SURVEY

THE PURPOSE OF THE SURVEY IS TO PROVIDE INFORMATION ON THE CURRENT PRACTICE IN THE DESIGN AND CONSTRUCTION OF BLACK BASES AND DATA ON SPECIFICATION REQUIREMENTS BEING USED IN THE 48 CONTINENTAL STATES. THE INFORMATION COLLECTED IS PRESENTED IN TABULAR FORM. DATA FROM THE QUESTIONNAIRES SHOW METHODS OF DESIGN AND CONSTRUCTION PRACTICE AND DATA FROM THE STANDARD SPECIFICATIONS AND SPECIAL PROVISIONS SUMMARIZE CURRENT SPECIFICATION REQUIREMENTS.

Sonderegger, PE Damkorgor, VJ
National Asphalt Pavement Association Feb. 1963

ACKNOWLEDGMENT: Highway Research Board Bibliography

3A 211060

GUSSASPHALT SURFACINGS IN WEST BERLIN /GERMAN/
THE AUTHOR REPORTS ON EXPERIENCES WITH AND KNOWLEDGE OBTAINED FROM GUSSASPHALT ON ROADS IN BERLIN. CURRENTLY ALMOST A THIRD OF ALL THE SURFACINGS ON THE WEST BERLIN URBAN ROAD NETWORK (APPROX. 8.3 MILLION SQUARE METRES) ARE MADE OF GUSSASPHALT. EXPERIENCES OBTAINED OVER MANY YEARS HAVE LED TO THE WELL KNOWN "BERLIN RECIPE" FOR THE COMPOSITION OF THE MINERAL MIXTURE. AT PRESENT THE PARTICULAR WAY IN WHICH THE GUSSASPHALT MUST BE MIXED IN ORDER TO WITHSTAND HARSH BRAKING FORCES WHICH OCCUR AT BUS- STOPS AND TRAFFIC LIGHTS IS BEING STUDIED. PREVIOUSLY THE STANDARD CONSTRUCTION METHOD CONSISTED OF A CEMENT BASE WITH A GUSSASPHALT SURFACING, BUT IN RECENT YEARS PREFERENCE HAS BEEN GIVEN TO THE FLEXIBLE CONSTRUCTION METHOD HAVING A BITUMEN-BOUND BASE, A BITUMINOUS BASECOURSE AND A GUSSASPHALT SURFACING. WITH A POINTLESS CONSTRUCTION WITH A SCREED THE SEAMS ARE HEATED WITH INFRARED EQUIPMENT AND THEN SMOOTHED OVER. THE TOP OF THE GUSSASPHALT SURFACING IS NO LONGER TEXTURED, AND THE SURFACE CHIPPINGS ARE ONLY PRESSED IN WITH A SMOOTH ROLLER. /FG/RRL/

Kosanke, K
Veroffent Strassenbau, Essen /Ger/ 1967
SPONSORING AGENCY: Veroffent Strassenbau, Essen /Ger/ 67, *

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 211082

SURFACINGS ON STEEL CARRIAGEWAYS /IN GERMAN/
THE COATING CAN BE USED AS A COMPOSITE MEMBER IF ITS TENSILE, COMPRESSIVE AND SHEAR STRESS UNDER LOADING IS SMALL, IF IT REMAINS ELASTIC UNDER LIVELOADING AT ANY TEMPERATURE, AND IF ITS STRESSES IN PROPORTION TO THE MODULUS OF ELASTICITY ARE NO WORSE THAN WITH PLATE STEEL. UNDER THESE CONDITIONS THE THICKNESS OF THE COATING COULD BE REDUCED FROM 6 TO 3-4 CM. TESTS ARE BEING MADE ON THIS POINT. THE CURRENTLY USED ASPHALT DOES NOT ADMIT A REDUCTION OF THE CROSS-SECTION OF THE STEEL; FOR THIS AN ADMISSABLE BOND ACTION OF STEEL AND COATING WOULD BE NECESSARY. /FG/RRL/

Sedlacek, H
Der Bauingenieur, Berlin /Germany/ 1966

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 211174

QUALITY CONTROL IN CONSTRUCTION METHODS INVOLVING USE OF BITUMEN /IN GERMAN/
THE CAUSES OF UNAVOIDABLE FLUCTUATIONS IN THE QUALITY OF BITUMINOUS MIXTURES AND THE PAVEMENTS CONSTRUCTED WITH THEM ARE OUTLINED. THE USE OF QUALITY CONTROL TO PINPOINT THE EXTENT OF FLUCTUATIONS AND TO ENABLE THE NECESSARY CORRECTIVE MEASURES TO BE CARRIED OUT IS ALSO DISCUSSED. /FG/RRL/

Wester, K *Strassen Und Tiefbau /Germany/* 1969

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 211178

NEW WORKS IN GUSSASPHALT /IN GERMAN/
DETAILS ARE GIVEN OF THREE REPORTS WHICH ARE CONCERNED WITH RECENT GUSSASPHALT CONSTRUCTION: H. KOHLER, IN HIS ARTICLE ENTITLED "RECENT DEVELOPMENTS IN GUSSASPHALT SURFACINGS ON GERMAN MAIN ROADS," REPORTS ON THE RATIONALIZATION OF GUSSASPHALT APPLICATION, THE DEVELOPMENT OF MECHANIZATION AND CONSTRUCTIONAL INNOVATIONS. THE LATTER INCLUDE THE INTRODUCTION OF THE CAM ROLLER, THE "BERLIN" MIX-DESIGN FOR MECHANICALLY LAID GUSSASPHALT, THE ELIMINATION OF RIGID CARRIAGEWAY EDGING, THE CONSTRUCTION OF SKID-RESISTANT SURFACINGS, AND SIMULTANEOUS MANUFACTURE OF LIGHT-COLOURED EDGE STRIPS WITH A SPECIALLY DEVELOPED SLIP FORM FOR THE EDGE OF THE SURFACING. H. SOLTERBECK, DESCRIBES THE SURFACING WORK IN SECTION 4 ("NEUMUNSTER BY-PASS") OF THE HAMBURG-FLENSBURG MOTORWAY. THIS INCLUDES THE STAGGERED USE OF TWO FINISHERS TO SPEED UP THE CONSTRUCTION OF THE BITUMEN-BOUND ROAD-BASE, AND THE USE OF A TRACKED VEHICLE TO PLACE THE GUSSASPHALT SURFACING. W. KUREK'S KURKA, EXPLAINS THE CONSTRUCTION OF A FLEXIBLE EXPERIMENTAL ROAD IN ESSEN. THIS INCLUDED THE ANCHORAGE OF THE BARS ON A BITUMEN-GRAVEL ROADBASE BY MEANS OF BOLT JOINTS, FOLLOWED BY THE FILLING OF THE SPACE BETWEEN THE BITUMEN-GRAVEL ROADBASE AND THE UPPER EDGES OF THE BASE PLATES WITH TWO LAYERS OF GUSSASPHALT. /FG/RRL/

Teerbau /Germany/ 1969

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 211250

PERFECTING THE DESIGN AND CONSTRUCTION METHODS FOR FLEXIBLE PAVEMENTS /IN BULGARIAN/
THE RESULTS OF TESTS CARRIED OUT AND RECOMMENDATIONS MADE BY COUNTRIES SUCH AS THE USA, FRANCE, BELGIUM AND ENGLAND ARE ANALYZED REGARDING FLEXIBLE PAVEMENT DESIGN AND CONSTRUCTION. THEY

ARE COMPARED WITH TESTS CARRIED OUT IN SEVERAL INSTITUTES IN THE USSR. TABLES CONTAINING RECOMMENDED VALUES FOR THE CALCULATION OF THE MODULUS OF ELASTICITY OF PAVEMENT MATERIALS IN RELATION TO CLIMATIC CONDITIONS ARE GIVEN. /RRL/

Iwanov, NN
Patista /Bulgaria/ 1969

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 211326

ADHESION OF ASPHALT TO STONE

A SCRAPING TEST WAS USED TO DETERMINE CONDITIONS FOR FORMING A PROPER JOINT BETWEEN ASPHALT AND STONE, AND A PEELING TEST WAS USED TO SHOW THAT THE ADHESION OF COMPOSITES OF STONE, ASPHALT, AND ALUMINUM-FOIL RIBBON FOLLOWS THE RHEOLOGICAL THEORY OF ADHESION. VENEZUELAN ASPHALT OF PENETRATION GRADE 85 TO 100 WAS APPLIED TO GRANITE AND MARBLE SLABS AT TEMPERATURES FROM 100 TO 170 C. AFTER COOLING 1 TO 3 HR. ASPHALT WAS SCRAPED FROM THE SLABS WITH A RAZOR BLADE. THE AMOUNT OF ASPHALT REMAINING AFTER SCRAPING WAS NEARLY INDEPENDENT OF APPLICATION TEMPERATURES OF 110 TO 170 C BUT STRONGLY DEPENDENT ON SURFACE ROUGHNESS. STONE-ASPHALT-ALUMINUM-FOIL SANDWICHES WERE HEATED AT 130 C FOR 20 TO 30 MIN AND ALLOWED TO COOL 1 TO 3 HR. THE ALUMINUM FOIL WAS THEN PEELED FROM THE ASPHALT USING AN APPARATUS THAT PROVIDED A PERPENDICULAR TENSILE FORCE. CONFORMING TO RHEOLOGICAL THEORY, THE PEELING RATE AND RATIO OF RESIDUE ON STONE AND ASPHALT DEPENDED ON PEELING TENSION AND TEMPERATURE. ATTEMPTS TO USE THIS TEST TO DETERMINE PENETRATION OF ASPHALT BY WATER WERE NOT SUCCESSFUL, BUT THE PENETRATION OF WATER BY ASPHALT WAS MEASURED AT 3 AND 25 C. IN THESE TESTS A STONE SLAB WAS APPLIED TO AN ASPHALT-COATED METAL UNDER WATER. INITIALLY THERE WAS VERY LITTLE ADHESION. WITH AGING, HOWEVER, ADHESION INCREASED, THEN LEVELLED OFF. THE RATE OF DISPLACEMENT APPEARED TO BE DIFFERENT FOR GRANITE AND MARBLE. /JM/

Bikerman, JJ *Journal Materials* Mar. 1966

3A 211330

EXTENDING THE LIFE OF ASPHALT PAVING

AN ASPHALT REJUVENATING AGENT CAN EXTEND THE LIFE OF AN ASPHALT PAVEMENT. THE AGENT IS RECLAMITE, AN EMULSION OF SELECTED PETROLEUM RESINS AND OILS. WHEN USED AS A CONSTRUCTION SEAL IT HAS BEEN FOUND THAT THE FRACTIONS OF ASPHALT THAT ARE NORMALLY DRIVEN OFF AT THE HOT PLANT ARE RESTORED, THE NEW PAVEMENT IS SEALED AGAINST THE INTRUSION OF AIR AND WATER WITH A SEAL THAT CANNOT BE WORN OR WEATHERED OFF, THE EFFECTIVE SERVICE LIFE OF AN ASPHALT PAVEMENT IS EXTENDED, AND PAVEMENT SLICKNESS IS NOT APPRECIABLY EFFECTED.

Canessa, W *Pacific Road Builder & Engineering Rev* Jan. 1968

3A 211356

SOUTH DAKOTA CHIP SEAL COAT STUDY

THIS STUDY IS CONCERNED WITH THE COMPARISON AND EVALUATION OF CHIP SEAL COATS PLACED USING AN RS-2 EMULSIFIED ASPHALT, AN RC-4 CUTBACK ASPHALT AND SEVERAL RUBBERIZED RC-4 ASPHALTS. ALL COMPARISONS AND THE EVALUATION ARE BASED ON RATINGS DETERMINED BY THE SOUTH DAKOTA SEAL COAT EVALUATION PROCEDURE. THE RS-2 CHIP SEAL COATS DID NOT PERFORM AS WELL AS THE RC-4 AND RUBBERIZED PROJECTS. THE ADDITION OF RUBBER TO ASPHALT OF THE TYPE USED IN SOUTH DAKOTA FROM 1956 TO 1959 DOES NOT IMPROVE EITHER THE QUALITY OR LIFE EXPECTANCY OF CHIP SEALS. FOR THIS REASON RUBBERIZED ASPHALTS ARE NOT CONSID-

ERED TO BE ECONOMICALLY FEASIBLE AT THE PRESENT TIME. OTHER OBSERVATIONS CONCERNING CHIP SEAL PERFORMANCE WERE MADE DURING THE STUDY. IT IS CONCLUDED THAT CONSTRUCTION CONTROL, WEATHER, EQUIPMENT AND THE EXPERIENCE OF CONSTRUCTION PERSONNEL ARE VARIABLES WHICH APPARENTLY HAVE MORE PROFOUND EFFECTS ON A SEAL COAT THAN THE TYPE OF ASPHALT USED. /AUTHOR/

Crawford, RA *Highway Research Record, Hwy Res Board* 1968

3A 211373

REPORT ON DESIGNATION FOR SURFACE TREATMENTS

ALL TYPES OF SURFACE APPLICATIONS OF BITUMINOUS MATERIALS HAVE BEEN INCLUDED IN THE REPORT ON BITUMINOUS SURFACE TREATMENTS SINCE IT WAS POINTED OUT THAT THE SAME PROCEDURES ARE CALLED BY DIFFERENT NAMES IN DIFFERENT AREAS. THESE DIFFERENCES IN TERMINOLOGY MAKE IT DIFFICULT TO COMPARE PRACTICES, TECHNIQUES, BITUMINOUS MATERIALS, AND AGGREGATES USED BY VARIOUS STATES AND AGENCIES. THEREFORE, QUESTIONNAIRES WERE SENT TO EACH HIGHWAY DEPARTMENT DOING SURFACE TREATMENT WORK TO OBTAIN THE NOMENCLATURE AND DESCRIPTION OF THE PARTICULAR TYPE USED. FROM THE EXCELLENT RESPONSES A SYSTEM FOR IDENTIFYING SURFACE TREATMENTS WAS DEVELOPED IN WHICH TYPE OF TREATMENT, METHOD OF CONSTRUCTION, AND NOMINAL THICKNESS WERE CODED. IN THIS WAY, ANY SURFACE TREATMENT CAN BE IDENTIFIED WITHOUT HAVING TO DECIPHER LOCAL TERMINOLOGY.

Highway Res Circular, Hwy Res Board Feb. 1968

3A 211400

CONSTRUCTION PRACTICE FOR HOT-MIX BITUMINOUS PAVEMENTS

THE RELATIONSHIP BETWEEN THE CONTRACTOR AND THE ENGINEER IS DESCRIBED. THE IMPORTANCE OF MUTUAL RESPECT BETWEEN THE TWO IS EMPHASIZED. RECOMMENDED PRACTICE FOR THE ENGINEER IS GIVEN, INCLUDING INSPECTION, TESTING AND OTHER CONTROL OPERATIONS. /ASCE/

Am Soc Civil Engr J Aerospace Transport Nov. 1968

3A 211410

CONSTRUCTION AND PERFORMANCE OF PLANT MIXED SEAL COATS

THE TYPE OF PLANT MIX SEAL COAT DISCUSSED IS ONE IN WHICH AGGREGATE, SIMILAR TO THAT IN A NORMAL CHIP SEAL, IS USED (OPEN GRADING, WITH MAXIMUM SIZE ABOUT 3/8 INCH). THIS AGGREGATE IS MIXED HOT IN A PLANT WITH RELATIVELY HIGH PERCENTAGE OF AN ASPHALT CEMENT AND PLACED TO A COMPACT DEPTH OF 5/8-3/4 INCH BY AN ASPHALT PAVER. THE HISTORY IS BRIEFLY REVIEWED OF THE USE OF OPEN-GRADED PLANT MIX SEALS AS A WEARING COAT ON MAIN ROADS. THE FOLLOWING ADVANTAGES OF OPEN-GRADED PLANT MIX SEAL ARE DISCUSSED: (1) EXCEPTIONAL SMOOTHNESS WHICH IS CONSISTENTLY BETTER THAN OTHER TYPE OF SURFACE, (2) SKID RESISTANCE AND RESISTANCE TO HYDROPLANING, (3) LESS EXPENSE PER INCH BY DEPTH THAN CHIP SEALS WITH GREATER DURABILITY AND STRUCTURAL VALUE, (4) CAN BE BUILT UNDER TRAFFIC CONDITIONS WHICH WOULD PROHIBIT THE USE OF CHIP SEALS BUT OPEN TO TRAFFIC AS SOON AS ROLLED, AND (5) GOOD APPEARANCE WITH GOOD VISIBILITY PARTICULARLY AT NIGHT WHEN WET. THE DISADVANTAGES INDICATE THAT: (1) MIXING TEMPERATURES ARE QUITE CRITICAL, (2) UNDER CONDITIONS OF VERY HEAVY TRAFFIC AND CONTINUED HIGH TEMPERATURES, ADDITIONAL CONSOLIDATION CAN TAKE PLACE WHICH MAY RESULT IN THE VOIDS BEING OVER-FILLED WITH ASPHALT WITH THE EXCESS ASPHALT THEN FLUSHING TO THE SURFACE AND ELIMINATING THE NON-SKID ADVANTAGES, (3) SHRINKAGE CRACKS IN THE

UNDERLYING SURFACE WILL BE REFLECTED THROUGH THE PLANT MIX SEAL THE SAME AS THEY WILL THROUGH ANY THIN BITUMINOUS OVERLAY, (4) PROBLEMS HAVE APPEARED IN LACK OF RESISTANCE TO SOLVENTS, WATER, ICE, SNOW, AND TIRE CHAIN TRAFFIC, (5) PATCHING IS DIFFICULT IF THE PATCH IS TO BE INCONSPICUOUS AND MATCH THE REST OF THE SURFACE, AND (6) BECAUSE OF THE HIGH VOID CONTENT AND RESULTING EXPOSURE TO AIR OR MORE OF THE ASPHALT, THERE IS THOUGHT THAT THE OPEN-GRADED MIXES ARE MORE SUBJECT TO ASPHALT OXIDATION AND HARDENING THAN DENSE MIXES. CONSTRUCTION PROCEDURES ARE DESCRIBED IN DETAIL FOR OPEN-GRADED PLANT MIX SEAL. IT IS CONCLUDED THAT THE OUTSTANDING ADVANTAGE OF THE GOOD OPEN-GRADED PLANT MIX SEAL (SMOOTHNESS, SKID, AND HYDROPLANING RESISTANCE) MAKE THEM OF SUCH VALUE THAT IT SEEMS WORTHWHILE TO DEVOTE CONSIDERABLE EFFORT TO ELIMINATING DEFECTS.

Eager, WL *Am Assoc State Highway Officials Proc* Oct. 1967

3A 211425

THE EFFECTS OF AIR AND BASE TEMPERATURE ON COMPACTION

AN INVESTIGATION WAS CONDUCTED IN LOUISIANA BECAUSE THE EXTENT OF COLD WEATHER CONSTRUCTION OF HOT MIX ASPHALTIC CONCRETE PAVEMENT HAD SHOWN CONSIDERABLE INCREASE. RESULTS OF THE SURFACE COURSE INVESTIGATION SHOW A DEFINITE RELATIONSHIP BETWEEN AIRBASE TEMPERATURE AND PERCENTAGE OF COMPACTION. A CURVE IS PRESENTED WHICH REPRESENTS MARSHALL STABILITY-TEMPERATURE RELATIONSHIP AT THE END OF A 6-MONTH PERIOD. AN ADDITIONAL STUDY WAS CONDUCTED TO ESTABLISH AN APPROXIMATE RELATIONSHIP BETWEEN THE AIR AND BASE TEMPERATURES UNDER DIFFERENT WEATHER CONDITIONS. THIS STUDY INDICATED THAT: (1) THE AIR TEMPERATURE NEVER EXCEEDS THE BASE TEMPERATURE ALTHOUGH IN COLD AND CLOUDY WEATHER THE BASE TEMPERATURE IS ONLY SLIGHTLY HIGHER THAN AIR TEMPERATURE, (2) BASE TEMPERATURE OF ASPHALTIC CONCRETE PAVEMENT IS ALWAYS HIGHER THAN PORTLAND CEMENT CONCRETE PAVEMENT, AND (3) ON BRIGHT AND SUNNY DAYS THE SURFACE TEMPERATURE OF PORTLAND CEMENT CONCRETE PAVEMENT IS NORMALLY 15 TO 20 DEGREES HIGHER THAN THE AIR TEMPERATURE, AND ASPHALTIC CONCRETE WAS 25 TO 30 DEGREES HIGHER.

Adam, V *Highway Research Board Special Reports* 1960

3A 211440

EFFECT OF WATER ON BEHAVIOR OF SAND-ASPHALT MIXTURES UNDER REPEATED LOADING

THIS PAPER REVEALS THE FUNDAMENTAL CONCEPTS RELATED TO ADHESION AND THE STRIPPING PHENOMENON IN BITUMINOUS MIXTURES. STRIPPING, WHICH MAY OCCUR IN ONLY A SMALL PORTION OF THE PAVEMENT, IS CONSIDERED A GREAT ECONOMIC LOSS AND ENGINEERING FAILURE IN TERMS OF PROPER MIXTURE DESIGN. THE FACTORS AFFECTING ADHESION AND ADHESION FAILURE ARE INNUMERABLE. THEY INCLUDE THE MATERIAL CHARACTERISTICS, CONSTRUCTION TECHNIQUES, AND DIVERSIFIED ENVIRONMENTAL CONDITIONS. DUE TO THE EXTREME COMPLEXITIES OF ADHESION AND ADHESION FAILURE PHENOMENA IN BITUMINOUS MIXTURES, A SPECIFIC ENGINEERING PROBLEM IS ANALYZED IN THIS REPORT AND THE VALIDITY OF THE ADHESION FAILURE CONCEPTS IS DISCUSSED. IN THE STUDY, A HOT-MIX SAND-ASPHALT MIXTURE THAT HAD SHOWN SEVERE DISTRESS AND DISINTEGRATION IN THE FIELD IS SUBJECTED TO NUMEROUS LABORATORY TESTS TO EVALUATE THE CAUSES OF STRIPPING. THE RESULTS INDICATED THAT STANDARD TEST METHODS FOR EFFECT OF WATER ON COHESION OF COMPACTED MIXTURES DID NOT REVEAL ANY STRIPPING TENDENCIES. HOWEVER, THE APPLICATION OF DYNAMIC

LOADING ON SATURATED MIXTURES RESULTED IN DRASTIC REDUCTION IN THE COMPRESSIVE STRENGTH. SIMILARLY, THE CREEP RESPONSE OF MIXTURES WAS AFFECTED BY THE NUMBER OF LOAD REPETITIONS. IT IS ALSO SHOWN THAT THE SOAKED SPECIMENS UNDER DYNAMIC LOADING EXHIBIT PERMANENT DEFORMATION THAT MAY LEAD TO FAILURE IN THE SAND-ASPHALT MIXTURE. /AUTHOR/

Majidzadeh, K Stander, RR *Highway Research Record, Hwy Res Board* 1969

3A 211480

ASPHALT EMULSION-VERSATILE CONSTRUCTION MATERIAL

THE EXPERIENCE OF DOUGLAS COUNTY, OREGON, WITH OPEN GRADED COLD MIX PAVING, HAS ESTABLISHED IT AS AN ECONOMIC AND SATISFACTORY PAVING METHOD. CONSTRUCTION METHODS AND MATERIALS ARE DESCRIBED.

Grubb, GE *Public Works* Jan. 1970

3A 211494

THE USE OF FOAMED BITUMEN PREMIX AS A SURFACE COURSE FOR RURAL PAVEMENTS

A BRIEF OUTLINE IS GIVEN OF THE DEVELOPMENT AND USE OF FOAMED BITUMEN AS THE BINDER IN A SURFACE COURSE MIX, WITH PARTICULAR REFERENCE TO THE WORK OF PROFESSOR L. H. CSANYI OF IOWA STATE COLLEGE. THE FIRST KNOWN SIGNIFICANT USE OF THIS PROCESS IN AUSTRALIA WAS THE SURFACING WITH 1 IN. OF PREMIX OF SEVEN WHEAT STORAGE AREAS IN THE NORTH WEST OF NEW SOUTH WALES. THIS WORK WAS CARRIED OUT TOWARDS THE END OF 1967. A DESCRIPTION IS GIVEN OF THE LOCAL MATERIALS SELECTED FOR THE WORK, THE PLANT USED, AND THE GENERAL CONSTRUCTION TECHNIQUES, TOGETHER WITH AN INDICATION OF THE COSTS. THE PROCESS PERMITS THE PRODUCTION OF A BITUMINOUS PREMIX WITHOUT THE USE OF A CONVENTIONAL HOTMIX PLANT AND THE POSSIBLE ECONOMIC USES OF THIS PROCESS, PARTICULARLY FOR COUNTRY AREAS, ARE DISCUSSED. /AUTHOR/

Larcombe, LA Newton, R Martin, KG DISCUSSEER *Australian Road Research Board Proc* 1968

3A 211510

COLD WEATHER PAVING-TEMPERATURE-DENSITY

A COLD WEATHER PAVING EXPERIMENT WAS CONDUCTED IN WOODBRIDGE, NEW JERSEY, DURING JANUARY 1968 WITH THE COOPERATION OF THE ASPHALT INSTITUTE. THE DEMAND FOR HOT-MIX ASPHALT IN THE AREA FAR EXCEEDED THE PRODUCTION CAPABILITIES SO IN ORDER TO PERMIT COLD WEATHER PAVING, IT WAS NECESSARY TO DETERMINE WHAT CHANGES IN THE SPECIFICATIONS WERE NEEDED TO OBTAIN THE DESIRED RESULTS. THE RELATIONSHIP WAS STUDIED BETWEEN THE TEMPERATURE OF THE MIX AT THE TIME OF PLACEMENT AND THE DENSITY OBTAINED IN TERMS OF PER CENT VOIDS. THIS RELATIONSHIP WAS COMPARED WITH THAT WHICH HAD BEEN PREVIOUSLY DETERMINED FOR HOT WEATHER PAVING. WOODBRIDGE REQUIRED CERTAIN STANDARDS AND PROCEDURES FOR FULL DEPTH PAVEMENT CONSTRUCTION AND THESE STANDARDS AND PROCEDURES WERE FOLLOWED FOR ALL THE RESEARCH AND EXPERIMENTAL WORK. THE FOLLOWING CONCLUSIONS WERE REACHED: (1) THE TEMPERATURE-DENSITY RELATIONSHIP DURING THE ROLLING PROCEDURE IS THE SAME FOR BOTH WARM WEATHER AND COLD WEATHER CONSTRUCTION, (2) WITH PROPER ENFORCEMENT OF THE DESIRED MIX TEMPERATURE AT THE TIME OF PLACEMENT AND PROPER ROLLING PROCEDURE, DEEP LIFTS OF HOT PLANT MIX ASPHALT BASE CAN BE COMPACTED TO THE DESIRED DENSITY IN COLD WEATHER, (3) WHEN A GOOD SYSTEM OF QUALITY CONTROL, INSPECTION AND PERFORMANCE IS REQUIRED, THE PROBABILITY OF SUCCESS WHEN PAVING IN COLD WEATHER IS THE SAME AS THE PROBABILITY OF SUCCESS IN WARM WEATHER, AND (4) DEEP LIFT

ASPHALT BASE CONSTRUCTION MAY BE EXTENDED INTO THE COLD WEATHER AS LONG AS IT IS PRACTICAL AND ECONOMIC TO PROPERLY PREPARE THE SUBGRADE, THE MINIMUM COMPACTED THICKNESS IS NOT LESS THAN FOUR INCHES, AND THE TEMPERATURE OF THE MIX WHEN LAID IS NOT LESS THAN 275F. THE APPENDICES PRESENT THE MIX DESIGN DATA, PLAN OF TEST SECTION, CORE SCHEDULE, RECORDED TEMPERATURES, AND CORE AIR VOIDS.

Beagle, CW Jones, GM DISCUSSEER Parker, CF
DISCUSSEER Zube, E DISCUSSEER Campen, WH
DISCUSSEER Finn, FN DISCUSSEER Krchma, LC DISCUSSEER Assoc
Asphalt Paving Technol Proc Feb. 1969

3A 211511

A GENERAL METHOD OF DESIGN FOR SEAL COATS AND SURFACE TREATMENTS

THE PRINCIPAL OBJECTIVE OF THIS PAPER IS TO DEMONSTRATE THAT ONE EQUATION FOR THE QUANTITY OF COVER AGGREGATE REQUIRED AND ANOTHER EQUATION FOR THE QUANTITY OF ASPHALT BINDER TO BE APPLIED, CAN BE USED FOR THE DESIGN OF EITHER SINGLE APPLICATION OR MULTIPLE APPLICATION SURFACE TREATMENTS AND SEAL COATS. THE REQUIRED CHARACTERISTICS OF BOTH COVER AGGREGATES AND ASPHALT BINDERS ARE REVIEWED. THE SUPERIORITY OF ONE-SIZE OVER GRADED COVER AGGREGATES IS DEMONSTRATED. EQUATIONS ARE DEVELOPED FOR THE QUANTITIES OF COVER AGGREGATE AND ASPHALT BINDER REQUIRED FOR SINGLE APPLICATION SURFACE TREATMENTS AND SEAL COATS. A SAMPLE CALCULATION ILLUSTRATES THEIR USE FOR THIS PURPOSE. IT IS SHOWN THAT THESE SAME EQUATIONS CAN BE EMPLOYED FOR THE DESIGN OF MULTIPLE SEAL COATS AND SURFACE TREATMENTS. SAMPLE CALCULATIONS ARE INCLUDED TO ILLUSTRATE THEIR USE IN THIS RESPECT. THE PRINCIPLES OF CONSTRUCTION FOR SINGLE AND MULTIPLE APPLICATION SURFACE TREATMENTS AND SEAL COATS ARE REVIEWED. /AUTHOR/

McLeod, NW Chaffin, CW DISCUSSEER Holberg, AE
DISCUSSEER Parker, CF DISCUSSEER Obrcian, V Edwards,
JM Campen, WH DISCUSSEER Kari, WJ DISCUSSEER Assoc Asphalt
Paving Technol Proc Feb. 1969

3A 211518

"GUSSASPHALT" OR POURABLE ASPHALTIC MIXTURES

GUSSASPHALT IS A PAVING MIXTURE WHICH CAN BE Poured OR CAST IN PLACE. IT MAY BE DESCRIBED AS A SPECIAL MASTIC TYPE PAVING MIXTURE. THE BEHAVIOR OF GUSSASPHALT DEPENDS ON THE PROPERTIES AND RELATIVE PROPORTIONS OF ASPHALT CEMENT AND MINERAL FILLER. IT FORMS A PRACTICALLY VOIDLESS PAVEMENT SURFACE THAT CAN BE ACHIEVED WITHOUT THE USE OF ROLLERS OR ANY OTHER COMPACTION EQUIPMENT. A NUMBER OF GUSSASPHALT CONSTRUCTION PROJECTS WERE VISITED IN GERMANY. THE SPECIFICATIONS FOR THE MATERIALS, CURRENT CONSTRUCTION PRACTICES, TESTING, AND PERFORMANCE OF GUSSASPHALT PAVEMENT SURFACES WERE REVIEWED. THE PRINCIPAL USE FOR GUSSASPHALT IS A SURFACING MATERIAL FOR HIGHWAY AND CITY STREETS. WHEN PORTLAND CEMENT CONCRETE BASE IS TOPPED WITH GUSSASPHALT SURFACE, ASPHALT CONCRETE BINDER IS USED AS AN INTERMEDIATE LAYER. GUSSASPHALT IS USED TO OVERLAY OLD ASPHALT, PORTLAND CEMENT CONCRETE AND COBBLE STONE PAVEMENTS WHICH NEED RENEWING, REHABILITATION OR IMPROVEMENT IN THEIR SKID-RESISTANCE PROPERTIES. GUSSASPHALT IS COMPOSED OF CRUSHED STONE, SAND, MINERAL FILLER AND ASPHALT CEMENT. THE SOFTNESS OR HARDNESS OF GUSSASPHALT IS CONTROLLED BY EITHER THE USE OF ASPHALT CEMENT OF DIFFERENT CONSISTENCIES OR BY SLIGHT ADJUSTMENT IN THE ASPHALT CONTENT. THE MANUFACTURE OF GUSSASPHALT, TRANSPORT, AND PAVING EQUIPMENT AND PAVING PROCESS ARE DESCRIBED. IT IS FELT THAT STRONG EFFORT SHOULD BE MADE TO DEVELOP THE USE OF THE MASTIC TYPE MIXES SUCH AS GUSSASPHALT IN THE UNITED STATES.

Puzinauskas, VP
Asphalt Institute Feb. 1970

3A 211560

DESIGN CONSTRUCTION, AND INITIAL EVALUATION OF EXPERIMENTAL TEST SECTIONS OF ASPHALT CONTAINING SYNTHETIC RUBBER

THE 16 TEST SECTIONS OF ASPHALT CONTAINING RUBBER WERE CONSTRUCTED AS PART OF A PRIMARY HIGHWAY PROJECT IN SOUTHEASTERN UTAH. THE EXPERIMENT CONSISTS OF 5 FACTORS AT 2 LEVELS, EACH INCORPORATED IN A ONE-HALF REPLICATE OF A 2 TO THE FIFTH POWER FRACTIONAL FACTORIAL EXPERIMENT. THE DESIGN PROVIDES THE BASIS FOR DETERMINING THE EFFECT OF EACH OF 5 FACTORS AND EACH OF 10 TWO-WAY INTERACTIONS ON PAVEMENT CONSTRUCTION, PERFORMANCE, AND DESIGN. THE EFFECT OF EACH VARIABLE WAS DETERMINED FOR THE CONSTRUCTION PROCESS, AND AN INITIAL EVALUATION WAS MADE. A DESCRIPTION OF THE CONSTRUCTION PROCESS, INCLUDING THE RUBBERIZING PROCESS, IS GIVEN. EVALUATION IS CONTINUING THROUGH MANY OBSERVATIONS AND PHYSICAL TESTS ON THE PAVEMENTS AND PAVING MATERIALS. FAILURE RATE OF PAVEMENTS WILL BE ACCELERATED BY THE REDUCTION OF HALF THE DESIGN THICKNESS. THE DESIGN PROVIDES A SOUND METHOD OF ANALYSIS AND OFFERS A DEFINITE BASIS TO DETERMINE WHICH FACTORS AND INTERACTIONS ARE SIGNIFICANTLY AFFECTING PAVEMENT PERFORMANCE AND DESIGN. /AUTHOR/

Darter, MI Peterson, DE Jones, GM Vokac, R *Highway Research Record, Hwy Res Board* 1970

3A 211598

EMULSIFIED ASPHALTS

STUDIES ARE BEING CONDUCTED ON THE PHYSICAL CHEMISTRY OF, SPECIFICATIONS FOR, AND CONSTRUCTION METHODS USING EMULSIFIED ASPHALTS. THE LAST CATEGORY INCLUDES METHODS OF APPLYING ASPHALT CEMENT TO PAVEMENT COMPONENTS WITH EMULSIFIED ASPHALTS. /RRI/

Monte, NL

Road Research Institute /Brazil/ 1970

ACKNOWLEDGMENT: Road Research Institute /Brazil/

3A 211735

BITUMINOUS SURFACE TREATMENTS FOR NEWLY CONSTRUCTED RURAL ROADS

THIS GUIDE DESCRIBES SOME COMMONLY USED SURFACE TREATMENT METHODS FOR PROVIDING A NEWLY CONSTRUCTED ROAD WITH A BITUMINOUS SURFACING AND INTRODUCES A NEW DESIGN METHOD BASED ON THE RESULTS OF ROAD EXPERIMENTS. DISCUSSED ALSO ARE FACTORS AFFECTING THE CHOICE OF TREATMENT, MATERIALS, DESIGN METHODS, AND CONSTRUCTION PROCESSES.

Nat Inst Road Research /S Africa/ Feb. 1971, 58 pp, 4 Fig, 3 Tab, 9 Ref

3A 211802

COLD WEATHER PAVING WITH GLASPHALT

DECREASED COOLING RATES, AS OBSERVED IN FIELD TESTS, FOR GLASPHALT AS COMPARED TO CONVENTIONAL STONE AGGREGATE ASPHALT HAVE BEEN FOUND TO BE CAUSED BY TWO EFFECTS: 1. THE RELATIVELY LONGER-THINNER GLASS AGGREGATE PARTICLE RESULTS IN A MORE EFFECTIVE TRANSFER OF HEAT TO THE GLASS PARTICLE BECAUSE OF THE SHORTER CONDUCTION PATH AND INCREASED HEAT TRANSFER SURFACE AREA. THE RESULT IS THAT FOR THE SAME MEASURED "BULK" TEMPERATURE, THE GLASS AGGREGATE PARTICLE ACTUALLY CONTAINS MORE THERMAL ENERGY THAN DOES THE STONE AGGREGATE PARTICLE. 2. THE EFFECTIVE THERMAL CONDUCTIVITY OF GLASPHALT IS LOWER THAN THAT FOR A CONVENTIONAL MAT BECAUSE OF

THE SHAPE OF THE GLASS AGGREGATE AND ITS ORIENTATION IN THE MAT. THIS EFFECTIVE LOWERING OF THE THERMAL CONDUCTIVITY CAN BE EXPLAINED BY A COMBINATION OF RESISTANCES APPROACH. THE RESULT OF THE ABOVE IS THAT THE GLASPHALT MAT: (1) CONTAINS MORE THERMAL ENERGY INITIALLY; AND (2) COOLS AT A SLOWER RATE THAN DOES THE CONVENTIONAL MAT. THE COMBINATION OF MORE ENERGY INITIALLY AND SLOWER HEAT LOSS RESULTS IN THE INCREASED COOLING TIMES EXPERIENCED IN THE FIELD TESTING OF GLASPHALT UNDER COLD WEATHER CONDITIONS. THIS EXTENDED COOLING TIME FOR GLASPHALT WOULD BE EXTREMELY BENEFICIAL IN ALLOWING SUFFICIENT TIME FOR COMPACTION OF THIN MATS, WHERE, WITH CONVENTIONAL ASPHALT PAVING, PAVING OPERATIONS WOULD BE POSSIBLE.

Dickson, PF
Symposium On Secondary Uses of Waste Glass Jan. 1973, 18 pp, 3 Fig, 3 Tab, 3 Ref

3A 211818
COOLING OF HOT-MIX ASPHALT LAID ON FROZEN SUBGRADE WITH DISCUSSION

THE DESCRIPTION AND SOLUTION OF THE TEMPERATURE DISTRIBUTION AND HEAT FLOW PROBLEM REQUIRES THAT AN ACCOUNT BE TAKEN, IN THE MATHEMATICAL FORMULATION, OF THE POSSIBILITY OF MULTIPLE PHASES IN THE SUBGRADE. ONE MUST CONSIDER A BASE WITH A THAWING REGION WHICH MOVES INTO THE BASE WITH TIME. FOR THE SAME AMOUNT OF HEAT LOSS FROM THE MAT, THE THERMAL WAVE (TEMPERATURE RISE) PROGRESSES FURTHER INTO THE UNFROZEN SUBGRADE THAN INTO THE FROZEN SUBGRADE. AS AN INCREMENT OF FROZEN SOIL REACHES 32 F, THE TEMPERATURE CHANGE "PAUSES" UNTIL THE MOISTURE HAS BEEN THAWED BEFORE THE TEMPERATURE AGAIN STARTS TO RISE. THIS PHENOMENA HAS THE EFFECT OF PRODUCING A SUBSTANTIAL TIME LAG IN THE THERMAL WAVE PENETRATION INTO FROZEN SOIL. COMPUTER RESULTS SHOW THAT THE SOLAR FLUX HAS LESSER EFFECT ON THE TEMPERATURE PROFILE IN THE UPPER HALF OF THE MAT THAN DOES THE WIND VELOCITY. NEITHER OF THESE EFFECTS IS IMPORTANT IN THE LOWER HALF OF THE ASPHALT MAT. COMPUTATIONS FOR VARIOUS MOISTURE CONTENTS OF FROZEN SUBGRADE SHOWED THE EFFECT OF MOISTURE CONTENT ON MAT TEMPERATURE PROFILE AND HEAT FLUX INTO SUBGRADE TO BE APPRECIABLE IN THE LOWER PORTION OF THE MAT. THIS EFFECT DECREASES IN IMPORTANCE WITH INCREASED DISTANCE FROM THE MAT-SUBGRADE INTERFACE. INCREASED MOISTURE CONTENT IN THE FROZEN SUBGRADE PRODUCES A LOWER INTERFACIAL TEMPERATURE AND REQUIRES A HIGHER LAYDOWN TEMPERATURE TO PROVIDE SUFFICIENT TIME TO COOL TO A SPECIFIED AVERAGE MAT TEMPERATURE. A DISCUSSION IS INCLUDED WHICH DEALS WITH VARIOUS QUESTIONS CONCERNING THIS STUDY.

Dickson, PF Corlew, JS *Assoc Asphalt Paving Technol Proc Proceedings* Vol. 41 Feb. 1972, pp 49-69, 15 Fig, 2 Tab, 8 Ref

3A 211828
PLANT-MIXED SEAL COATS IN UTAH WITH DISCUSSION
THIS REPORT DISCUSSES THE PERFORMANCE OF PLANT-MIXED SEAL COATS IN UTAH. INCLUDED IS A DISCUSSION OF THE AGGREGATE GRADATIONS AND ASPHALTIC MATERIALS USED, AND THE CONSTRUCTION PROCEDURES FOLLOWED. THE TEST PROCEDURES DESCRIBED ARE THOSE PERFORMED IN THE FIELD AND IN THE LABORATORY. FIELD TESTS INCLUDE A DETERMINATION OF THE SKID RESISTANCE AND THE RIDEABILITY OF THE SURFACE. LABORATORY TESTS INCLUDE VOIDS CONTENT, COHESION AND BONDING. THE DATA PRESENTED ARE FROM PROJECTS BUILT BETWEEN 1965 AND 1969. FROM THESE, PLANT-MIXED SEAL COATS HAVE BEEN FOUND TO PROVIDE GOOD SKID RESISTANCE AND EFFECTIVELY SEAL THE SURFACE IF THE

PROPER ASPHALT CONTENT IS USED. DENSER AGGREGATE GRADATIONS HAVE GIVEN BETTER PERFORMANCE. SMOOTHER RIDING SURFACES ARE OBTAINED WITH PLANT-MIXED SEAL COATS. REASONS FOR THE USE OF PLANT-MIXED SEAL COATS ARE GIVEN AND SPECIFIC RECOMMENDATIONS FOR AGGREGATE AND ASPHALT ARE INCLUDED. A DISCUSSION IS INCLUDED WHICH DEALS WITH VARIOUS QUESTIONS CONCERNING THIS STUDY. /AUTHOR/

Betenson, WB *Assoc Asphalt Paving Technol Proc Proceedings* Vol. 41 Feb. 1972, pp 664-84, 21 Fig, 8 Tab, 6 Ref

3A 211888
THE MAIN TECHNOLOGICAL PROBLEMS IN THE USE OF BITUMINOUS MATERIALS 2ND PART
THE TEMPERATURE CONTROL OF BITUMINOUS MIXTURES DURING ROAD CONSTRUCTION IS DISCUSSED, AND MODERN CONSTRUCTION PROCEDURES AND PLANT ARE DESCRIBED FOR FULL-DEPTH AND LAYERED CONSTRUCTION. /TRRL/

Domenighettid, *Le Strade /Italy/* Vol. 7 July 1972, pp 425-33, 5 Fig, 4 Phot

IRRD 202 900, 1C31235474

3A 211936
BITUMINOUS SURFACING ON THE M.73 MOTORWAY COMPLIANCE WITH SPECIFICATION-AN ANALYSIS OF THE USE OF THE HARDMAN SYSTEM FOR THE JUDGEMENT OF COMPLIANCE WITH SPECIFICATION FOR HOT ROLLED ASPHALT
THIS ARTICLE DESCRIBES THE USE OF THE HARDMAN SYSTEM AND ITS ADVANTAGES. BITUMINOUS SAMPLES WERE TAKEN FROM THE BASE COURSE AND WEARING COURSE OF THE M.73 AND TESTED FOR QUALITY. THE RESULTS AND CONCLUSIONS FROM THESE TESTS ARE GIVEN. /TRRL/

Davidson, JB Morgan, RO *Roads & Road Construction, London /UK/* Vol. 50 No. 596, Aug. 1972, pp 227-9, 1 Fig

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 211944
MARYLANDS TWO CONTINUOUSLY-REINFORCED CONCRETE PAVEMENTS-- A PROGRESS REPORT
TWO HIGHWAY PROJECTS USING CONTINUOUSLY-REINFORCED CONCRETE PAVING HAVE BEEN CONSTRUCTED BY THE MARYLAND STATE ROADS COMMISSION. NINE SECTIONS OF CONTINUOUSLY-REINFORCED PAVEMENT ARE INCLUDED IN THE PROJECT. THE PAVEMENT IS 8 IN. THICK, FOUNDED ON A GRANULAR-TYPE SUBBASE OF 6 IN. MINIMUM THICKNESS. TWO LENGTHS OF CONVENTIONAL JOINTED PAVEMENT ARE INCLUDED AS CONTROL SECTIONS. THEY ARE 9 IN. THICK, JOINTED AT 40 FT. CENTERS, AND FOUNDED ON A GRANULAR SUBBASE OF THE SAME THICKNESS. TRAFFIC DATA TABLES PROVIDE AN ANNUAL REPORT OF AXLE LOADS OF VARIOUS MAGNITUDES USING THE FACILITY. ANALYSIS IS MADE OF CRACK PATTERNS, CRACK WIDTHS, FAILURES AND POSSIBLE CAUSES, END MOVEMENTS OF CONTINUOUSLY-REINFORCED SLABS, END ANCHORAGES, AND ROAD ROUGHNESS MEASUREMENTS. THE PERFORMANCE AND COST OF CONTINUOUSLY-REINFORCED CONCRETE PAVEMENT IS COMPARED WITH CONVENTIONAL PAVEMENT. THE FOLLOWING IMPROVEMENTS ARE SUGGESTED FROM THIS STUDY: 1/ IT IS IMPORTANT TO VIBRATE BOTH LIFTS OF A CONTINUOUSLY-REINFORCED PAVEMENT AND TO USE TWO PAVERS WHEN TWO LIFT CONSTRUCTION PROCEDURE IS FOLLOWED, 2/ PREPLACING THE STEEL IN VERY LONG LENGTHS AND COMPLETELY RANDOMIZING SPLICE LOCATIONS WOULD BE A PREFERRED TYPE OF CONSTRUCTION, 3/ THE LENGTH OF THE LAP SHOULD BE LENGTHENED 4/ THE SIMPLEST TYPE OF TERMINAL JOINT SHOULD BE USED, AND 5/ END ENCHORAGES, IF USED, MUST BE MASSIVE.

Lee, A *Highway Research Record, Hwy Res Board* 1963

3A 211956

A 10-YEAR REPORT ON PERFORMANCE OF BONDED CONCRETE RESURFACINGS

THE PERFORMANCE OF SEVERAL BONDED CONCRETE OVERLAY PROJECTS WAS SURVEYED AND REPORTED. RESULTS ARE TABULATED OF TESTS OF CORE SAMPLES AND BOND INTERFACE. SOME AREAS OF DISTRESS AND OF BOND LOSS ARE PICTURED. CAUSES OF BOND LOSS AND ITS EFFECT ON THE PERFORMANCE OF THE OVERLAY ARE DISCUSSED. GOOD BOND MUST BE THE PRIMARY GOAL, BUT A LOSS OF BOND DOES NOT APPEAR TO IMPEDE THE PERFORMANCE OF A BONDED CONCRETE OVERLAY IN LONG-TERM CONTINUOUS USE. SOME OF THE FINDINGS FOLLOW: /1/ IT IS ESSENTIAL TO FOLLOW THE RECOMMENDED TECHNIQUES AND CONSTRUCTION SEQUENCE TO ASSURE A SUCCESSFUL PROJECT, /2/ THIN WATERY GROUT OR FREE WATER LEFT STANDING ON THE SURFACE OF THE BASE PAVEMENT TENDS TO WEAKEN THE BOND, /3/ AN ADEQUATE BOND STRENGTH CAN BE OBTAINED, USING THE TECHNIQUES OUTLINED BY WESTALL /SEE REFERENCES BELOW/. WHEN SUCH BOND IS OBTAINED, SHEAR TESTS CAUSE A BREAK IN THE BASE PAVEMENT IN PRACTICALLY EVERY CORE TESTED, /4/ SOME LOSS OF BOND WAS FOUND ON PRACTICALLY EVERY PROJECT WITH MOST AREAS BEING SMALL IN SIZE ALONG LONGITUDINAL CONSTRUCTION JOINTS, /5/ LOSS OF BOND AREAS CAN ONLY BE FOUND BY SOUNDING THE PAVEMENT AND SHOW LITTLE OR NO DETERIORATION, /6/ NO DISTRESS WAS OBSERVED ALONG LONGITUDINAL CONSTRUCTION JOINTS WHICH COULD BE ATTRIBUTED TO LACK OF LOAD TRANSFER, /7/ JOINTS IN THE BASE PAVEMENT WILL REFLECT THROUGH THE RESURFACING AND SHOULD BE MATCHED WHENEVER POSSIBLE, AND /8/ CRACKS IN THE BASE PAVEMENT WILL ALSO REFLECT THROUGH THE RESURFACING IN MOST CASES. THE EVIDENCE GATHERED SHOWS THAT ADEQUATE PERFORMANCE CAN BE EXPECTED REGARDLESS OF THE THICKNESS OF THE RESURFACING AND THE TYPE AND FREQUENCY OF TRAFFIC. REFERENCES: BONDING THIN CONCRETE TO OLD, W. G. WESTALL, CIVIL ENG., VOL. 28, NO. 6, PP. 406-409, JUNE 1958. BONDED RESURFACING AND REPAIRS OF CONCRETE PAVEMENT, W. G. WESTALL, HIGHWAY RESEARCH BOARD BULL. 260, PP. 14-24, 1960.

Gillette, RW *Highway Research Record, Hwy Res Board* Nov. 1965

3A 211981

AN EVALUATION OF CONCRETE CONTAINING COARSE AGGREGATE FROM THE MANLIUS, LOCKPORT, AND ONONDAGA FORMATIONS IN WESTERN AND CENTRAL NEW YORK

1. AIR-ENTRAINED CONCRETE IN THE STATE HIGHWAY SYSTEM CONTAINING COARSE AGGREGATE FROM THE MANLIUS, LOCKPORT, AND ONONDAGA FORMATIONS IS GENERALLY IN EXCELLENT CONDITION. SEVERAL INVESTIGATIONS OF NONAIR-ENTRAINED CONCRETE HAVE SHOWN MORE SEVERE DETERIORATION THAN THAT FOUND IN THE AIR-ENTRAINED CONCRETE. THIS SEVERE DISTRESS HAS BEEN ATTRIBUTED TO THE LACK OF ENTRAINED AIR RATHER THAN THE QUALITY OF THE COARSE AGGREGATES. 2. SMALL NUMBERS OF POPOUTS WERE OBSERVED IN NEARLY ALL PAVEMENT CONCRETE. THE POPOUTS USUALLY DID NOT EXCEED FIVE PER SLAB AND DID NOT DETRACT FROM THE APPEARANCE OR QUALITY OF THE PAVEMENT. SEVERE POPOUTS OCCURRED ON THREE CONTRACTS. THEY WERE CAUSED BY A SMALL PERCENTAGE OF LIGHT GRAY ARGILLACEOUS DOLOMITE MATERIAL THAT IS EXTREMELY SENSITIVE TO FREEZE-THAW DETERIORATION AND, THEREFORE, IS NO LONGER QUARRIED. 3. PAVEMENT CONCRETE ON THE THOMAS E. DEWEY THRUWAY CONTAINING COARSE AGGREGATE FROM THE ONONDAGA FORMATION WAS ALSO IN GENERALLY EXCELLENT CONDITION EXCEPT IN THE AREAS WHERE JOINT SPALLING IS PREVALENT. POSSIBLE CAUSES ARE BEING INVESTIGATED. 4. NO EVIDENCE WAS FOUND TO INDICATE THAT A DELETERIOUS CHEMICAL REACTION HAS TAKEN PLACE BETWEEN THE ONONDAGA CHERTS AND

ALKALIES IN THE CEMENT. THE ONLY DISTRESS OBSERVED TO BE POSITIVELY ASSOCIATED WITH THE CHERT WERE POPOUTS CAUSED BY THE PHYSICALLY UNSOUND NO. 45 WHITE CHERT. 5. THE PROCEDURES USED FOR ACCEPTANCE OF COARSE AGGREGATES HAVE APPARENTLY PREVENTED THE DEVELOPMENT OF DEEP-SEATED DETERIORATION RESULTING FROM UNSOUND AGGREGATE. HOWEVER, THERE IS AN INDICATION THAT THE PRESENT MAXIMUM LIMIT OF 3.0 PERCENT LOSS IN THE UNCONFINED FREEZE-THAW TEST MAY BE TOO RESTRICTIVE SINCE APPROXIMATELY 20 PERCENT OF THE ACCEPTANCE TESTS HAD VALUES ABOVE THIS LIMIT BUT THE STONE WAS ACCEPTED ON THE BASIS OF ITS PREVIOUS SERVICE RECORD AND USED WITHOUT UNDESIRABLE CONSEQUENCES. 6. TO CONTINUALLY IMPROVE ACCEPTANCE, DESIGN, AND CONSTRUCTION PROCEDURES, SYSTEMATIC CONDITION SURVEY OF ALL STATE HIGHWAY CONCRETE SHOULD BE CONDUCTED PERIODICALLY.

Chamberlin, WP Eucker, AJ
New York State Dept Transportation

ACKNOWLEDGMENT:

3A 212151

LABORATORY STUDY OF EFFECTS OF ENVIRONMENT AND CONSTRUCTION PROCEDURES ON CONCRETE PAVEMENT SURFACES

A STUDY WAS CONDUCTED TO DEVELOP IMPROVED CONSTRUCTION PRACTICES RELATED TO THE CONSOLIDATION, FINISHING, AND CURING OF CONTINUOUSLY REINFORCED CONCRETE PAVEMENTS (CRCP). A TOTAL OF 56 SIDEWALK SIZE SLABS WERE CAST IN CONTROLLED ENVIRONMENTAL ROOMS. PARAMETERS INVESTIGATED INCLUDED TYPE OF SUBBASE, METHOD OF CONSOLIDATION (VIBRATION), TYPE OF FINISH, TYPE OF CURING METHOD, AND CURING ENVIRONMENT. ALSO, THE SLABS WERE UTILIZED TO DETERMINE THE EFFECTS OF WIND ON THE EVAPORATION RATE OF WATER FROM THE SURFACE OF THE SLABS. THIS WAS ACCOMPLISHED BY GENERATING WIND OVER THE SURFACE OF THE SLABS. AFTER A 28 DAY CURING PERIOD THE SLABS WERE REMOVED FROM THEIR CURING ENVIRONMENT AND A MINIMUM OF THREE CORES WERE TAKEN FROM EACH. THESE CORES WERE THEN SUBJECTED TO DIAGNOSTIC ANALYSES. AT THE CONCLUSION OF THE TESTS, THE DATA TAKEN FROM THE CORES ALONG WITH THE WATER LOSS MEASUREMENTS WERE REDUCED, TABULATED, ANALYZED, AND CURVES PLOTTED TO ILLUSTRATE THE RESULTS OBTAINED. /FHWA/

Wrbas, RO Ledbetter, WB Meyer, AH
Texas Transportation Institute, Res Rept 141-1 Fcp 41h1 212 Fc Nov. 1972, 31 pp

ACKNOWLEDGMENT: Texas Highway Department, Federal Highway Administration FHWA M0046, NTIS PB 220 078, 1C32023456

3A 212215

WAYS OF INDICATING THE AMOUNT OF CEMENT IN SOIL-CEMENT

THE VARIOUS METHODS THAT CAN BE USED TO INDICATE THE AMOUNT OF CEMENT IN SOIL-CEMENT ARE PRESENTED. CEMENT CONTENT BY WEIGHT, CEMENT CONTENT BY VOLUME, CEMENT CONTENT, WEIGHT BY VOLUME, AND CEMENT CONTENT IN ABSOLUTE VOLUME OF CEMENT. EXPRESSIONS WHICH RELATE THE VARIOUS METHODS OF EXPRESSING THE AMOUNT OF CEMENT ARE COMPARED AND THE DIFFERENCE BETWEEN LABORATORY AND CONSTRUCTION TECHNIQUES ARE DISCUSSED. THE INCONVENIENCE OF SPECIFYING IN THE FIELD CEMENT CONTENT BY WEIGHT IS PRESENTED, AND IN CONCLUSION A SPECIFICATION BY PONDERAL PROPORTIONING IS PROPOSED. /RRL/A/

Ferreira, HN *Fomento, Lisbon /Portugal/* July 1965

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 212529

INVESTIGATION OF CONCRETE BRIDGE DECK DETERIORATION

THE CAUSES OF DETERIORATION OF CONCRETE BRIDGE DECKS IN CONNECTICUT WERE STUDIED TO DETERMINE MEANS OF PREVENTING DETERIORATION AND EVALUATE ANY POSSIBLE PERMANENT DAMAGE. THE INVESTIGATION CONSISTED OF THE FOLLOWING STEPS: (1) FIELD SURVEY OF APPROXIMATELY 250 BRIDGES OF ALL AGES, TYPES AND USE, (2) STATIC ANALYSIS OF TYPICAL BRIDGES, (3) DYNAMIC ANALYSIS OF A TYPICAL BRIDGE, (4) CONTINUING SURVEILLANCE OF FOUR BRIDGES FROM SHORTLY AFTER CONSTRUCTION TO THE PRESENT, (5) LABORATORY SIMULATION OF CONCRETE BRIDGE DECK CONSTRUCTION, (6) OBSERVATION OF ACTUAL BRIDGE DECK CONSTRUCTION PROCEDURES, AND (7) ANALYSIS OF STRESSES DUE TO DIFFERENTIAL THERMAL STRAINS. IT WAS CONCLUDED THAT: (1) DETERIORATION IS DUE PRIMARILY TO RANDOM CRACKS AND POOR CONCRETE RESULTING FROM EARLY DRYING AND POOR CURING, (2) TRANSVERSE CRACKS ARE NOT HARMFUL IF SEALED TO PREVENT CORROSION OF REINFORCING STEEL, (3) TENSILE STRESSES DUE TO DYNAMIC LOADING AND POURING SEQUENCE ARE NOT SERIOUS, (4) TENSILE STRESSES DUE TO PLACEMENT OF HOT CONCRETE CAN CAUSE TRANSVERSE CRACKS, AND (5) DEBRIS INCLUDED IN THE CONCRETE DURING CONSTRUCTION CAN CAUSE SPALLING. IT IS RECOMMENDED THAT CONCRETE SHOULD BE PLACED RAPIDLY ENOUGH TO ALLOW SCREEDING TO OCCUR WITHIN 30 MINUTES AFTER PLACEMENT AND FLOATING SHOULD BE DONE IMMEDIATELY AFTER SCREEDING. METHODS USED FOR ROUGHENING THE CONCRETE SURFACE SHOULD BE CARRIED OUT IMMEDIATELY AFTER FLOATING, SO THAT COVERING CAN BE PLACED BEFORE DRYING. THE CONCRETE SHOULD BE COOL WHEN PLACED AND BE KEPT FREE OF ALL DEBRIS. TWO STATE INSPECTORS SHOULD BE PRESENT AT ALL TIMES TO ENSURE PROPER CONSTRUCTION PROCEDURES ARE EMPLOYED.

Healy, KA Borjeson, RW Perazella, JC
Connecticut University May 1967

3A 212533

INFLUENCE OF CREEP AND SHRINKAGE OF CONCRETE ON COMPOSITE CONSTRUCTION

IN REINFORCED CONCRETE CONSTRUCTION THE TWO MATERIALS TO BE CONSIDERED ARE CONCRETE AND STEEL. THESE MATERIALS HAVE DIFFERENT PROPERTIES WHICH MUST BE TAKEN INTO ACCOUNT WHEN DESIGNING A CONCRETE STRUCTURE. SHRINKAGE, CREEP, AND ELASTICITY ARE TIME-DEPENDENT PROPERTIES WHICH, WHEN MODIFIED, WILL CHANGE THE STRESSES IN THE STRUCTURE. IF THE STRUCTURE IS DESIGNED FOR THE ULTIMATE LOAD, THE TIME-DEPENDENT PROPERTIES BECOME INTERNAL MODIFICATIONS AND CAN BE IGNORED. IF, HOWEVER, THE STRUCTURE IS DESIGNED ACCORDING TO THE THEORY OF ELASTICITY, THESE TIME-DEPENDENT FACTORS ARE IMPORTANT AND MUST BE CONSIDERED. IN THIS STUDY, A NEW METHOD IS GIVEN FOR CALCULATING THE EFFECT OF CREEP AND SHRINKAGE IN CONCRETE, THE CREEP OF STEEL, AND THE TIME-DEPENDENT INCREASES OF THE MODULUS OF ELASTICITY UPON COMPOSITE CONSTRUCTIONS OF REINFORCED OR PRESTRESSED CONCRETE. A BASIC FORMULA IS DERIVED. EXAMPLES OF ITS APPLICATION ARE GIVEN AND COMPARISONS ARE MADE BETWEEN OLDER METHODS OF CALCULATION AND THE ONE DESCRIBED HERE. A SATISFACTORY CORRELATION IS ACHIEVED. /AUTHOR/

Scherpbier, G
Delft Technical University /Neth/ Dec. 1965

3A 212561

ACI MANUAL OF CONCRETE PRACTICE, PARTS I, II AND III

American Concrete Institute 1973

3A 212609

PLASTIC SHRINKAGE CRACKING

PLASTIC SHRINKAGE CRACKING OF MORTARS EXPOSED TO DIFFERENT CONDITIONS, AS PREVALENT IN HOT-DRY CLIMATES, WAS INVESTIGATED UNDER CONTROLLED CONDITIONS. THE VARIABLES STUDIED WERE AIR TEMPERATURE AND HUMIDITY, WIND VELOCITY, MORTAR TEMPERATURE, TYPE AND CONTENT OF CEMENT, AND CONSISTENCY. SHRINKAGE, TENSILE STRENGTH AND TENSILE STRESS OF FRESH MORTARS, EVAPORATION AND TIME OF CRACKING WERE MEASURED. WIDTH, DEPTH, AND LENGTH MEASUREMENTS OF THE CRACKS WERE ALSO TAKEN. THE RESULTS CONFIRM THAT RAPID EVAPORATION HAS A PREDOMINANT EFFECT ON PLASTIC SHRINKAGE CRACKING. OTHER CONCLUSIONS ARE THAT PLASTIC SHRINKAGE CRACKING IS NOT A DIRECT FUNCTION OF WATER LOSS, EVAPORATION RATE OR SHRINKAGE, AND THAT SEMIPLASTIC MORTAR DID NOT CRACK UNDER HIGH EVAPORATION CONDITIONS WHICH BROUGHT ABOUT SEVERE CRACKING OF PLASTIC AND WET MORTARS. IT WAS ALSO ESTABLISHED THAT THE FIRST CRACK COINCIDES WITH THE TRANSITION FROM THE INTENSIVE, PRACTICALLY UNRESTRAINED, LINEAR SHRINKAGE OF FRESH MORTAR TO THE MUCH SLOWER RATE DUE TO RESTRAINT ON STIFFENING OF THE MORTAR. /ACI/

Ravina, D Shalon, R *Am Concrete Inst Journal & Proceedings* Apr. 1968

3A 212613

EXPERIMENTAL RESEARCH IN ABUSE OF 4000 PSI CONCRETE

EXPERIMENTAL RESEARCH WAS PERFORMED IN A LABORATORY TO DUPLICATE FIELD ABUSE OF 4000 PSI CONCRETE ON ONE JOB. IT WAS DESIRED TO FIND THE AMOUNT OF STRENGTH LOSS DUE TO HIGH SLUMP, EXTENDED MIXING WITH SLUMP KEPT AT THE HIGH FIGURE, HIGH SUMMER TEMPERATURE, AND PARTIAL ABUSE OF CYLINDERS. IT IS INTERESTING THAT JOB STRENGTHS WERE ALMOST DUPLICATED USING TWO DIFFERENT BRANDS OF CEMENT. /AUTHOR/

Hersey, AT *Am Concrete Inst Journal & Proceedings* May 1968

3A 212718

THE WORK OF THE RESEARCH AND DEVELOPMENT DIVISION OF THE CEMENT AND CONCRETE ASSOCIATION: ROADS DEPT

THIS REPORT DESCRIBES THE WORK OF THE ROADS DEPARTMENT SINCE ITS FORMATION IN JANUARY, 1954. RESEARCH AND DEVELOPMENT WORK INCLUDES LEAN CONCRETE BASES AND SOIL-CEMENT BASES. SOIL-CEMENT BASE STUDIES INVOLVE LABORATORY TESTS, CONSTRUCTION TECHNIQUES, SITE CONTROL AND PAVEMENT THICKNESS DESIGN.

Blake, LS
Cement & Concrete Assoc, London /UK/ Apr. 1957

ACKNOWLEDGMENT: Highway Research Board Bibliography

3A 212719

PROGRESS REPORT ON CALIFORNIA EXPERIENCE WITH CEMENT-TREATED BASES

THE CALIFORNIA DIVISION OF HIGHWAYS HAS BUILT 123 MILES OF PAVEMENT BASE BY MIXING CEMENT WITH GRANULAR MATERIALS OF MANY KINDS AND COMPACTING ON THE SUBGRADE BY ROLLING OR TAMPING. MOST OF THESE BASES HAVE BEEN FOR FIRST CLASS ROAD IMPROVEMENTS. THE MATERIALS HAVE INCLUDED FINE SILTY SANDS, STREAMBED GRAVELS, DISINTEGRATED GRANITE, SOFT CRUSHED SANDSTONE, FAIRLY CLEAN SAND, AND AGGREGATES SUITABLE FOR CONCRETE. MANY CONSTRUCTION METHODS HAVE BEEN TESTED. TWENTY-EIGHT PROJECTS RANGING IN LENGTH FROM 0.5 MILE TO 13.1 MILES HAVE BEEN CONSTRUCTED.

Stanton, TE Hveem, FN Beatty, JL *Highway Research Board Proceedings* 1943

3A CONSTRUCTION EQUIPMENT AND METHODS

3A 212720

RUNWAY IS EXTENDED AT WESTERN AIR CENTER
BULK METHOD OF CEMENT SPREADING WAS USED ON THIS PROJECT AND A CEMENT METER, AN AUTOMATIC MEASURING DEVICE, WAS EMPLOYED FOR ADDING THE CORRECT PERCENTAGE OF CEMENT. METHODS OF CONSTRUCTION AND EQUIPMENT USED AT THE LOS ANGELES MUNICIPAL AIRPORT ARE DESCRIBED.

Contractors & Engineers Aug. 1947

ACKNOWLEDGMENT: Highway Research Board Bibliography

3A 212725

CALIFORNIA CEMENT TREATED BASES
A SUMMARY IS PRESENTED OF SPECIFICATION REQUIREMENTS, DESIGN CHARACTERISTICS, CONSTRUCTION METHODS AND EQUIPMENT, AND FIELD CONTROL TESTS AS USED BY THE CALIFORNIA DIVISION OF HIGHWAYS FOR CEMENT-TREATED BASES. REPRESENTATIVE BID PRICES ARE INCLUDED.

Wance, LD *Western Construction* Jan. 1961

ACKNOWLEDGMENT: Highway Research Board Bibliography

3A 212940

ELECTRICAL HEATING OF NEWLY POURED CONCRETE /IN SWEDISH/
ELECTRICALLY HEATED MOULDS ARE USED IN COLD WEATHER TO PREVENT FREEZING OF NEWLY-POURED CONCRETE AND TO HASTEN HARDENING. THE WIRE-HEATING PRINCIPLE, THE EFFECT OF THE HEATING ON THE STRENGTH OF THE MATERIAL, COSTS, CALCULATION OF THE THERMAL EFFICIENCY AND THE HEATING PROCESS ARE DISCUSSED AND CONCLUSIONS ARE GIVEN. /RRL/SVI/

Janhunen, P
Vag-och Vattenbyggaren /Sweden/ Dec. 1967

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 212975

REPORT FOR THE YEAR 1967
THE DEVELOPMENT AND RESEARCH IN MATERIALS, DESIGN OF STRUCTURES, AND CONSTRUCTION METHODS ARE REVIEWED. A SPECIAL MENTION IS MADE OF THE TWO WORKING GROUPS, SET UP JOINTLY WITH THE ROAD RESEARCH LABORATORY, WHOSE PROGRAMS OF WORK ON THE SKIDDING RESISTANCE OF CONCRETE ROADS, AND DESIGN AND CONSTRUCTION OF JOINTS IN CONCRETE ROADS ARE DESCRIBED. /RRL/

Cement & Concrete Assoc, London /UK/ 1967

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 213126

THE CURING OF CONCRETE PAVEMENT SLABS IN HOT WEATHER
TWENTY-EIGHT 1 M THICK SLABS WERE CAST ON WARM SUNNY DAYS TO DETERMINE THE TEMPERATURE VARIATIONS IN CONCRETE WHEN THE EXOTHERMIC HYDRATION REACTION IS STIMULATED BY STRONG SUNLIGHT. THE EFFECT OF THE TIME OF PLACING WAS INVESTIGATED BY CASTING SLABS AT DIFFERENT TIMES DURING THE DAY AND THE EFFICIENCY OF A RANGE OF TEMPERATURE CONTROL TECHNIQUES WAS EXAMINED. IT IS CONCLUDED THAT CURING MEMBRANES WILL PROVE ADEQUATE DURING WARM WEATHER ONLY IF A WHITE PIGMENT IS ADDED. /RRL(A)/

Hunt, JG
Cement & Concrete Assoc, London /UK/ Nov. 1969

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 213196

PORTLAND CEMENT CONCRETE PAVING WITH CENTRAL-MIXED CONCRETE
THE INCREASED VOLUME OF HIGHWAY CONSTRUCTION DURING THE PAST DECADE HAS CHALLENGED THE INGENUITY OF DESIGNER, CONTRACTOR AND EQUIPMENT MANUFACTURER. GREATER NEED FOR INTRICATE INTERCHANGES, URBAN CONSTRUCTION AND OTHER COMPLICATED PAVEMENT ARRANGEMENTS PROMOTED THE CONSIDERATION OF MORE EFFICIENT CONSTRUCTION METHODS. CENTRAL-MIXED CONCRETE OFFERED THE NECESSARY CHARACTERISTICS OF HIGH-CAPACITY AUTOMATION, VERSATILITY AND PORTABILITY. THROUGH THE COOPERATIVE EFFORTS OF OWNER AND CONTRACTOR THIS METHOD HAS NOW PROVED ITS MERIT BY PERFORMANCE AND RANKS AS AN OUTSTANDING DEVELOPMENT OF THE HIGHWAY INDUSTRY. THIS PAPER REPRESENTS THE EXPERIENCE OF A CONTRACTOR EMPLOYING CENTRAL PLANT PROCEDURES ON VARIED HIGHWAY PROJECTS FOR THE STATE OF OHIO. /AUTHOR/

Yamarick, WP *Highway Research Board Bulletin* 1961

3A 213216

REVIEW OF A THREE-YEAR BRIDGE DECK STUDY IN PENNSYLVANIA
THE RESULTS OF THE INITIAL THREE YEARS OF CONTINUING RESEARCH PROJECT ON THE DURABILITY OF CONCRETE BRIDGE DECKS IN PENNSYLVANIA ARE PRESENTED. THE STUDY INVOLVED FIELD SURVEYS OF 38 BRIDGE DECKS COMPRISING 2,782 TEN-FT LONG SURVEY UNITS. A TOTAL OF 154 CORES WERE TAKEN FROM 34 OF THE DECKS. THE CORES WERE SUBJECTED TO DETAILED LABORATORY ANALYSES INCLUDING DETERMINATION OF AIR VOID PARAMETERS BY LINEAR TRAVERSE TECHNIQUES, WATER CEMENT (W/C) RATIO DETERMINATIONS, AND PETROGRAPHIC EXAMINATION. SEVEN BRIDGE DECKS WERE OBSERVED DURING CONSTRUCTION TO EXAMINE AND EVALUATE THE EFFECT OF CONSTRUCTION PRACTICES ON DURABILITY. BRIDGE DECKS WERE RESURVEYED ANNUALLY TO ESTABLISH RATES. THE MAJOR TYPES OF DETERIORATION FOUND WERE TRANSVERSE CRACKING, FRACTURE PLANES, POTHoles, AND SURFACE MORTAR DETERIORATION. THE PRIMARY CAUSES OF DETERIORATION WERE INDICATED TO BE MATERIALS (AGGREGATES) AND WORKMANSHIP (OVERFINISHING, POOR QUALITY CONTROL WITH RESPECT TO ENTRAINMENT AIR AND W/C, AND IMPROPER PLACEMENT OF REINFORCEMENT). RECOMMENDATIONS TO ALLEVIATE THE CAUSES OF POOR PERFORMANCE AND SUGGESTED AREAS OF NEEDED RESEARCH ARE INCLUDED. /AUTHOR/

Larson, TD Cady, PD Price, JT *Highway Research Record, Hwy Res Board* 1968

3A 213489

LONG-TIME STUDY OF CEMENT PERFORMANCE IN CONCRETE-CHAPTER 7. NEW YORK TEST ROAD
TEST PROCEDURE, MATERIALS, MIX PROPORTIONS AND CONSTRUCTION PROCEDURES ON THE NEW YORK TEST ROAD, A PART OF THE LONG-TIME STUDY OF CEMENT PERFORMANCE IN CONCRETE, ARE DESCRIBED. ALL 27 OF THE LONG-TIME STUDY CEMENTS WERE USED. PERFORMANCE OF THE TEST SECTIONS IS ASSESSED WITH RESPECT TO DURABILITY OF THE CONCRETE AS A MATERIAL, THE ONLY PROPERTY DIRECTLY STUDIED IN RELATION TO THE CEMENT USED. SEVEN AND ONE-HALF YEARS AFTER THE TEST PAVEMENT WAS COMPLETED NO ONE CEMENT PROVED SUPERIOR TO THE OTHERS TESTED. HOWEVER, THE EFFECTS OF AIR ENTRAINMENT IN IMPROVING RESISTANCE OF THE PAVEMENT TO SCALING AND WEATHERING OVERSHADOWED ALL OTHER VARIABLES. /PCA/

Jackson, FH Tyler, IL *Portland Cement Assoc R & D Lab Bull* No 38

ACKNOWLEDGMENT: Portland Cement Assoc R & D Lab Bull, No 228, July 1969

3A 213529

PLASTIC SHRINKAGE

PLASTIC SHRINKAGE AND PLASTIC SHRINKAGE CRACKING SOMETIMES OCCUR IN THE EXPOSED SURFACE OF FRESHLY-PLACED CONCRETE. THIS SHRINKAGE AND CRACKING IS CAUSED BY A RAPID EVAPORATION OF WATER FROM THE SURFACE OF THE CONCRETE. CONDITIONS THAT DETERMINE THE RATE OF EVAPORATION ARE DESCRIBED. CONSTRUCTION PROCEDURES AND PRACTICES THAT CAN MINIMIZE THE CAUSES OF THIS TYPE OF SHRINKAGE AND CRACKING ARE RECOMMENDED. SPECIFIC CASES CITED SHOW HOW APPLICATION OF THESE PROCEDURES HAS SOLVED THE PROBLEM. IT IS BELIEVED THAT THE RECOMMENDED CORRECTIVE MEASURES WILL SOLVE THE PROBLEM OF PLASTIC SHRINKAGE AND PLASTIC SHRINKAGE CRACKING ON CONSTRUCTION PROJECTS. /PCA/

Lerch, W *Portland Cement Assoc R & D Lab Bull* No 81ACKNOWLEDGMENT: *Portland Cement Assoc R & D Lab Bull*, No 228, July 1969

3A 213697

RANDOM CRACKING OF BRIDGE DECKS CAUSED BY PLASTIC SHRINKAGE

INVESTIGATION WAS MADE TO DETERMINE THE CAUSES OF SEVERE RANDOM CRACKING THAT AFFECTED TWO OF FOUR REINFORCED CONCRETE SPANS ON AN INTERSTATE SYSTEM BRIDGE. THE REMAINING TWO SLABS WERE UNAFFECTED. THE OVERALL CHARACTERISTICS OF THE CRACKING BASED ON VISUAL SURVEY WERE SIMILAR TO PLASTIC SHRINKAGE WHICH SUGGESTED THAT CRACKING HAD OCCURRED EARLY IN THE LIFE OF THE DECK. TWO 4-IN. DIAMETER CORES WERE REMOVED FROM THE CRACKED AREA FOR PETROGRAPHIC EXAMINATION. EXAMINATION OF THESE CORES INDICATED THAT THE CRACKS TRAVELED AROUND RATHER THAN THROUGH AGGREGATE PARTICLES. CONSIDERING THIS AND THE FACT THAT THE STRENGTH OF THE CONCRETE WAS HIGH, IT WAS CONCLUDED THAT THE CRACKING OCCURRED WHEN THE CONCRETE WAS RELATIVELY GREEN AND PERHAPS FRESH. RESULTS INDICATE THAT WHEN EARLY RANDOM CRACKING OCCURS, THE SEVERE DRYING CONDITIONS AS REFLECTED IN THE COMPUTED EVAPORATION RATE EXISTS. THE EXISTENCE OF SEVERE CONDITIONS DOES NOT ALWAYS RESULT IN THIS EARLY CRACKING. THIS WOULD SUGGEST THAT THE CRACKING CAN BE PREVENTED, OR AT LEAST BE REDUCED IN SEVERITY, BY CONSTRUCTION FACTORS THAT MODIFY THE INFLUENCE OF THE FOUR MAJOR VARIABLES OF AIR TEMPERATURE, CONCRETE TEMPERATURE, WIND VELOCITY, AND RELATIVE HUMIDITY.

Newlon, HH Mather, B DISCUSSOR Geymayer, HG DISCUSSOR
Highway Research Board Special Reports 1970

3A 213807

CRACKING INDUCED BY ENVIRONMENTAL EFFECTS

WHEN CONCRETE CRACKS AS A RESULT OF ITS INTERACTION WITH ITS ENVIRONMENT AND THE CRACKING IS AN UNDESIRABLE FEATURE OF THE HISTORY OF THE CONCRETE, THE OCCURRENCE REPRESENTS THE CONSEQUENCES OF AN IMPERFECT CHOICE IN SELECTING THE PARTICULAR CONCRETE THAT WAS PRODUCED FOR SERVICE IN THE ENVIRONMENT IN WHICH IT WAS USED. SIX PHENOMENA THAT BRING ABOUT ENVIRONMENTALLY INDUCED CRACKING ARE MENTIONED: EXPANSION DUE TO THE USE OF UNSOUND CEMENT, THE ALKALI-SILICA REACTION, SULFATE ATTACK, CORROSION OF EMBEDDED METAL, FREEZING AND THAWING, AND PLASTIC SHRINKAGE. IN ALL OF THE PHENOMENA, ENVIRONMENTALLY INDUCED MOISTURE MOVEMENTS ARE PRIMARY PARTICIPANTS IN THE PHENOMENA THAT MAY CAUSE CRACKING. IN EACH CASE THE ENVIRONMENTALLY INDUCED CRACKING THAT THESE PHENOMENA MAY PRODUCE CAN BE AVOIDED BY GIVING APPROPRIATE ATTENTION TO THE PROPERTIES OF THE ENVIRONMENT AND THEIR ANTICIPATED INTERACTION WITH THE PROPERTIES

OF THE CONCRETE AND THUS INCLUDING IN THE SPECIFICATIONS FOR THE WORK APPROPRIATE REQUIREMENTS FOR MATERIALS PROPERTIES, PROPORTIONS OF THE MATERIALS, AND CONSTRUCTION PRACTICES, AND BY INSURING STRICT ENFORCEMENT OF THE SPECIFICATION REQUIREMENTS SELECTED. /ACIJP/

Mather, B
American Concrete Institute Title No Sp 20-4, 1968ACKNOWLEDGMENT: *Am Concrete Inst Journal & Proceedings*

3A 213808

CONTROL OF TEMPERATURE CRACKING IN CONCRETE

THE CRACKING AND CONTROL OF CRACKING ARE DESCRIBED IN MASS CONCRETE STRUCTURES. CRACKING IN THE LARGER STRUCTURES IS PREDOMINANTLY CAUSED BY VOLUMETRIC CHANGES IN THE CONCRETE DUE TO TEMPERATURE DROPS, BUT TEMPERATURE GRADIENTS WITHIN THE STRUCTURES ARE CONTRIBUTING FACTORS. THE TYPICAL LOCATIONS OF CRACKS WHICH DEVELOP IN MASS CONCRETE ARE DESCRIBED, TOGETHER WITH METHODS FOR ESTIMATING THE MAGNITUDE OF THE STRESSES WHICH CAUSED THE CRACKS. THE TEMPERATURE HISTORY OF MASS CONCRETE IS RELATED TO THE SEVERAL INFLUENCING FACTORS. EACH OF THESE FACTORS IS BRIEFLY REVIEWED, AND THE DEGREE OF CONTROL WHICH CAN BE EXERCISED BY EACH IS DISCUSSED. AMONG THOSE MEASURES WHICH MAY BE USED TO INFLUENCE AND PARTIALLY CONTROL THE TEMPERATURE RISE IN MASS CONCRETE ARE CEMENT CONTENT, TYPE OF CEMENT, USE OF POZZOLAN TO REPLACE PART OF THE CEMENT, RETARDING AGENTS, WATER CURING, USE OF LOW CONSTRUCTION LIFTS, AND ARTIFICIAL COOLING WITH EMBEDDED PIPE SYSTEMS. MEASURES WHICH MAY BE USED TO INFLUENCE AND PARTIALLY CONTROL THE PEAK TEMPERATURES IN MASS CONCRETE STRUCTURES INCLUDE ALL OF THOSE ABOVE AND, IN ADDITION, THE USE OF PRECOOLING MEASURES TO OBTAIN A DESIRED MAXIMUM CONCRETE PLACING TEMPERATURE. THE DEGREE OF TEMPERATURE CONTROL EXERCISED FOR ANY ONE STRUCTURE IS RELATED TO THE TYPE OF STRUCTURE AND ITS OVER-ALL DIMENSIONS, THE CONDITIONS ANTICIPATED DURING THE CONSTRUCTION PERIOD, AND THE DESIRED DESIGN STRESSES WHICH WILL OCCUR DURING OPERATION. THE EFFECT THAT CRACKING WILL HAVE ON THE ABILITY OF THE STRUCTURE TO PERFORM ITS FUNCTIONS SHOULD ALSO BE TAKEN INTO CONSIDERATION. DESIGN CONSIDERATIONS INCLUDE THE SIZE OF CONSTRUCTION BLOCK AND CONTRACTION JOINT GROUTING. CONSTRUCTION PROCEDURES CREATING CRACKING TENDENCIES IN CONCRETE ARE DISCUSSED AND REMEDIAL MEASURES TO REDUCE THE EFFECT OF THESE CONDITIONS ARE PRESENTED. /ACIJP/

Townsend, CL
American Concrete Institute Title No Sp 20-7, 1968ACKNOWLEDGMENT: *Am Concrete Inst Journal & Proceedings*

3A 213838

INTERNAL ELECTRICAL CURING OF PRESTRESSED CONCRETE

THE EFFECTS OF ELECTRICAL CURING ON THE BOND STRENGTH BETWEEN CONCRETE AND PRESTRESSING STRANDS IS STUDIED TO DETERMINE IF FULL SCALE PRECAST PRESTRESSED CONCRETE BEAMS COULD BE PRODUCED UNDER PLANT CONDITIONS. THE TEST DATA INDICATE THAT THE INTERNAL ELECTRICAL CURING METHOD DOES NOT ADVERSELY AFFECT THE QUALITY OF THE CONCRETE NOR THE STRENGTH OF PRESTRESSED CONCRETE BEAMS. NONE OF THE TESTS HAVE REVEALED ANY ADVERSE EFFECTS CAUSED BY INTERNAL ELECTRICAL CURING WHICH WOULD RESTRICT THE USE OF THE METHOD. THE TESTS ALSO INDICATE THAT THE METHOD IS AN EFFECTIVE AND ECONOMIC METHOD FOR CURING CONCRETE. THE FLEXIBILITY OF THE HEAT OUTPUT MAKES THE METHOD ADAPTABLE TO

MANY FIELD CONDITIONS INCLUDING OUTDOOR WINTER CONSTRUCTION. /AUTHOR/

Chi, CT Barnoff, RM Cady, PD
Pennsylvania State University 235 pp, Jan. 1970

3A 214003

RECOMMENDED PRACTICE FOR HOT WEATHER CONCRETING: PROPOSED REVISION OF ACI 605-59
CONCRETE MIXED, TRANSPORTED, AND PLACED UNDER CONDITIONS OF HIGH TEMPERATURE, LOW HUMIDITY, OR WIND, REQUIRES AN UNDERSTANDING OF THE EFFECTS SUCH ENVIRONMENTAL FACTORS HAVE ON CONCRETE PROPERTIES AND CONSTRUCTION OPERATIONS. WHEN THESE FACTORS ARE UNDERSTOOD, MEASURES CAN BE TAKEN TO ELIMINATE OR MINIMIZE UNDESIRABLE EFFECTS. THIS RECOMMENDED PRACTICE DEFINES HOT WEATHER, LISTS POSSIBLE UNFAVORABLE EFFECTS AND RECOMMENDS PRACTICES INTENDED TO MINIMIZE THEM. AMONG THESE RECOMMENDATIONS ARE SUCH IMPORTANT MEASURES AS PRECOOLING INGREDIENTS, LIMITATIONS OF CONCRETE TEMPERATURE AS PLACED, LENGTH OF HAUL, FACILITIES FOR HANDLING CONCRETE AT THE SITE, AND SPECIAL PLACING AND CURING TECHNIQUES. /AUTHOR/

Wescott, WF *Am Concrete Inst Journal & Proceedings* July 1971

3A 214056

USE OF CONCRETES CONTAINING ANTIFROST ADDITIVES DURING THE CONSTRUCTION OF BRIDGES /IN RUSSIAN/
THE EFFECT OF TEMPERATURE (DOWN TO-23 C) AND ANTIFROST ADDITIVES CALCIUM AND SODIUM CHLORIDE ON THE HARDENING PERIOD, STABILITY, AND STRENGTH OF CONCRETES USED IN THE CONSTRUCTION OF BRIDGES AND WATER PIPES IN THE NORTHERN REGIONS OF THE USSR IS DISCUSSED. THE FROST-RESISTANCE AND STRENGTH OF THE CONCRETES DEPENDS ON THE AMOUNT OF THE SALTS ADDED AND INCREASES WITH INCREASING SALT CONTENT UP TO 7.5% OF THE AMOUNT OF CEMENT USED, BUT THE USE OF THE SALT ADDITIVES IN AMOUNTS EXCEEDING 7.5% MAY HAVE A NEGATIVE EFFECT ON THE FROST-RESISTANCE OF THE CONCRETE AT LOW TEMPERATURES. TESTS REVEALED THAT THE STRENGTH OF CONCRETE BRIDGES AND PIPES CONSTRUCTED DURING THE PAST 10 YEARS VARIES BETWEEN 350 AND 500 KG (FORCE) /SQUARE CM. /CA/

Kostyacy, PS *Chemical Abstracts, Beton I Zhelezobeton /Ussr/* Nov. 1971

3A 214189

UNDER WATER CONCRETE CONSTRUCTION
UNDERWATER CONCRETE CONSTRUCTION IS CURRENTLY CARRIED OUT BY FOUR BASIC METHODS: TREMIE, BUCKET, GROUT-INTRUDED AGGREGATE, AND GROUTING. THIS ARTICLE SUMMARIZES THE PRESENT STATE OF THE ART, EVALUATES SIGNIFICANT NEW DEVELOPMENTS, AND INDICATES DIRECTIONS FOR FUTURE UTILIZATION TO OBTAIN MORE EFFECTIVE AND RELIABLE UNDERWATER CONSTRUCTION. /DOT/

Gerwick, BC *Mechanical Engineering* Vol. 94 No. 11, Nov. 1972, pp 29-34

3A 214227

EXERCISE CAUTION IN USING FLY-ASHES
VERY LITTLE IS KNOWN ABOUT THE STRENGTH OF A CONCRETE CONTAINING FLY ASH AND THE HAZARDS CONNECTED WITH THE VARIOUS TECHNIQUES FOR LAYING SUCH CONCRETES. THE PRESENT PAPER DEALS WITH DAMAGES TO CONCRETE CONTAINERS FOR THE INDUSTRIAL WASTES OF A TANNERY, ORIGINATING FROM INAPPROPRIATE CONSTRUCTION FROM A CONCRETE CONTAINING FLY ASH. THE DAMAGE DID NOT RESULT FROM ACTION OF THE SULFURIC ACID, ARSENIC SULFIDE, AND ALUMS--ON THE CONTRARY, THE FLY ASH EFFECTIVELY PROTECTED THE TANK AGAINST CHEMICAL DECAY--BUT RATHER FROM LEAKAGES, OCCURRING ALONG THE LINES OF CONCRETING INTERVALS, THAT

HAD BEEN COMPACTED BY VIBRATION. ANALYSIS OF THE DISTINCT LAYERS, WHICH HAD SEPARATED DURING VIBRATION, SHOWED THEM TO CONSTITUTE AN ISOLATED PASTE CONSISTING ALMOST ENTIRELY OF ASH. IT IS SHOWN HOW THIS CONDITION CAN BE ATTRIBUTED TO THE CONSTRUCTION METHOD AND PRACTICE USED FOR THE TANK, WHICH DID NOT TAKE INTO ACCOUNT THE PECULIARITIES OF FLY-ASH CONCRETE. SEVERAL RECOMMENDATIONS ARE MADE ABOUT CONSTRUCTION PRECAUTIONS TO BE TAKEN WHEN FLY-ASH CONCRETE IS USED.

Braun, K
Building Review /Poland/ 1969

3A 214274

POLYMERIZED LIGHTWEIGHT STRUCTURAL ELEMENTS
IMPREGNATION OF CONCRETE MATERIALS WITH POLYMERS WAS EXTENDED TO INCLUDE THE IMPREGNATION OF LIGHTWEIGHT FOAM CONCRETES. FILLING APPROXIMATELY 90 PERCENT OF THE EXTENSIVE VOID SYSTEM OF THE FOAM CONCRETE WITH A POLYMER INCREASED THE COMPRESSIVE STRENGTH FROM 202 PSI TO 3250 PSI, THE SPLITTING TENSILE STRENGTH FROM 30 PSI TO 1008 PSI, AND THE MODULUS OF ELASTICITY FROM 100,000 PSI TO 425,000 PSI. BEAM STRUCTURAL ELEMENTS WERE PARTIALLY IMPREGNATED TO PRODUCE A "SANDWICH PANEL" ELEMENT WHICH CAN UTILIZE THE FOAM CONCRETE CORE TO ACT AS AN INSULATOR AND AS A SPACER TO SEPARATE THE POLYMER IMPREGNATED SURFACE REGIONS; AND CAN UTILIZE THE POLYMER IMPREGNATED SURFACE REGIONS TO RESIST LOADINGS. THE SANDWICH ELEMENT PRODUCED THUS UTILIZES MATERIALS EFFICIENTLY TO SATISFY THE MULTIPLE FUNCTIONAL REQUIREMENTS OF LOAD AND OF ENVIRONMENT. /AUTHOR/

Lott, J Birkimer, D
Construction Eng Res Lab, Army Ce /US/ May 1973, 7 pp, 1 Tab, 6 Ref

3A 214341

STRENGTH DEVELOPMENT OF CONCRETE EXPOSED IN WINTER
THE RELATIONSHIP OF THE STRENGTH OF STANDARD LABORATORY-CURED CYLINDERS TO THE STRENGTH OF CONCRETE IN COLUMNS AND SLABS AND TO FIELD-CURED CYLINDERS EXPOSED UNDER WINTER CONDITIONS HAVE BEEN REPORTED. THE COLUMNS, SLABS, AND ABOUT HALF OF THE CYLINDERS WERE LEFT AT AN OUTDOOR EXPOSURE SITE AFTER AN INITIAL 3-DAY CURING AT 50 PLUS OR MINUS 10 DEGREES F (10 PLUS OR MINUS 6 DEGREE C) THE REMAINING CYLINDERS WERE STANDARD-CURED. CORES WERE TAKEN FROM THE COLUMNS AND SLABS AT 3 DAYS, 14 DAYS, 28 DAYS, 120 DAYS, AND 355 DAYS FOR TESTING IN COMPRESSION. THE TEST RESULTS SHOW THAT CONCRETE INITIALLY CURED FOR 3 DAYS AT ABOUT 50 DEGREE F (10 DEGREE C) AND ABOUT 75, RELATIVE HUMIDITY AND THEN EXPOSED TO BELOW FREEZING TEMPERATURES CONTINUES TO GAIN STRENGTH. THE RATE OF STRENGTH GAIN OF THE FIELD-CURED CONCRETE SHOWS A MARKED INCREASE AFTER THE AMBIENT AIR TEMPERATURE EXCEEDS 50 DEGREE F (10 DEGREE C). AT THE AGE OF ABOUT 1 YR, THE COMPRESSIVE STRENGTHS OF THE FIELD-CURED CONCRETE GENERALLY EXCEEDED THE STANDARD STRENGTH. /ASCE/ME/

Berwanger, C Malhotra, VM *Am Soc Civil Engr J Eng Me H Div* Vol. 100n No. m2, Apr. 1974, pp305-, 10 Fig 3 T, ab, 9 Ref

3A 214370

PRECAST CONCRETE LINING FOR TUNNELS SYMPOSIUM HELD BY THE SLOVAT SCIENTIFIC AND TECHNOLOGICAL SOCIETY OF BUILDING, BRATISLAVA, HUNGARY, 2ND-3RD JUNE 1970
PAPERS PRESENTED AT THE SYMPOSIUM DISCUSS METHODS OF CONSTRUCTING PRECAST CONCRETE TUNNEL LININGS IN BOTH SHIELD- AND NON-SHIELD-DRIVEN TUNNELS, AND METHODS OF MEASURING EARTH PRESSURE ON AND STRESSES WITHIN THE LININGS.

Slov Sci & Tech Soc, Bratislava /Czech/ Sept. 1973, 359 pp, Figs, Tabs

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 214407

CONDITION OF LARGE CAISSONS DURING CONSTRUCTION
NEW YORK CITY'S NARROWS BRIDGE PIER FOUNDATION CONSISTED OF A MASSIVE CONCRETE CAISSON WITH OPEN WELLS FOR DREDGING. PLACEMENT WAS BY OPEN DREDGE METHOD. BOTH TOWER PIERS ARE EMBEDDED IN GLACIAL SAND. THE BROOKLYN TOWER PIER IS FOUNDED 170 FT. BELOW SEA LEVEL ON SILTY CLAY. THE STATEN ISLAND PIER IS FOUNDED AT MINUS 105 FT. ON TRANSITION OF MORAINAL DEPOSIT. DURING THE CONSTRUCTION, THE DRIVING FORCE FOR SEATING THE CAISSON WAS GAINED BY REMOVING THE SUPPORTING SOILS AT THE BOTTOM. AT ANY STAGE OF THE SINKING, THE EFFECTIVE WEIGHT OF A CAISSON SHOULD EXCEED THE ANTICIPATED RESISTANCE, WHICH CONSISTS OF THE SKIN FRICTION ON CAISSON SURFACE AS WELL AS THE BEARING RESISTANCE OF SOILS AT THE CUTTING EDGE. THE THEORETICAL METHODS FOR DETERMINING SUCH RESISTANCE ON THE BASIS OF SOIL TESTS ARE NOT OFTEN RELIABLE AND EXPERIENCES OF INDIVIDUAL ENGINEERS ARE WIDELY DIVERSIFIED. A REVIEW OF THE ACTUAL MECHANICS OF SINKING A CAISSON IS MADE.

Yang, NC *Highway Research Record, Hwy Res Board* 1965

3A 214416

SLIP-FORM PAVING-CONSTRUCTION PRACTICES ON IOWA'S SECONDARY ROADS
SINCE 1949 OVER 1,000 MI OF SLIP-FORM PAVEMENT HAVE BEEN CONSTRUCTED IN IOWA. MOST OF THESE MILES ARE ON SECONDARY ROADS. SEVERAL CONSIDERATIONS FOR THIS CONSTRUCTION ARE PRESENTED. PAVING ON NARROW GRADES, POOR SOILS, SUBGRADE CONSTRUCTION, MIXING AND PLACING OPERATIONS, CONCRETE MIXES, AND SMOOTHNESS ARE ALSO DISCUSSED. /AUTHOR/

Clauson, LM *Highway Research Record, Hwy Res Board* 1965

3A 214417

OHIO'S FIRST EXPERIENCE WITH SLIP-FORM PAVING
THE SUCCESSFUL CONSTRUCTION IS DESCRIBED OF APPROXIMATELY 8 MI OF PLAIN CONCRETE PAVEMENT ON THE SECONDARY HIGHWAY SYSTEM IN OHIO USING THE SLIP-FORM TECHNIQUE. DESIGN FEATURES, AS WELL AS CONSTRUCTION EXPERIENCES, ARE REPORTED. THE PAVEMENT WAS CONSTRUCTED ON EARTH SUBGRADE ON FILLS AND ALL CUTS EXCEPT FOR ROCK CUTS WHERE A 4-IN. SUBBASE WAS SPECIFIED. THE GRADE WAS PREPARED USING AN AUTOMATIC SUBGRADER. CONCRETE WAS PRODUCED IN A CENTRAL MIX PLANT ERECTED ON THE PROJECT AND HAULED TO THE PAVING SITE IN TRUCKS WITH DUMP BODIES. A SLIP-FORM PAVER, WITHOUT AUTOMATIC CONTROLS, WAS USED TO EXTRUDE THE CONCRETE INTO A 24-FT BY 7-IN. CONCRETE PAVEMENT. /AUTHOR/

Dixon, JC Marshall, HE *Highway Research Record, Hwy Res Board* 1965

3A 214418

SLIP-FORM PAVING-CONSTRUCTION PRACTICES ON COLORADO INTERSTATE SYSTEM
CONSTRUCTION METHODS FOR CONCRETE PAVEMENT ARE SUBJECT TO A WIDE VARIETY OF PROCEDURES. MANY NEW TYPES OF EQUIPMENT ARE BEING DEVELOPED TO PRODUCE BETTER CONCRETE PAVEMENT FASTER AND MORE ECONOMICALLY. A RECENT CONCRETE PAVEMENT PROJECT IN COLORADO IS DESCRIBED BRIEFLY. THE ENTIRE OPERATION FROM SUBBASE TO COMPLETED ROADWAY WAS ACCOMPLISHED IN RECORD TIME AND INVOLVED CAREFUL JOB PLANNING BY THE CONTRACTOR. /AUTHOR/

Zulian, A *Highway Research Record, Hwy Res Board* 1965

3A 214419

SLIP-FORM PAVING-CONSTRUCTION PRACTICES FOR 3-LANE AT A TIME PAVING IN CALIFORNIA
AFTER 5 YR OF USE, SLIP-FORM PAVING NOW ACCOUNTS FOR MORE THAN 80 PERCENT OF ALL CONCRETE PAVING IN CALIFORNIA. IT PROVIDES SIGNIFICANT PRODUCTION ADVANTAGES TO THE CONTRACTOR AND BENEFIT OF LESS COST TO THE HIGHWAY USER, AS COMPARED WITH SIDE-FORM PAVING. THREE DIFFERENT TYPES OF SLIP-FORM PAVERS HAVE BEEN SUCCESSFULLY EMPLOYED, BUT ONLY ONE IS CAPABLE OF PAVING 3 LANES AT A TIME. THE PROCEDURES UTILIZED ARE NOT SIGNIFICANTLY DIFFERENT THAN THOSE UTILIZED WHEN PAVING NARROWER WIDTHS WITH THE SAME TYPE OF EQUIPMENT. SUCCESSFUL USE OF THIS TYPE OF EQUIPMENT IS DEPENDENT ON STANDARD OPERATING PROCEDURES ESTABLISHED THROUGH A LOGICAL ANALYSIS OF CAUSE AND EFFECT, TECHNICALLY QUALIFIED FIELD LEVEL SUPERVISION, EXPERIENCED OPERATORS AND MECHANICS, PROPERLY MAINTAINED EQUIPMENT, UNIFORM CONCRETE AT THE PAVER, AND CLOSE ATTENTION TO OPERATIONAL DETAILS BEFORE, DURING AND AFTER CONCRETE PLACEMENT. /AUTHOR/

Gillis, LR Spickelmire, LS *Highway Research Record, Hwy Res Board* 1965

3A 214421

SLIP-FORM PAVING WITH MESH AND DOWELS IN ILLINOIS
THE FIRST USE OF THE SLIP-FORM PAVING PROCESS IN CONSTRUCTING A PORTLAND CEMENT CONCRETE PAVEMENT ON THE PRIMARY HIGHWAY SYSTEM IN ILLINOIS IS DISCUSSED. THE PAVEMENT CONTAINS THE TRANSVERSE JOINTS, DOWELS, TIE BARS, AND DISTRIBUTED WELDED WIRE FABRIC REINFORCEMENT EMPLOYED BY ILLINOIS IN STANDARD FORMED CONSTRUCTION. DETAILS OF THE CONSTRUCTION PROCESS AND THE RESULTS THAT WERE ACHIEVED ARE DESCRIBED AND EVALUATED. /AUTHOR/

Burke, JE Mascunana, I *Highway Research Record, Hwy Res Board* 1965

3A 214422

A CONTRACTOR LOOKS AT SLIP-FORM PAVING
THIS PAPER COVERS THE CONTRACTORS EXPERIENCE WITH EARLY BIDDING AND CONSTRUCTION, AGENCY ACCEPTANCE, AND JOB QUALITY. IT DISCUSSED EFFICIENCY, PRODUCTION CAPABILITIES, CAPITAL EQUIPMENT AND LABOR INVOLVED. IT REVIEWS THE COMPETITIVE POSITION OF SLIP-FORM PAVING. /AUTHOR/

Swanson, WE *Highway Research Record, Hwy Res Board* 1965

3A 214431

CONSTRUCTION OF SECTIONAL PAVEMENTS
DESIGN AND CONSTRUCTION METHODS FOR THREE TYPES OF PRE-FABRICATED PRESTRESSED CONCRETE PAVEMENT WERE DESCRIBED AND ILLUSTRATED. DEVELOPED IN THE USSR, THE PAVEMENTS HAVE SAND AND BITUMEN OR CEMENT STABILIZED BASES. THE PREFABRICATED CONSTRUCTION METHOD WAS FOUND ECONOMICAL AND EFFECTIVE. IMPROVEMENTS SUGGESTED WERE DEVELOPMENT OF LIGHTWEIGHT SLABS HIGH PRESSURE GROUTING, ROTARY GRADERS, VACUUM-GRIP LAYING PLANT, AND MULTIPOINT WELDING EQUIPMENT.

Stepuro, NT *Avtomobil Nye Dorogi /Ussr/*

ACKNOWLEDGMENT: Highway Res Abstracts Hwy Res Board, Am Concrete Inst Journal & Proceedings

3A 214445

PRESPLITTING-A CONTROLLED BLASTING TECHNIQUE FOR ROCK CUTS
RESEARCH WAS CONDUCTED ON CONSTRUCTION METHODS OF IMPROVED QUALITY AND LOWER COSTS IN THE HIGHWAY BUILDING OPERATIONS. THE EFFICACY AND ECONOMIC FEAT-

SIBILITY OF PRESPLITTING WORK IN HIGHWAY CUT SECTIONS WERE INVESTIGATED, AS WERE DEVELOPMENTS IN BLASTING, SUCH AS DRILL HOLE PATTERNS, DELAY CAPS, CONTROL OF SHOCK WAVE, SMOOTH WALL EXCAVATION TECHNIQUES, NEW TYPES OF EXPLOSIVES AND RESULTS ACHIEVED ON ROAD CONSTRUCTION. A COLLECTION OF CONSTRUCTION SPECIFICATIONS IN USE AND A SERIES OF PHOTOGRAPHS ILLUSTRATING RESULTS ACHIEVED ON SPECIFIC PROJECT APPLICATIONS ARE PRESENTED. THE FINDINGS DEMONSTRATE THAT SIGNIFICANT ADVANTAGES IN QUALITY OF CONSTRUCTION, SAFETY AND MAINTENANCE ARE ATTAINABLE THROUGH APPROPRIATE USE OF CONTROLLED BLASTING TECHNIQUES.

State Highway Departments Feb. 1967

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (2723013 67)

3A 214451

BITUMINOUS PAVEMENT CONSTRUCTION

THIS REPORT SUMMARIZES THE FINDINGS FROM FIELD RESEARCH STUDIES ON 11 BITUMINOUS PAVEMENT CONSTRUCTION PROJECTS. THESE STUDIES WERE CONCERNED WITH DETERMINING THE EFFECT OF CONSTRUCTION METHODS AND EQUIPMENT OPERATION ON PAVEMENT AND LONGITUDINAL JOINT QUALITY. SEMI-HOT AND COLD JOINT DENSITIES WERE FOUND TO BE SLIGHTLY LOWER AND AIR FLOWS HIGHER THAN IN THE ABUTTING LANES. INFRARED HEATING OF THE JOINT APPEARED TO BE THE BETTER OF SEVERAL METHODS TESTED FOR IMPROVING SEMI-HOT AND COLD JOINT QUALITY. HOT JOINTS, CONSTRUCTED BY PAVING IN ECHELON, HAD THE HIGHEST QUALITY OF ALL JOINT TYPES STUDIED. PAVER SPEED WAS NOT FOUND TO BE A SIGNIFICANT FACTOR IN FINAL LANE DENSITY. THE PRIMARY ADVANTAGE OF PNEUMATIC-TIRED ROLLERS, BOTH AT THE BREAKDOWN AND INTERMEDIATE STAGE, WAS FOUND TO LIE IN THE ABILITY OF PNEUMATIC TIRES TO SEAL THE PAVEMENT SURFACE AND THUS REDUCE THE AIR FLOW. WITH RESPECT TO DENSITY, NO PARTICULAR ADVANTAGE COULD BE FOUND IN PERFORMING BREAKDOWN ROLLING WITH PNEUMATIC ROLLERS AS COMPARED TO A STEEL THREE-WHEEL OR TANDEM ROLLER. THE VALUE OF HIGH ROLLING TEMPERATURES WAS VERIFIED. THE HIGHEST DENSITIES WERE OBTAINED WHEN BREAKDOWN ROLLING WAS ACCOMPLISHED AT TEMPERATURES ABOVE 200 DEGREE F. WHEN ROLLER OPERATORS WERE ALLOWED TO FOLLOW THEIR NORMAL ROLLING PROCEDURES, IT WAS FOUND THAT THE COMPACTIVE EFFORT AT THE CENTER OF THE LANE WAS FROM THREE TO SIX TIMES GREATER THAN AT THE LANE EDGES. TWO NEWLY-DEVELOPED NONDESTRUCTIVE TEST METHODS-NUCLEAR DENSITY AND AIR FLOW-WERE USED IN ADDITION TO CONVENTIONAL TEST METHODS TO MEASURE PAVEMENT AND JOINT QUALITY. IT WAS FOUND THAT THE ACCURACY OF THESE NONDESTRUCTIVE TESTS WAS AFFECTED TO A SIGNIFICANT DEGREE BY SURFACE TEXTURE OF THE PAVEMENT. IT IS RECOMMENDED THAT THESE TWO TESTS BE USED TO MEASURE COMPACTION ON A RELATIVE, RATHER THAN ABSOLUTE BASIS. /AUTHOR/

Kilpatrick, MJ Mcquate, RG
Bureau of Public Roads /US/ Hpr-pr-adm, Apr. 1967

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (2723214 67)PB 177 383, IC33020859

3A 214459

THE STATISTICAL APPROACH TO QUALITY CONTROL IN HIGHWAY CONSTRUCTION

THIS PUBLICATION IS INTENDED TO ASSIST STATE HIGHWAY DEPARTMENTS IN PLANNING RESEARCH PROGRAMS TO ESTABLISH QUANTITATIVE VALUES OF STATISTICAL PARAMETERS FOR HIGHWAY MATERIALS AND PROCESSES. THESE PARAMETERS ARE NEEDED TO APPLY STATISTICAL CONCEPTS TO QUALITY CONTROL IN HIGHWAY CONSTRUCTION. THIS PUBLICATION INCLUDES BACKGROUND INFORMATION

CONCERNING THE DEVELOPMENT OF AN OVERALL PLAN FOR APPLICATION OF THE STATISTICAL APPROACH TO QUALITY CONTROL IN HIGHWAY CONSTRUCTION. TO AVOID MISUNDERSTANDING, IT MUST BE EMPHASIZED THAT THE RELATIVELY LARGE AMOUNT OF SAMPLING AND TESTING REQUIRED IN THIS RESEARCH PROGRAM TO ESTABLISH SIGNIFICANT PARAMETERS INVOLVED WILL NOT BE REQUIRED WHEN SPECIFICATIONS ARE BASED ON STATISTICAL CONCEPTS. THE METHODS OF APPLICATION OF STATISTICAL PRINCIPLES TO SPECIFIC CONTROL PROBLEMS IN HIGHWAY CONSTRUCTION HAVE NOT, AS YET, BEEN SELECTED. IN CERTAIN CASES, IT IS LIKELY THAT PRESENT CONTROL PRACTICES WILL BE CONTINUED WHEREAS, IN OTHER CASES, A DIFFERENT SYSTEM OF CONTROL EMPLOYING CONSIDERABLY REDUCED NUMBER OF TESTS MAY BE ADEQUATE. HOWEVER, A NEW CONCEPT OF INTERPRETATION OF TEST RESULTS THEN WILL BE NECESSARY. /BPR/

Bureau of Public Roads /US/ Apr. 1965

ACKNOWLEDGMENT: Bureau of Public Roads /US/PB 176 059, IC33021018

3A 214460

QUALITY CONTROL OF CONSTRUCTION BY STATISTICAL TOLERANCES

THIS REPORT REFLECTS THE EFFECTIVENESS OF THE CONSTRUCTION PRACTICES IN EFFECT IN 1965-66 TOWARDS MEETING THE REQUIREMENTS OF THE CONSTRUCTION SPECIFICATIONS AND GIVES AN EXCELLENT REVIEW OF THE DEGREE OF COMPLIANCE WITH THE SPECIFICATIONS BEING ACHIEVED BY THE CONTRACTORS ON: (1) GRADING PROJECT, (2) A BASE AND BITUMINOUS CONCRETE PAVEMENT PROJECT, AND (3) A BASE AND PORTLAND CEMENT CONCRETE PAVEMENT PROJECT. THE RESULTS REPORTED WERE FROM MATERIALS AND CONSTRUCTION WHICH HAD MET ALL REQUIREMENTS OF THE CONTRACT AS CURRENTLY USED BY THE STATE, NEVER-THE-LESS THE STATISTICAL METHODS OF SAMPLING, TESTING AND ANALYSIS DO SHOW A TENDENCY FOR A SMALL NUMBER OF RESULTS TO FALL OUTSIDE OF THE CONTRACT SPECIFICATIONS. THIS STUDY SHOULD SERVE TO GIVE THE DEPARTMENT REASSURANCE IN IGNORING THE STATISTICALLY SMALL PERCENTAGE OF UNSATISFACTORY RESULTS ENCOUNTERED ON NORMAL CONSTRUCTION OPERATIONS. THE MATTER OF ADJUSTING CONSTRUCTING SPECIFICATIONS ACCORDINGLY IS A POLICY DECISION. /BPR/

David, JH
Alabama State Highway Department May 1967

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4601103 67)

3A 214461

QUALITY ASSURANCE THROUGH PROCESS CONTROL AND ACCEPTANCE SAMPLING

THIS PAMPHLET EXPRESSES THE PHILOSOPHY BEHIND THE RESEARCH EFFORT OF THE QUALITY ASSURANCE GROUP OF THE OFFICE OF RESEARCH AND DEVELOPMENT, BUREAU OF PUBLIC ROADS. IT PRESENTS MANY OF THE STATISTICAL CONCEPTS AND METHODS EMPLOYED IN THE PROCESS OF QUALITY ASSURANCE. QUALITY ASSURANCE FOR HIGHWAYS REQUIRES THE ANSWER TO (1) HOW DO WE ORDER WHAT WE NEED TO PERFORM THE SERVICE REQUIRED AND (2) HOW DO WE KNOW WE ARE GETTING WHAT WE ORDERED? SPECIFICATIONS MUST RECOGNIZE VARIABILITIES AND BE WRITTEN ON A PROBABILITY RATHER THAN AN ABSOLUTE BASIS. THE NECESSARY LEVEL OF QUALITY MUST BE CONSIDERED. STATISTICAL APPROACH TO MATERIALS SPECIFICATIONS MUST PROVIDE FOR A CLEAR UNDERSTANDING OF HOW MEASUREMENTS WILL BE MADE. SAMPLING PLANS ARE DESIGNATED AND CORRESPONDING TOLERANCES DOCUMENTED. THIS REPORT IS A GUIDE TO INSTRUMENTING SUCH A PROGRAM WITH REFERENCES TO PRIOR STUDIES ON THIS NEWER CONCEPT OF EVALUATING AND ACCEPTING HIGHWAY MATERIALS AND CONSTRUCTION PROCESSES. ANALYSIS OF VARIANCES OF CHARACTERISTICS AND ATTRIBUTES DIS-

CLOSE AREAS NEEDING CORRECTIVE ACTION THUS PROVIDING ECONOMICAL SATISFACTION FOR BOTH THE BUYER AND SELLER. /BPR/

Bureau of Public Roads /US/ Adm, Apr. 1967

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (2601012 67)PB 176 335, 2C33084583, 1C33021088

3A 214467
TRANSVERSE WEAKENED PLANE JOINTS BY PLASTIC INSERT

A NEW CONSTRUCTION TECHNIQUE IS EVALUATED INVOLVING A MACHINE DEVELOPED FOR THE PURPOSE OF INSERTING A PLASTIC STRIP IN THE FRESH CONCRETE TO FORM A TRANSVERSE WEAKENED PLANE JOINT. THIS TYPE OF JOINT CONSTRUCTION OFFERS MANY POTENTIAL ADVANTAGES OVER THE CURRENT METHOD OF SAWING WEAKENED PLANE JOINTS. A RESEARCH PROJECT WAS INITIATED TO DETERMINE THE ACCEPTABILITY OF JOINTS FORMED BY THE NEW DEVICE, EVALUTE THE SHORT-TERM PERFORMANCE OF THE JOINTS, AND ESTABLISH GUIDELINES TO PERMIT OR SPECIFY GENERAL USE OF THE METHOD. ADEQUACY OF INSTALLATIONS WAS VERIFIED FROM CORES TAKEN ON TWO PAVING PROJECTS. PERFORMANCE OF THIS TYPE OF JOINT UNDER TRAFFIC APPEARS TO BE EQUAL OR SUPERIOR TO SAWED JOINT CONSTRUCTION. A PROPOSED SPECIFICATION FOR THE NEW TECHNIQUE IS INCLUDED IN THIS REPORT. /BPR/

Spellman, DL Stoker, JR Woodstrom, JH
California Division Highways, Bureau of Public Roads /US/ Jan. 1968

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4811442 68)

3A 214473
STATISTICAL APPROACH TO THE QUALITY CONTROL OF PLANT MIX PAVEMENT

THE INCENTIVE FOR THIS STATISTICAL STUDY WAS BASED ON THE GENERAL DESIRE TO IMPROVE CONTROL AND ACCEPTANCE PROCEDURES. THIS SPECIFIC STUDY OF PLANT MIX PAVEMENT (ASPHALT CONCRETE) HAS PROVIDED PARAMETERS FOR GRADATION, DENSITY AND EXTRACTION TESTS WHICH ENABLE AN EVALUATION OF EXISTING SPECIFICATIONS. SAMPLING WAS CONDUCTED ON THREE CONSTRUCTION PROJECTS DURING ROUTINE PRODUCTION. THE SAMPLING PROCEDURES AND CONSTRUCTION TECHNIQUES WERE DESCRIBED FOR EACH PROJECT. THE TESTING WAS PERFORMED IN ACCORDANCE WITH THE STATE'S STANDARD PROCEDURES. AFTER ANALYSIS OF DATA, A COMPARISON WAS MADE WITH CURRENT TOLERANCE LIMITS. USING THE PARAMETERS FROM THIS STUDY, THERE ARE SOME AREAS OF NON-CONFORMANCE WITH CURRENT SPECIFICATIONS. THESE COMPARISONS ARE CLEARLY SHOWN IN GRAPHICAL FORM AND A DISCUSSION IS PROVIDED. /BPR/

Wyoming State Highway Department, Bureau of Public Roads /US/
State-510, June 1968

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4601363 68)PB 179 251, 1C33021373

3A 214475
USE OF PRECAST, PRESTRESSED CONCRETE FOR BRIDGE DECKS

A PRETENSIONED CONCRETE SLAB 4 FEET WIDE BY 6 INCHES DEEP AND LONG ENOUGH TO PROVIDE A 32-FOOT ROADWAY SURFACE BETWEEN CENTER LINES OF EXTERIOR BEAMS WAS PROPOSED AS THE BASIC ELEMENT IN CONSTRUCTING A PRECAST CONCRETE BRIDGE DECK. AFTER POSITIONING A SUFFICIENT NUMBER OF SLABS, EDGE TO EDGE, ON THE STEEL FRAMEWORK UNTIL THE DESIRED ROADWAY LENGTH WAS REACHED, THE SLABS WOULD BE DRAWN TOGETHER TO ACT AS A UNIT BY MEANS OF POST-TENSIONING TENDONS. TO TEST THE FEASIBILITY OF THIS METHOD, FOUR UNREINFORCED CONCRETE SLABS 24 INCHES WIDE BY

6 INCHES DEEP AND 34 INCHES LONG WITH KEYWAYS CAST INTO THEIR EDGES WERE ASSEMBLED ON A BEAM, POST-TENSIONED BY MEANS OF A 3/8-INCH DIAMETER CABLE, AND SUBJECTED TO A CONCENTRATED LOAD. IN ADDITION, A PHOTO-ELASTIC STRESS STUDY OF VARIOUS KEYWAY CONFIGURATIONS WAS MADE, VARIOUS JOINT MATERIALS WERE INVESTIGATED FOR USE BETWEEN SLABS, A STEEL CLIP AND BOLT ASSEMBLY SIMILAR TO THAT EMPLOYED BY THE ASSOCIATION OF AMERICAN RAILROADS TO FASTEN RAILS TO PRESTRESSED CONCRETE TIES WAS PROPOSED FOR ATTACHING THE FLOOR SLABS TO THE TOP FLANGES OF THE BRIDGE BEAMS, AND A COST ESTIMATE OF USING THIS PARTICULAR METHOD OF DECK CONSTRUCTION OVER CONVENTIONAL METHODS WAS PREPARED. /BPR/

Gutzwiller, MJ Lee, RH Scholer, CF
Purdue University, Indiana State Highway Commission, Bureau of
Public Roads /US/ July 1968

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4613292 68)PB-179
424, 3C33021394

3A 214498
USE OF PRECAST, PRESTRESSED CONCRETE FOR BRIDGE DECKS

A STRUCTURAL DECK SYSTEM COMPOSED OF PRECAST AND PRESTRESSED CONCRETE SECTIONS OF A SIZE PERMITTING OVER-THE-HIGHWAY TRANSPORTATION WAS CONCEIVED; STRUCTURAL DESIGN CALCULATIONS CONFORMING TO THE 'STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES 1965', AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS, WERE MADE FOR THE DECK SUPPORTED BY STEEL BEAMS SPACED AT THE MAXIMUM ANTICIPATED PROTOTYPE BEAM SPACING. THE COMPLETED DECK WOULD CONSIST OF SIMILAR PRECAST PIECES, EACH BEING SIX INCHES DEEP, AS LONG AS THE TRANSVERSE DIMENSION OF THE BRIDGE, AND OF A CONVENIENT WIDTH, FOUR FEET BEING ANTICIPATED AS A COMMON WIDTH. SPECIFIC AREAS OF INVESTIGATION INCLUDED THE SLAB TIE-DOWN SYSTEM, THE TRANSVERSE CONTINUITY JOINT, THE POST-TENSIONING SYSTEM, JOINT MATERIALS FOR WATERPROOFING AND REDUCTION OF STRESS CONCENTRATION, AND STATIC AND REPEATED LOAD TESTING OF FULL-SCALE SPECIMENS. THE INVESTIGATION INDICATED THAT THE SYSTEM IS WORKABLE AND THAT THE DESIGN PROCEDURES EMPLOYED ARE ADEQUATE. PERFORMANCE OF THE DECK IN FLEXURE INDICATED THAT A WHEEL LOAD WOULD BE NEARLY ALL CARRIED BY ONE PRESTRESSED SECTION OR BY TWO ADJOINING SECTIONS FOR A WHEEL LOAD NEAR THEIR JUNCTION. THE BOLTING SYSTEM WAS OBSERVED TO REDUCE DEFLECTIONS AND TO INCREASE RESISTANCE OF THE DECK TO HORIZONTAL MOTION. /AUTHOR/

Ford, JH
Purdue University, Indiana State Highway Commission, Bureau of
Public Roads /US/ July 1969

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4613264 69)

3A 214526
STUDY OF LONGITUDINAL JOINT CONSTRUCTION IN BITUMINOUS CONCRETE PAVEMENTS

IT HAS LONG BEEN RECOGNIZED THAT LONGITUDINAL JOINTS BETWEEN SEPARATELY PLACED LANES OF BITUMINOUS CONCRETE HAVE BEEN VERY VULNERABLE TO THE EFFECTS OF WATER, WEATHER, AND TRAFFIC CONDITIONS. THIS PROJECT WAS UNDERTAKEN TO STUDY AND EVALUATE SEVERAL DIFFERENT TYPES OF JOINT CONSTRUCTION TECHNIQUES TO AID IN THE FUTURE CONSTRUCTION OF MORE DURABLE JOINTS. FOR THE PURPOSES OF THIS STUDY ONLY COLD FACE JOINT CONSTRUCTION WAS USED, WITH THE ROLLING TECHNIQUE VARIED IN THE SECOND PLACED LANE TO GIVE THREE METHODS OF JOINT CONSTRUCTION, THE LAP JOINT, THE PINCHED JOINT, AND THE FORCED JOINT. THE EVALUATION SHOWS THAT, AS APPLIED IN THIS STUDY,

THERE IS NO SUPERIOR ROLLING METHOD; ALL APPEAR TO BE EQUAL IN THE APPLICATION OF END RESULTS. TEST RESULTS SHOWED VARIATIONS IN THE DENSITY WITHIN EACH LANE OF EACH TEST SITE. IN ALL CASES, THE IMMEDIATE JOINT AREA REFLECTED LOWER DENSITY PROPERTIES THAN ADJACENT AREAS. THERE IS EVIDENCE, HOWEVER, THAT THE CONSTRUCTION DURING AND AFTER RESEARCH IMPLEMENTATION AND DIRECTION WAS SUPERIOR TO THE QUALITY OF THE CONSTRUCTION PRIOR TO THE IMPLEMENTATION OF THIS PROJECT. THEREFORE, IT MAY BE SAID THAT IMPROVED JOINT CONSTRUCTION MAY BE OBTAINED THROUGH THE USE OF ADDITIONAL CARE IN THE FIELD. IT IS ALSO FELT THAT PRESENT TEST METHODS ARE NOT TRUE PERFORMANCE INDICATORS OF THE LONGITUDINAL JOINTS, AS VISUAL EXAMINATION OVER PERIODS OF EXPOSURE UP TO FIVE YEARS REFLECT SATISFACTORY CONSTRUCTION. /AUTHOR/

Briscoe, OE
Maryland St Dept Transp, Highway Admin, Federal Highway Administration /US/ Study No Aw-71-60-46

ACKNOWLEDGMENT: Federal Highway Administration (4722065 72)REPORT PENDING, 3C33022851

3A 214528

EFFECT OF CONSTRUCTION PRACTICES ON DURABILITY-PART I

IN ORDER TO STUDY THE EFFECT OF CONSTRUCTION PRACTICES ON THE DURABILITY OF BRIDGE DECKS, SEVEN CONCRETE DECKS WERE OBSERVED DURING CONSTRUCTION. EACH DECK WAS THEN EXAMINED ANNUALLY FOR 5 YEARS, AND EVIDENCE OF DETERIORATION RECORDED UNDER FOUR HEADINGS: SURFACE MORTAR DETERIORATION (SMD), TRANSVERSE CRACKING, FRACTURE PLANES, AND SPALLING. THESE WERE RELATED TO SEVEN CONSTRUCTION FACTORS: FORM TYPE, SLUMP, AIR CONTENT, PLACEMENT TIME, FINISHING TIME, DELAY IN CURING, AND DEPTH OF CONCRETE COVER. ANALYSIS INDICATED THAT THE THREE DECKS BUILT WITH CONVENTIONAL REMOVABLE FORMS EXHIBITED HIGHER RATES OF CRACKING AND LOWER RATES OF SMD THAN THE FOUR DECKS BUILT WITH STAY-IN-PLACE (SIP) FORMS. THOSE SECTIONS HAVING AVERAGE SLUMPS GREATER THAN 3 IN. SHOWED A HIGHER FREQUENCY OF DEEP SMD THAN THOSE HAVING AVERAGE SLUMPS LESS THAN 3 INCHES. AN UNEXPLAINED ASSOCIATION BETWEEN HIGH AIR CONTENT AND SIP FORMS PRECLUDED ANY MEANINGFUL ANALYSIS OF THE INFLUENCE OF AIR CONTENT AND THE RATE OF DETERIORATION. DELAYS IN PLACEMENT AND FINISHING TIMES WERE ASSOCIATED WITH HIGHER RATES OF CRACKING. DELAYS IN START OF CURING WERE ASSOCIATED WITH HIGHER RATES OF SMD. SPANS OF DECKS HAVING LESS THAN 1.5 INCHES OF COVER OVER TOP STEEL EXHIBITED FRACTURE PLANES AND/OR SPALLS. /FHWA/

Cady, PD Carrier, RE Bakr, T Theisen, J
Pennsylvania State University, Pennsylvania Department Transp, Federal Highway Administration /US/ Study No 63-6

ACKNOWLEDGMENT: Federal Highway Administration (4641186 72)REPORT PENDING, 3C33022867

3A 214531

TRANSVERSE JOINT CONSTRUCTION

TRANSVERSE JOINTS ARE CONSTRUCTED IN PORTLAND CEMENT PAVEMENTS TO RELIEVE INTERNAL STRESSES BY PERMITTING CONTRACTION AND EXPANSION OF PAVEMENT SLABS. ALTHOUGH MANY DIFFERENT METHODS HAVE BEEN USED TO CONSTRUCT THESE JOINTS THE METHODS CAN BE CLASSIFIED IN THREE GROUPS: HAND FORMING, INSERT FORMING, AND SAWING. THIS STUDY WAS UNDERTAKEN TO EVALUTE THE VARIOUS METHODS, NOT ONLY FROM A CONSTRUCTION STANDPOINT, BUT ALSO FOR LONG TERM PERFORMANCE OF THE JOINT. TO ACCOMPLISH THIS,

OBSERVATIONS OF CONSTRUCTION METHODS AND SPALL SURVEYS WERE CONDUCTED THROUGHOUT NEW YORK STATE. DURING THE EARLY STAGES OF EVALUATION, IT WAS DETERMINED THAT CERTAIN VARIABLES SUCH AS, WEATHER DURING PAVING, SMALL MODIFICATIONS TO CONSTRUCTION METHODS, CLIMATE, AND TRAFFIC COULD INFLUENCE THE PERFORMANCE OF THE JOINTS. THEREFORE IN AN ATTEMPT TO EVALUATE JOINTS CONSTRUCTED BY VARIOUS METHODS, BUT WITH MANY OF THE VARIABLES CONTROLLED. A TEST AREA WAS CONSTRUCTED AT FISHKILL, NEW YORK, ON A SECTION OF INTERSTATE ROUTE 84. BASED ON THE DATA COLLECTED AND THE FIELD OBSERVATIONS THAT WERE MADE BOTH AT THE TEST SITE AND STATEWIDE, ADVANTAGES AND DISADVANTAGES OR PROBLEMS ASSOCIATED WITH EACH METHOD HAVE BEEN IDENTIFIED AND ARE DISCUSSED WITHIN THE REPORT. IN ADDITION, ELEVEN GENERAL CONCLUSIONS HAVE BEEN DRAWN WHICH CAN SERVE AS A GUIDE TO ONE DESIGNING OR EVALUATING A CONSTRUCTION METHOD. /AUTHOR/

Mccarty, WM Hiss, JG
New York State Dept Transportation, Federal Highway Administration Jan. 1972

ACKNOWLEDGMENT: Federal Highway AdministrationREPORT PENDING, 4C33022927

3A 214542

PRESPLITTING INTERIM REPORT 3

THIS REPORT ON PRESPLITTING HIGHWAY CUT SLOPES BY THE CALIFORNIA DIVISION OF HIGHWAYS DISCUSSES AND ANALYZES THE CONSTRUCTION METHODS AND PROBLEMS, THE SPECIFICATIONS, AND THE ECONOMICS INVOLVED WITH THE PRESPLITTING OF SEDIMENTARY ROCKS.

Forsyth, RA Mccauley, ML Mearns, R Hoover, TP
California Division Highways, Federal Highway Administration /US/ Mar. 1973

ACKNOWLEDGMENT: Federal Highway AdministrationREPORT PENDING, FHWA P-0017, 2C33023214

3A 214549

THE DRYER-DRUM MIXING PROCESS FOR PRODUCING ASPHALT MIXTURES IN THE STATE OF WASHINGTON

THIS REPORT DESCRIBES THE DRYER-DRUM PROCESS FOR PRODUCTION OF ASPHALT PAVEMENT MIXTURES. DAMP OR WET AGGREGATES AND ASPHALT ARE INTRODUCED INTO A DRYER DRUM. DRYING THE AGGREGATE AND COATING IT WITH ASPHALT ARE ACCOMPLISHED AS THE MATERIALS PASS THRU THE DRYER. NO FURTHER MIXING IS REQUIRED. RESULTS OF TESTS, I.E., PENETRATION LOSS, COMPACTION, EXTRACTION, ETC., ARE GIVEN PRACTICALLY ALL PARTICULATE EMISSIONS ARE ELIMINATED. SUBSTANTIAL COST REDUCTIONS ARE ENVISIONED.

Allen, WL JR Price, JT
Washington Department Highways June 1972, 29 pp

ACKNOWLEDGMENT: Federal Highway AdministrationFHWA P-0012, NTIS PB 221 348, IC33023297

3A 214551

USE OF PRECAST-PRESTRESSED CONCRETE FOR BRIDGE DECKS

A PRECAST, PRESTRESSED CONCRETE BRIDGE DECK SYSTEM HAS BEEN DESIGNED TO BE USED EITHER ON NEW BRIDGES OR FOR RECONSTRUCTION OF DETERIORATED DECKS. THE REPORT DESCRIBES THE CONSTRUCTION ACTIVITIES INVOLVED IN THE USE OF THE PRESTRESSED PLANK ON TWO INSTALLATIONS IN INDIANA. ACTUAL TIME REQUIRED TO PLACE THE ELEMENTS AND POST-TENSION THEM TOGETHER WAS TWO DAYS FOR EACH BRIDGE. LOAD TESTS HAVE BEEN MADE ON BOTH BRIDGES AT INTERVALS SINCE THEIR CONSTRUCTION. RESULTS HAVE INDICATED NO SIGNIFICANT CHANGES IN DECK PERFORMANCE DURING THIS PERIOD. /FHWA/

Kropp, PK
 Purdue & Ind State Hwy Comm Jhrp Interim Mar. 1973, 39 pp

ACKNOWLEDGMENT: Indiana State Highway Commission Ca (390), Federal Highway Administration /US/FHWA S0189, NTIS PB 228205/AS, IC33023438

3A 214558
THE COMPACTION OF SOIL AND ROCK MATERIALS FOR HIGHWAY PURPOSES

THE INVESTIGATION WAS DESIGNED TO REVIEW THE STATE OF THE ART OF THE COMPACTION OF SOIL AND ROCK FOR HIGHWAY PURPOSES; TO LAY THE GROUNDWORK FOR IMPROVED FIELD CONSTRUCTION PRACTICES AND SPECIFICATIONS. THE RESEARCHERS REVIEWED THE MECHANICS OF COMPACTION, MOISTURE-DENSITY RELATIONS, PROPERTIES OF COMPACTED MATERIALS AND FACTORS THAT AFFECT THEM, BEHAVIORAL REQUIREMENTS OF PAVEMENT ELEMENTS, VARIABILITY AND RELIABILITY OF TESTING PROCEDURES, AND STATISTICAL QUALITY CONTROL METHODOLOGY. THEY REVIEWED CONSTRUCTION SPECIFICATIONS AND FIELD PRACTICES AND DEVELOPED RECOMMENDATIONS FOR IMPROVEMENTS. THEY ALSO RECOMMENDED GOALS FOR FUTURE RESEARCH.

Wahls, HE Fisher, CP Langfelder, LJ
 North Carolina State Highway Comm Aug. 1966

ACKNOWLEDGMENT: Federal Highway Administration FHWA S0170, NTIS PB 227 931/AS, IC33023530

3A 214576
CONCRETE ROAD CONSTRUCTION

ADVANCES IN CONSTRUCTION TECHNIQUES ARE REVIEWED WITH EMPHASIS ON AMERICAN PLANT, PARTICULARLY THE SLIP-FORM PAVER. REFERENCE IS INCLUDED TO RESEARCH AND DEVELOPMENT ON DESIGN AND CONSTRUCTION OF CONCRETE ROADS IN GREAT BRITAIN BY THE ROAD RESEARCH LABORATORY, HARMONDSWORTH, AND THE CEMENT AND CONCRETE ASSOCIATION, LONDON. /RRL/

Stroud, A *Muck Shifter* /UK/ Apr. 1965

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 214578
TUNNEL BREAK-THROUGH UNDER WATER

THE FIRST PART OF THE ARTICLE GIVES A SURVEY OF THE CONSTRUCTIONAL ASPECTS OF TUNNELLING BREAK-THROUGH UNDER WATER AS PRACTISED FOR YEARS BY NORWEGIAN WATER POWER DEVELOPERS. THE SECOND PART DEALS WITH MODEL TESTS GENERALLY AND PRESENTS EXAMPLES OF ACTUAL EXPERIMENTS. HITHERTO IMPORTANT HYDRAULIC DATA, SUCH AS THE SITE OF DEPOSITION OF THE DEBRIS, HAVE NOT BEEN AMENABLE TO VERIFICATION AND CONTROL, BUT NOW THIS HAS BEEN MADE POSSIBLE BY MODEL TESTS. /RRL/

Hoyer, H Groner, CF Slovik, O *Teknisk Ukeblad, Oslo /Norway/* APR65

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 214580
MULTI-STAGE BRIDGE CONSTRUCTION KEEPS TRAFFIC MOVING

TO IMPROVE THE FACILITIES PROVIDED BY A FREQUENTLY CONGESTED 250-FT LONG BY 24-FT WIDE OVERHEAD STEEL TRUSS SPAN OVERPASS, A DESIGN AND THREE-STAGE SEQUENCE OF CONSTRUCTION WERE DEVISED THAT WOULD INCUR A MINIMUM DISRUPTION OF TRAFFIC FLOW. TWO SECTIONS OF BRIDGE, PROVIDING TEMPORARY ROUTES FOR VEHICULAR AND PEDESTRIAN TRAFFIC, WERE CONSTRUCTED ADJACENT TO THE OLD STRUCTURE. FOLLOWING THE REMOVAL OF THIS OLD BRIDGE STRUCTURE, THE THIRD STAGE WAS COMPLETED' CONSTRUCTION OF THE CLOSURE,

OR FILL-IN UNIT, WHICH JOINED THE TWO PREVIOUSLY ERECTED SECTIONS. THE RESULTING NEW OVERPASS IS A 67-FT WIDE BY 588- FT LONG BRIDGE, PROVIDING FOUR 14-FT WIDE TRAFFIC LANES AND TWO PEDESTRIAN FOOTWAYS SEPARATED BY A 4-FT CONCRETE CENTRAL RESERVE. /RRL/

Clark, WH *Texas Highways, Texas Highway Dept* Apr. 1965

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 214582
PAVING OF PUBLIC ROADS IN FINLAND

PAVING OF HIGHWAYS WAS STARTED ON A LARGER SCALE AT THE BEGINNING OF THE 1960S. IN 1964 THE USE OF OIL GRAVEL DECREASED, AND THE LENGTH OF ASPHALT CONCRETE PAVEMENTS WAS AT THE SHORTEST IN THE DECADE. THE USE OF BITUMINOUS GRAVEL AND CUT-BACK ASPHALTIC BITUMEN, HOWEVER, INCREASED. THERE HAVE BEEN NO ESSENTIAL CHANGES CONCERNING THE ACTUAL ASPHALT PAVEMENTS, ALTHOUGH OVER 100 TEST ROAD SECTIONS HAVE BEEN CONSTRUCTED FOR ANALYSIS OF DIFFERENT BINDER MATERIALS, ADHESIVE AGENTS, WORKING METHODS, AND THE ECONOMY OF PAVING. THE LENGTH OF PAVED PUBLIC ROADS IN 1964 WAS 1,701 KM, WHICH CAN BE DIVIDED BY PAVEMENT TYPE AS FOLLOWS' ASPHALT CONCRETE 170, BITUMINOUS GRAVEL 329, CUT-BACK ASPHALTIC BITUMEN 169, AND OIL GRAVEL 1,033 KM, OF WHICH 712 KM ARE OLD ROADS /RRL/

Niemi, B
 Tielehti, Helsinki Apr. 1965

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 214588
FARM ROAD CONSTRUCTION. THIRD REVISED EDITION

DETAILS ARE GIVEN OF THE MATERIALS, EQUIPMENT AND PROCEDURE INVOLVED IN CONCRETE, FARM-ROAD CONSTRUCTION. IT IS CONSIDERED THAT FOR GENERAL PURPOSES THE ROAD SHOULD NOT BE LESS THAN 8 FT WIDE AND, UNLESS IT IS AT LEAST 16 FT WIDE PASSING BAYS SHOULD BE PROVIDED. THE SLAB SHOULD BE 6 IN THICK OR 5 INCHES ON A GOOD SUBGRADE. JOINTS ARE REQUIRED, BUT REINFORCEMENT IS NECESSARY ONLY UNDER CONDITIONS OF HEAVY TRAFFIC OR ON A WEAK SUBGRADE. /RRL/

Cement & Concrete Assoc, London /UK/ June 1965

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 214589
SURFACE IRREGULARITY DATA FOR RECENT MAJOR ROAD WORKS' SPECIFICATIONS AND TOLERANCES

MEASUREMENTS WERE MADE WITH A MULTI-WHEELED PROFILOMETER OR A BUMP INTEGRATOR ON A CONSIDERABLE NUMBER OF RECENT MAJOR ROAD WORKS, IN ORDER THAT THE STANDARDS OF SURFACE FINISH AND THE VARIABILITY BETWEEN AND WITHIN INDIVIDUAL PROJECTS COULD BE ASCERTAINED AND COMPARED WITH THE CURRENT REQUIREMENTS OF SPECIFICATIONS. STANDARDS WERE FOUND TO VARY WIDELY BUT ON NEARLY ALL THE ROADS AN APPRECIABLE PROPORTION OF THE WHOLE SURFACE HAD A FINISH BETTER THAN THE 1/8-INCH STANDARD. IT IS CONSIDERED THAT SUPERVISING ENGINEERS SHOULD AIM PRIMARILY AT MINIMIZING THE VARIABILITY OF SURFACE FINISH IN ORDER TO IMPROVE OVERALL RESULTS. THIS IN TURN IMPLIES EFFICIENT AND ADEQUATE CONTROL OF ALL MATERIALS AND PROCESSES IN CONSTRUCTION. /RRL/

Road Research Laboratory Notes /UK/ June 1965

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 214590
CONCRETE ROADS IN NIGERIA

THE PRESENT POSITION WITH REGARD TO THE DESIGN AND CONSTRUCTION OF CONCRETE ROADS IN NIGERIA IS DE-

SCRIBED. SOME DESIGNS ARE REVIEWED, AND THE CONSTRUCTIONAL METHODS ARE COMPARED WITH THOSE USED ELSEWHERE EMPLOYING MECHANIZED EQUIPMENT. /RRL/

Agbim, CC *Concrete & Constructional Eng /UK/* Aug. 1965

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 214596

OVERSLABBING AT SWANSEA AIRPORT. RECONSTRUCTION TO STRENGTHEN CONCRETE RUNWAY
THE CONTRACT INCLUDED MAKING UP SURFACE LEVELS WITH REGULATING COURSES OF HOT-ROLLED ASPHALT, OVERSLABBING WITH SIX-INCH REINFORCED CONCRETE, AND RECONSTRUCTING RUNWAY SHOULDERS AND TERMINAL AREA. DETAILS ARE GIVEN OF JOINT CONSTRUCTION AND PAVEMENT DESIGN. /RRL/

Surveyor and Municipal Engineer /UK/

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 214597

INVESTIGATIONS INTO ROAD BUILDING PRACTICE IN THE TROPICS. SIX STUDIES OF SOME ROAD BUILDING OPERATIONS ON A ROAD CONSTRUCTION SCHEME IN TORTOLA, BRITISH VIRGIN ISLANDS
AS PART OF A STUDY OF ASPECTS OF NORMAL ROAD-BUILDING PRACTICE IN THE TROPICS, MEASUREMENTS WERE MADE DURING THE CONSTRUCTION OF A CEMENT-STABILIZED BASE IN TORTOLA. THE BASE IS BEING CONSTRUCTED WITH A SINGLE-PASS STABILIZING TRAIN BY ADDING A SMALL PROPORTION OF CEMENT TO A GRANULAR MATERIAL KNOWN LOCALLY AS TARRAS. THE DATA OBTAINED SHOWED THAT WITH THE CONSTRUCTION METHODS USED ADEQUATE STATES OF COMPACTION AND THICKNESSES OF STABILIZED BASE WERE BEING PRODUCED BUT SHAPING BY BULLDOZERS WAS UNABLE TO PRODUCE A SURFACE OF ACCEPTABLE REGULARITY. /RRL/

Tanner, JS *Road Research Laboratory Notes /UK/* Sept. 1965

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 214599

IMMERSED TUBE METHOD. WORLDS FIRST SIX-LANE TUNNEL IN SWEDEN
THE TINGSTAD TUNNEL UNDER THE GOTA RIVER AT GÖTEBORG IS CONSTRUCTED ON THE SUNK TUNNEL PRINCIPLE, AND COMPRISES AN ENCLOSED COFFERDAM STRETCH OF 455 M WITH A 60 M LONG APPROACH RAMP AT EITHER END. THE TUNNEL CONSISTS OF 5 SECTIONS, EACH APPROX. 93 M LONG, WHICH ARE PRECONSTRUCTED, CLOSED, TOWED OUT AND SUNK INTO POSITION ON THE FOOTINGS PREPARED BEFOREHAND. HEADROOM IN THE CARRIAGEWAYS IS 4.55 M. THE THICKNESS OF THE STRUCTURAL CONCRETE IS 100 CM FOR OUTER WALLS AND BOTTOM, 82 CM FOR THE ROOF AND 50 CM FOR INBOARD DIVIDING WALLS. DETAILS ARE GIVEN OF ADDITIONAL WATER INSULATION, CONSTRUCTING THE UNITS IN THE BUILDING DOCK, SINKING OF UNITS, DIMENSIONING, VENTILATION, SOIL EXPLORATION AND EXPERIMENTATION. /RRL/

Gustafson, T *Contract Journal /UK/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 214604

HOT WEATHER CONCRETING
FACTORS INVOLVED IN HOT WEATHER CONCRETING IN THE UNITED KINGDOM ARE DISCUSSED. ATTEMPTS WERE MADE TO DEAL WITH THE PROBLEM BY CONCRETING AT MORE NORMAL TEMPERATURES. AS THE TEMPERATURE OF CONCRETE AT THE TIME OF MIXING OR PLACING INCREASES, THE CEMENT HYDRATES MORE RAPIDLY. THE RESULTANT LOWER WORKABILITIES CAN RESULT IN POOR COMPACTION.

THE CONCRETE IS ALSO MORE PRONE TO THERMAL CONTRACTION MOVEMENTS AND FASTER DRYING SHRINKAGE, LEADING POSSIBLY TO SURFACE CRACKING WITH SLABS. BECAUSE OF THE MORE RAPID GENERATION OF HEAT FROM THE CONCRETE ITSELF, THE PROBLEMS OF CONCRETING IN HOT WEATHER CAN BE FURTHER INCREASED WHEN CEMENTS WITH RAPID-HARDENING PROPERTIES ARE USED OR WHERE LARGE VOLUMES OF CONCRETE ARE BEING PLACED. /RRL/

Cement & Concrete Assoc Adv Notes /UK/ May 1965

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 214614

THE POSSIBILITY OF USING TRACKED WAYS /TRAMWAYS/ OF PRECAST CONCRETE UNITS AS A STANDARD CONSTRUCTION FORM FOR FARM ROADS
SINCE 1959, TRACKED WAYS /TRAMWAYS/, I.E. STABILIZATION OF THE WHEEL TRACKS, ARE BEING INCREASINGLY USED IN SCHLESWIG-HOLSTEIN IN BUILDING THE AGRICULTURAL ROAD SYSTEM. THEY ARE STILL TOO NEW TO ALLOW OF AN EVALUATION OF THEIR RELIABILITY. THE DEVELOPMENT OF TRAMWAY CONSTRUCTION IS ILLUSTRATED ON THE EXAMPLE OF THE STEINBERG RURAL DISTRICT. AS ROADS OF SUBSIDIARY IMPORTANCE /ACCOMMODATION ROADS/, THESE TRACKWAYS ARE SUFFICIENTLY DISTINGUISHABLE FOR ORDINARY ROAD TRAFFIC TO AVOID THEM. EXPERIENCE HITHERTO APPEARS TO INDICATE THAT STABILIZATION OF THE WHEEL TRACKS CAN BECOME A DECISIVE FACTOR IN THE DEVELOPMENT OF STANDARD CONSTRUCTION METHODS FOR AGRICULTURAL ROADS. /FG/RRL/

Radloef, W *Wasser Und Boden /Germany/* 65

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 214617

'SOFT-GROUND TUNNELLING' DESIGN AND CONSTRUCTION
THIS PAPER DEALS WITH VARIOUS DESIGN AND CONSTRUCTION TECHNIQUES EMPLOYED IN SOFT-GROUND TUNNELLING. THE PAST DEVELOPMENT, AS WELL AS THE LATEST TRENDS, ARE DISCUSSED. THE FIRST PART OF THE PAPER DEALS WITH SHIELD-DRIVEN TUNNELS AND REVIEWS THE TUNNELLING SHIELD, COMPRESSED AIR AND GROUND TREATMENT, TUNNEL LINING, VEHICULAR TUNNELS. SUNKEN-TUBE TUNNELS ARE DESCRIBED IN THE SECOND PART OF THE PAPER. A GENERAL DESCRIPTION OF THE METHOD IS GIVEN. REVIEWING VARIOUS TYPES OF VEHICULAR TUNNELS. CONDITIONS WHICH AFFECT THE FEASIBILITY OF THIS METHOD ARE SUMMARIZED AND THE MORE IMPORTANT DETAILS OF THE CONSTRUCTION PROCEDURES ARE DISCUSSED. THE PAPER IS CONFINED TO A BROAD REVIEW OF SOFT-GROUND TUNNELLING. /CGRA/

Noskiewicz, TM Ramsay, JA *Canadian Good Roads Association Proc* Oct. 1964

3A 214623

GIANT TOWERS ERECT BRIDGE
USING TEMPORARY TOWERS ERECTED ON SITE, DOMINION BRIDGE WAS ABLE TO CUT CONSTRUCTION TIME FOR THE BRIDGE BETWEEN MONTREALS MACKAY PIER AND EXPOS ILE VERTE, FROM 2 1/2 YEARS TO 1 1/2 YEARS. THE TOWERS WERE USED TO CANTILEVER THE SPANS UTILIZING CABLES ANCHORED IN THE BRIDGE ABUTMENTS. TWO TOWERS WERE USED ONE AT EACH END WITH THE BRIDGE MEETING AT THE CENTRE. THE SPANS THEMSELVES ARE OF AN ORTHOTROPIC STEEL DESIGN EMPLOYING A TRAPEZOIDAL, THREE CELL, BOX GIRDER WITH SLOPING WEBS ON THE OUTSIDE. /CGRA/

Caplan, B *Engineering and Contract Record /Can/* Mar. 1965

3A 214628

SPEEDY COMPACT CONCRETE PUMPING UNITS PRODUCE SAVINGS AND A NEW CONTRACTOR

COMPACT AND MOBILE CONCRETE PUMPING RIGS ARE COMPETITIVE IN COST AND SPEED-AND OFTEN MORE EASY TO HANDLE THAN CONVENTIONAL CRANE AND BUCKET OR TRUCK AND BUGGY COMBINATIONS. HERE ARE THE BENEFITS OF PUMPING: /1/ CONCRETE PLACEMENT TENDS TO BE A MORE STEADY, UNINTERRUPTED OPERATION AND IS GENERALLY FASTER THAN CONVENTIONAL METHODS, /2/ FORM PRESSURES AND WEAR ARE REDUCED BECAUSE OF ELIMINATION OF SURGES, /3/ CONCRETE CAN BE CAST IN LOCATIONS OTHERWISE COMPLETELY INACCESSIBLE TO CRANE OR BUGGIES, /4/ COSTS ARE USUALLY COMPARATIVE WITH, OR BETTER THAN MOVING CONCRETE BY OTHER METHODS. LABOR REQUIREMENTS ARE ALSO REDUCED, /5/ THE QUALITY CONTROL OF THE MIX BUILT RIGHT INTO THE PUMP MEANS BETTER AND STRONGER FINAL PRODUCT, /6/ CRANES ARE FREED FROM BUCKET-SWINGING DUTY TO BE MORE PRODUCTIVELY DEPLOYED. CONVEYOR SYSTEMS ARE OFTEN TEAMED UP WITH PUMPS FOR LONG DISTANCE OR HIGH VOLUME POURS, AND /7/ THE PIPELINES DELIVER THE MIX RIGHT TO THE FINAL LOCATION, AND IN SUCH A MANNER THAT OTHER TRADES OR OPERATIONS ARE NOT INTERRUPTED DURING THE POUR. BUGGY RUNWAYS ARE ELIMINATED. /CGRA/

Rooke, W *Heavy Construction News /Canada/* Apr. 1967

ACKNOWLEDGMENT: Canadian Good Roads Association

3A 214637

EXPERIENCE WITH AUTOMATICALLY CONTROLLED PAVERS IN ONTARIO

THIS REPORT DOCUMENTS EXPERIENCE IN THE USE OF AUTOMATICALLY CONTROLLED PAVERS INCLUDED IN CERTAIN DEPARTMENTS OF HIGHWAYS, ONTARIO CONTRACTS AS A SPECIAL PROVISION. SOME OF THE APPLICATIONS SUCH AS GRADE LEVELLING AND CROSS-FALL CONTROL ARE NOTED AND THE MEANS BY WHICH AUTOMATICALLY CONTROLLED PAVING IS ACHIEVED INCLUDING THE METHODS IN MOST COMMON USE ARE DISCUSSED. THE MERITS OF THE VARIOUS METHODS AND SENSING DEVICES ARE NOT EVALUATED BECAUSE OF LACK OF EXPERIENCE, MEASURING INSTRUMENTS, AND ACTUAL RECORDS OF THE RESULTS OBTAINED, BUT THE CONSTRUCTION TECHNIQUES FOUND MOST SUITABLE BY THE DEPARTMENT FOR RESURFACING OF OLD PAVEMENTS AND CONSTRUCTION OF NEW PAVEMENTS ARE OUTLINED. SPECIAL APPLICATIONS OF AUTOMATICALLY CONTROLLED PAVING ARE MENTIONED AND A PARTICULAR APPLICATION FOR THE RESURFACING OF A LONG BRIDGE DECK IS DOCUMENTED. MENTION IS MADE OF THE NEED FOR FURTHER IMPROVEMENT TO THE AUTOMATIC CONTROLS OF THE PAVERS AND IT IS SPECULATED THAT EVENTUALLY AUTOMATIC RECORDING DEVICES MAY BE DEvised WHICH WILL SUPPLY DATA FOR COMPUTERIZED CONTROL OF MATERIAL. FINALLY, IT IS CONCLUDED THAT INCREASING USE OF AUTOMATICALLY CONTROLLED PAVERS IS ASSURED BECAUSE OF THE GENERALLY FAVOURABLE RESULTS THAT ARE BEING OBTAINED. /AUTHOR/

Corkill, JT *Canadian Good Roads Association Proc* Sept. 1967

ACKNOWLEDGMENT: Canadian Good Roads Association

3A 214638

DEVELOPMENTS IN ASPHALT COMPACTION BY VARIABLE TIRE PRESSURE ROLLERS

PAVEMENTS ARE CURRENTLY COMPACTED IN THE FIELD IN TWO STAGES. THE FIRST STAGE CONSISTS OF ROLLING AT HIGH TEMPERATURES DURING CONSTRUCTION, AND IT MAY BE CONTINUED FOR AN HOUR OR TWO AFTER THE MIX LEAVES THE SPREADER. THE SECOND STAGE IS COMPACTION BY TRAFFIC, WHICH TAKES PLACE AT NORMAL SERVICE TEMPERATURES, AND IT ORDINARILY CONTINUES FROM

TWO TO FOUR YEARS TO ACHIEVE ULTIMATE DENSITY, WHICH CORRESPONDS TO 100% OF LABORATORY COMPACTED DENSITY. POOR COMPACTION BY ROLLING DURING CONSTRUCTION LEAVES A PAVEMENT WITH A HIGH AIR Voids CONTENT. THE HIGHER THIS CONTENT, THE FASTER THE ASPHALT CEMENT IN THE PAVEMENT HARDENS, AND THE SHORTER IS THE PAVEMENT'S SERVICE LIFE. CONSEQUENTLY, THERE IS A NEED TO COMBINE THIS TWO-STAGE PAVEMENT COMPACTION INTO A SINGLE STAGE. THIS MEANS THAT PAVEMENTS SHOULD BE ROLLED DURING CONSTRUCTION TO 100% OF LABORATORY COMPACTED DENSITY. EXPERIENCE SHOWS THAT ROLLING TO 100% OF LABORATORY COMPACTED DENSITY CANNOT BE ACHIEVED BY STEEL WHEEL ROLLERS. IT COULD PROBABLY BE ATTAINED BY THE PROPER USE OF PNEUMATIC-TIRE ROLLERS EQUIPPED FOR RAPID CHANGE OF TIRE INFLATION PRESSURE. SOME IMPROVEMENTS IN THE LATTER TYPE THAT ARE NEEDED TO ACCELERATE THIS DEVELOPMENT ARE REVIEWED. COMPACTION PAVEMENTS DURING CONSTRUCTION TO 100% OF LABORATORY COMPACTED DENSITY WOULD RETARD THE RATE OF HARDENING OF THE ASPHALT CEMENT IN THE PAVEMENT, THEREBY SUBSTANTIALLY LENGTHENING PAVEMENT SERVICE LIFE, AND IT WOULD GREATLY INCREASE THE LOAD CARRYING CAPACITY OF BINDER AND SURFACE COURSES, AND PARTICULARLY OF ASPHALT BASE COURSES, PER INCH OF THICKNESS. LOW VISCOSITY ASPHALT CEMENTS, BECAUSE OF THEIR LOW VISCOSITIES AT HIGH TEMPERATURE, PROVIDE PAVING MIXTURES WITH MUCH LESS RESISTANCE TO COMPACTION BY ROLLING, AND THIS WOULD BE HIGHLY ADVANTAGEOUS FOR: (1) ASSISTING PROPERLY OPERATED PNEUMATIC-TIRE ROLLERS WITH RAPIDLY ADJUSTABLE TIRE PRESSURE TO ATTAIN 100% OF LABORATORY COMPACTED DENSITY BY ROLLING DURING CONSTRUCTION, (2) ACHIEVING MUCH FASTER COMPACTION BY TRAFFIC TO 100% OF LABORATORY COMPACTED DENSITY, WHERE THIS IS NOT ATTAINED BY ROLLING, AND (3) ACHIEVING COMPACTION TO MUCH HIGHER DENSITY BY ROLLING DURING COLD WEATHER CONSTRUCTION. /AUTHOR/

McLeod, NW *Canadian Good Roads Association Proc* Sept. 1967

ACKNOWLEDGMENT: Canadian Good Roads Association

3A 214646

A CONSTRUCTION PROJECT INCORPORATING FULL DEPTH ASPHALTIC CONCRETE

INFORMATION PRESENTED AND DISCUSSED INCLUDES DATA ON SUBGRADE, ASPHALTIC CONCRETE DESIGN, AND CONSTRUCTION PRACTICES FOLLOWED. EXPERIMENTATION WITH ROLLING PROCEDURES IS DESCRIBED AS WELL AS TEMPERATURE RETENTION FOR LIFTS PLACED AT VARYING THICKNESSES. COST COMPARISONS WITH NORMALLY CONSTRUCTED STRUCTURES, I.E., GRANULAR OR SOIL-CEMENT BASE PLUS ASPHALTIC CONCRETE SURFACING, ARE MADE AND SOME INFORMATION AS TO THE PERFORMANCE TO DATE IS PRESENTED. /CGRA/

Kathol, B *Canadian Tech Asphalt Assoc Proc* Nov. 1968

ACKNOWLEDGMENT: Canadian Good Roads Association

3A 214661

MEASUREMENTS OF VIBRATIONS CAUSED BY CONSTRUCTION EQUIPMENT AND BLASTING
THE INVESTIGATION OF VIBRATIONS RESULTING FROM CONSTRUCTION ACTIVITY EMBODIED THREE PRINCIPAL OBJECTIVES: (1) TO FORMULATE A METHOD OF HOUSE INSPECTION WHICH WOULD ENABLE THE EVALUATION OF PROPERTY DAMAGE CLAIMS ARISING FROM CONSTRUCTION WORK; (2) TO MEASURE THE VIBRATION LEVELS PRODUCED BY DIFFERENT TYPES OF CONSTRUCTION EQUIPMENT; AND (3) TO SET-UP AND MAINTAIN A VIBRATION LEVEL MONITORING SERVICE ON EXPLOSIVE CHARGES USED IN THE EXCAVATION OF A SEWER TUNNEL, AND TO ENSURE THAT RECOMMENDED CHARGE LEVELS WERE NOT EXCEEDED. EARLIER STUDIES

ARE DISCUSSED INCLUDING INVESTIGATIONS BY THE U. S. BUREAU OF MINES, CRANDELL'S STUDIES INVOLVING GROUND VIBRATION INTENSITY AS A MEASURE OF THE DAMAGE LIKELY TO BE CAUSED, AND EDWARDS AND NORTHWOODS STUDY OF VELOCITY CRITERIA. THE EQUIPMENT DESIGNED AND USED DURING THE COURSE OF THE REPORTED INVESTIGATION IS DISCUSSED IN DETAIL AND THE RESULTS OF THE LATTER TWO PHASES OF THE PROJECT ARE FULLY DOCUMENTED. THESE INCLUDE RESULTS OF THE TESTS TO DETERMINE THE VIBRATION LEVELS FROM CONSTRUCTION EQUIPMENT, TESTS TO MONITOR THE VIBRATION EFFECTS OF BLASTING AND MEASUREMENTS OF VIBRATION CARRIED OUT DURING THE DEMOLITION OF A BRIDGE BY MEANS OF THE WRECKING BALL. IT IS CONCLUDED THAT THE REPORTED DATA CAN SERVE AS THE MEANS TO PREDICT VIBRATION LEVELS RESULTING FROM A FAIRLY WIDE RANGE OF CIRCUMSTANCES AND OUTLINES A PROCEDURE WHEREBY THIS CAN BE ACHIEVED. IN THE BLASTING MEASUREMENTS MADE IT WAS ESTABLISHED THAT THE VIBRATION LEVELS PRODUCED BY BLASTING AGREED REASONABLY WELL WITH THOSE PREDICTED. A NEW DESIGN OF SEISMOGRAPH IS ILLUSTRATED AND RECOMMENDATIONS FOR FUTURE RESEARCH WORK IN THE FIELD OF VIBRATION MEASUREMENT. /RATAOC/

Brown, LM
Ontario Dept Transp & Communications Apr. 1971

ACKNOWLEDGMENT: Roads & Transportation Assoc /Canada/

3A 214666
CONSTRUCTION PRACTICES-FLEXIBLE PAVEMENTS
THIS BIBLIOGRAPHY IS CONCERNED WITH CONSTRUCTION REQUIREMENTS, EQUIPMENT, MATERIALS FOR VARIOUS LAYERS, AND PROCESSING. IN ADDITION TO THE ITEMS CONCERNING CONSTRUCTION PRACTICES OF FLEXIBLE PAVEMENTS THERE ARE ITEMS ON SUBGRADES, BASES AND SUBBASES PERTINENT TO THIS TYPE OF CONSTRUCTION. THE BIBLIOGRAPHY IS PRESENTED IN THREE PARTS, A TECHNICAL LITERATURE SURVEY WITH LISTING OF COVERAGE, PUBLICATION COVERAGE OF ENGINEERING NEWS-RECORD AND OF ROADS & STREETS, BOTH FROM 1955 THROUGH 1964. KEY WORDS ARE INDICATED FOR EACH ARTICLE. ARTICLES ARE LISTED FOR EACH KEY WORD.

Highway Research Board Bibliography 1966

3A 214669
COFFERDAMS FOR THE TOWN CREEK PIERS OF THE SILAS N. PEARMAN BRIDGE OVER THE COOPER RIVER, CHARLESTON, SOUTH CAROLINA
THE COFFERDAM DESIGN IS DISCUSSED FOR PIER T-2 OF THE TOWN CREEK SPANS OF THE NEW COOPER RIVER BRIDGE, COVERING THE ADVERSE SOIL CONDITIONS AT THE SITE AS WELL AS THE DESIGN ASSUMPTIONS AND PROCEDURE. MUCH OF THE PAPER IS DEVOTED TO THE INSTALLATION PROCEDURE IN WHICH THE CONTRACTOR EMPLOYED VARIOUS EXPEDIENTS TO REDUCE THE COST OF COFFERDAM CONSTRUCTION. REDUCED COSTS WERE REFLECTED IN THE BID PRICE WHICH WAS BELOW THE ENGINEERS ESTIMATE. /AUTHOR/

Carle, RJ *Highway Research Record, Hwy Res Board* 1967

3A 214670
THE NATURE OF PRESTRESSED STEEL STRUCTURES
THE PRINCIPLES GOVERNING THE DESIGN, APPLICATION CONSTRUCTION AND BEHAVIOR OF PRESTRESSED STEEL BEAMS ARE DISCUSSED. ONLY ONE TYPE OF PRESTRESSING IS CONSIDERED AND THAT IS PRESTRESSING USING CABLES, STRANDS OR RODS. SEVERAL TYPES OF BEAM STRUCTURES ARE CONSIDERED INCLUDING PRESTRESSED I-SHAPED BEAMS, PRESTRESSED COMPOSITE BEAMS AND PRESTRESSED CONTINUOUS BEAMS. IN EACH CASE THE BEHAVIOR OF THE STRUCTURE IS PRESENTED ALONG WITH COMMENTS ON THE

POSSIBLE ECONOMY TO BE ACHIEVED. A COMPARISON IS GIVEN BETWEEN CONVENTIONAL AND PRESTRESSED COMPOSITE BEAMS AND THE RESULTS SHOW PROMISE FOR PRESTRESSING. THE EFFECTS OF PRESTRESSING ON SIGNIFICANTLY REDUCING BENDING MOMENTS IN CONTINUOUS BEAM CONSTRUCTION ARE DISCUSSED. SEVERAL EXAMPLES OF PRESTRESSED STRUCTURES ARE PRESENTED. /AUTHOR/

Hoadley, PG *Highway Research Record, Hwy Res Board* 1967

3A 214679
USE OF CEMENT BOUND BASECOURSE IN AUCKLAND AREA
THIS PAPER DESCRIBES LABORATORY AND FIELD TESTING, METHODS OF CONSTRUCTION, AND RESULTS ACHIEVED IN THE USE OF CEMENT BOUND BASECOURSE FOR HIGH CLASS PAVEMENTS IN THE AUCKLAND AREA. /AUTHOR/

Parsons, RR Mcnamara, GP
National Roads Board /New Zealand/ 1965

3A 214685
DEVELOPMENTS IN PRECAST CONCRETE FOR TUNNELS
THE USE OF PRECAST CONCRETE IN THE CONSTRUCTION OF TUNNELS CONTINUES TO DEVELOP, AND TWO DIRECTIONS WHICH THIS DEVELOPMENT IS TAKING ARE DESCRIBED IN THIS REPORT. THE FIRST IS THE USE OF NEW TYPES OF PRECAST CONCRETE SEGMENTS ACCOMPANIED BY REMARKABLE INCREASES IN THE RATE OF TUNNELLING. THE SECOND IS THE INCREASING USE TO WHICH THE THRUSTING PROCESS IS BEING USED IN INSTALLING PRECAST CONCRETE PIPE TUNNELS. /AUTHOR/

Concrete & Constructional Eng /UK/ July 1966

ACKNOWLEDGMENT: Highway Res Abstracts Hwy Res Board

3A 214700
SUBWAY TUNNEL CONSTRUCTION IN NEW YORK CITY
SUBWAY TUNNEL CONSTRUCTION PROVIDES A VARIETY OF CONDITIONS REQUIRING SPECIAL EQUIPMENT AND METHODS. TUNNEL SECTIONS VARY AS TO SHAPE, HEIGHT AND PROXIMITY TO EXISTING STRUCTURES. PROVEN AND NEW EQUIPMENT AND METHODS ARE USED FOR EXCAVATION AND CONCRETE OPERATIONS. A COMBINATION OF ROOF BOLT, TIMBER AND STRUCTURAL STEEL IS USED TO SUPPORT THE EXCAVATED TUNNEL. RUBBER-TIRED HAULING EQUIPMENT PROVED TO BE MANEUVERABLE AND ADAPTABLE TO A VARIETY OF TUNNEL OPERATIONS. CRAWLER-MOUNTED EQUIPMENT FOR LOADING IS SELECTED BECAUSE OF ITS SUCCESS DOING SIMILAR WORK. CONCRETE EQUIPMENT IS SELECTED AND ADAPTED TO BE MANEUVERABLE AND FLEXIBLE BECAUSE OF THE VARIETY PLACING REQUIREMENTS. ROCK FALL STOPS ADVANCE OF TUNNEL EXCAVATION. TUNNEL AND VOID ARE FILLED WITH CONCRETE TO FORM SUPPORT FOR FALLING ROCK. ROCK EXCAVATION IS CARRIED OUT DIRECTLY UNDER OPERATING RAILROAD AND PASSENGER STATION. SUPPORT OF OVERHEAD STRUCTURE IS DONE AS EXCAVATION IS ADVANCED. BLASTING IN THIS AREA IS LIMITED TO AVOID DAMAGE TO EXISTING STRUCTURE.

Knight, GB *Am Soc Civil Engr J Construction Div* Sept. 1964

3A 214701
EMPLOYMENT OF PIPEJACK METHOD FOR INSTALLING A CULVERT
A GREATLY INCREASED LENGTH OF CULVERT WAS NEEDED TO ACCOMMODATE A WIDENED FILL ON A HIGHWAY THAT WAS BARELY SUFFICIENT TO PROVIDE A TWO-LANE THROUGHFARE. THE DIFFICULTY OF DETOURING TRAFFIC RULED OUT OPEN TRENCH EXCAVATION AND SO JACKING A PRECAST PIPE WAS THE METHOD EMPLOYED. JACKING COMMENCED FROM THE DOWNSTREAM END WHERE A NATURAL RIDGE FORMED AN EXCELLENT BACK-STOP. A REINFORCED

CONCRETE LAUNCHING PAD WAS USED TO FACILITATE JACKING. JACKS WERE POSITIONED ON THE LAUNCHING PAD AND PRESSURE APPLIED TO THE LOWER ARC OF THE PIPE ONLY. THIS ALLOWED MUCKING OUT TO PROCEED WITHOUT DISTURBING THE JACKS. GREAT DIFFICULTY WAS EXPERIENCED IN SECURING RECUMBENT HYDRAULIC JACKS. TANGYE 15 TON HYDRAULIC JACKS WERE USED BUT LARGER 25 TON JACKS WOULD HAVE SPEEDED OPERATIONS. HOWEVER, CONSTRUCTION BY THE PIPE JACK METHOD FACILITATED CONSTRUCTION AND PERMITTED COMPLETION IN SHORT TIME WITHOUT TRAFFIC INTERFERENCE.

Neely, WG Kaikoura, MO *Road Res Newsletter /N Zealand/* Aug. 1967

3A 214702

INFLUENCE OF VISCOSITY OF ASPHALT-CEMENTS ON COMPACTION OF PAVING MIXTURES IN THE FIELD AND DISCUSSION

COMPACTION OF ANY GIVEN DENSE GRADED ASPHALT-CONCRETE PAVING MIXTURE BY ROLLING DURING CONSTRUCTION IS INFLUENCED BY THE VISCOSITY TEMPERATURE CHARACTERISTICS OF THE ASPHALT-CEMENT, THE TEMPERATURE OF THE MIX DURING COMPACTION, THE GRADUAL INCREASE OF STABILITY AND DENSITY OF THE MIX AS ROLLING PROCEEDS, THE RATE OF COOLING OF THE MIX BEHIND THE SPREADER, TYPE OF ROLLING EQUIPMENT, AND THE USE OF LOW RATHER THAN HIGH VISCOSITY ASPHALT-CEMENTS. THE INFLUENCE OF THE VISCOSITY OF THE ASPHALT-CEMENT ON COLD WEATHER PAVEMENT CONSTRUCTION, AND ON THE RATE AT WHICH A FINISHED ASPHALT PAVEMENT IS DENSIFIED BY TRAFFIC IS REVIEWED. OF CURRENT COMPACTION EQUIPMENT, IT IS INDICATED THAT PNEUMATIC-TIRE ROLLERS EQUIPPED FOR RAPID ADJUSTMENT OF TIRE INFLATION PRESSURES OVER THE RANGE OF FROM ABOUT 25 TO 150 PSI OR MORE, APPEAR MOST LIKELY TO BE CAPABLE OF ACHIEVING 100 PERCENT OF LABORATORY-COMPACTED DENSITY BY ROLLING DURING CONSTRUCTION.

McLeod, NW *Highway Research Record, Hwy Res Board* 1967

3A 214704

HANDBOOK OF HEAVY CONSTRUCTION

ADVICE IS GIVEN ON ALL PHASES OF CONSTRUCTION, FROM EQUIPMENT COSTS TO ERECTION, PLANNING TO FIELD OPERATION. ANSWERS ARE GIVEN TO A WIDE RANGE OF CONSTRUCTION PROBLEMS. EXPERTS OUTLINE THE BEST CURRENT PRACTICES IN THEIR FIELD, SHOW WHERE DIFFICULTIES MAY ARISE AND ELIMINATE NEED FOR COSTLY TRIAL AND ERROR. CASE HISTORIES ARE INCLUDED.

Stubbs, FW

Handbook of Heavy Construction 1040 pp

3A 214716

FOUNDATIONS AND OTHER CONSTRUCTION BELOW GROUND

SOME NEW METHODS OF CONSTRUCTING FOUNDATIONS AND OTHER WORK BELOW GROUND WERE GIVEN. APPLICATIONS OF THESE METHODS TOGETHER WITH SOME OTHER DEVELOPMENTS IN FOUNDATION ENGINEERING WERE DESCRIBED, SUCH AS THAT OF CONSTRUCTING RETAINING WALLS AND SIMILAR WORK BY PROCESSES UTILIZING BENTONITE SLURRY. A SHAFT CONSTRUCTED ON THE BENTONITE PROCESS WAS ILLUSTRATED, THE TECHNICAL DESCRIPTION OF THE SPECIAL BENTONITE, SODIUM MONTMORILLONITE, WAS GIVEN.

Concrete & Constructional Eng /UK/

3A 214717

PILED FOUNDATIONS AND SHEETPIILING

DETAILS ARE GIVEN ON THE CONSTRUCTION OF LARGE CYLINDER FOUNDATIONS OR PILES FOR BUILDINGS AND THE TASMAN BRIDGE, TASMANIA. THE SHAFTS OF THE PILES

FOR ONE BUILDING WERE LINED WITH GALVANIZED CORRUGATED METAL SLEEVES WHICH WERE PRESSURE-GROUTED INTO POSITION. THE SHAFTS WERE BELLED-OUT AT THE BOTTOM AND WERE FILLED WITH CONCRETE TO THE LEVEL AT WHICH THE CONCRETE AND STEEL CONSTRUCTION OF THE STRUCTURE COMMENCED. THE TASMAN BRIDGE HAS BORED PILES INSTALLED BY FORCING A HOLLOW STEEL CYLINDER INTO THE GROUND, EXCAVATING INSIDE, AND FILLING IT WITH REINFORCED CONCRETE. LOAD-BEARING CAST-INSITU PILES OF VARIOUS SHAPES ARE BEING CONSTRUCTED BY THE BENTONITE PROCESS. SILENT, SONIC, AND DESCRIBED. A DEVICE FOR CUTTING OFF CONCRETE PILES IS ILLUSTRATED.

Concrete & Constructional Eng /UK/ June 1965

3A 214722

HOW BRITISH ROAD TRENDS MAY AFFECT FUTURE PLANT THE CHANGING CHARACTERISTICS OF HIGHWAY CONSTRUCTION DUE TO INCREASING CONSTRUCTION IN URBAN AREAS IS DISCUSSED. STANDARDS ARE NEEDED FOR THE USE OF CONSTRUCTION EQUIPMENT IN HIGHWAY CONSTRUCTION. MACHINES SUCH AS THE DATUM-LAYER FOR LAYING CURB-BASE, SCRAPERS, FACE SHOVELS, WHEEL EXCAVATORS AND COMPACTION EQUIPMENT ARE DISCUSSED. THE USE OF CENTRAL BATCHING AND MIXING PLANTS AFFORDS ECONOMY IN CONSTRUCTION OF CONCRETE HIGHWAYS. SUGGESTIONS ARE MADE FOR IMPROVING CONVENTIONAL PAVING TRAINS.

Elbourne, DS *World Construction* Jan. 1967

3A 214737

RESPONSIBILITY FOR QUALITY IN HIGHWAY CONSTRUCTION

THE PROBLEMS OF RESPONSIBLE CONTROL FOR QUALITY IN HIGHWAY CONSTRUCTION ARE DISCUSSED. PERFORMANCE DEPENDS ON THE DESIGN OF THE PAVEMENT STRUCTURE AT LEAST AS MUCH AS ON THE QUALITY OF MATERIALS AND CONSTRUCTION USED. THE ULTIMATE CONCEPT IN RESPONSIBILITY WOULD BE HAVING THE CONTRACTOR OR GOVERNMENT AGENCY REQUIRED TO DESIGN, BUILD AND GUARANTEE THE PERFORMANCE OF THE HIGHWAY. HOWEVER, INITIATIVE IN USING NEW CONSTRUCTION METHODS MUST NOT BE HAMPERED. CONSTRUCTION CONTROL TOLERANCES AND THE RESPONSIBILITY FOR QUALITY CONTROL TESTING ARE DISCUSSED.

Smith, P *Highway Research News, Hwy Res Board* 1967

3A 214738

BITUMEN ROAD CONSTRUCTION IN DEPTH

FUNCTIONS AND DESIGNS OF ROAD STRUCTURES WERE DISCUSSED, AND WORLDWIDE DESIGN AND CONSTRUCTION TECHNIQUES FOR FLEXIBLE PAVEMENTS WERE REVIEWED. REASONS FOR INCREASES USE OF BITUMEN-BOUND BASES AND BASE COURSES. EQUIVALENT THICKNESSES OF DIFFERENT BASE MATERIALS WERE INDICATED. SPECIFICATIONS FOR BITUMINOUS MIXES RELYING UPON COMPOSITION ALONE WERE RATED INADEQUATE. MECHANICAL TESTS GIVING AN INDICATION OF PERFORMANCE WERE RECOMMENDED.

Bell, RP Peattie, KR Snashall, HM *Inst Hwy Engineers Journal London /UK/* Jan. 1966

ACKNOWLEDGMENT: Highway Res Abstracts Hwy Res Board

3A 214752

FEASIBILITY OF COLD WEATHER EARTHWORK IN INDIANA THE EFFECTS OF COLD AND INCLEMENT WEATHER ON MEN, MACHINES, AND MATERIALS INVOLVED IN HIGHWAY EARTHWORK WERE REVIEWED. THE COLD WEATHER EARTHWORK EXPERIENCE OF THE NORTHERN STATES OF THE UNITED STATES, THE PROVINCES OF CANADA, AND THE

SCANDINAVIAN COUNTRIES HAS BEEN REVIEWED WITH THE AIM OF DETERMINING, (1) HOW WEATHER AND SOIL CONDITIONS TEND TO RESTRICT THE LENGTH OF THE CONSTRUCTION SEASON, AND (2) WHAT COLD WEATHER CONSTRUCTION PRACTICES MIGHT BE APPLICABLE IN INDIANA. THE SEASONAL VARIATIONS OF WEATHER AND CERTAIN SOIL CONDITIONS IN INDIANA HAVE BEEN STUDIED. THE INCREASED COSTS OF VARIOUS EARTHWORK OPERATIONS IN INDIANA DURING COLD WEATHER HAVE BEEN ESTIMATED. THE PROBABLE BENEFITS OF (1) REDUCED INTEREST AND INFLATION COSTS, (2) REDUCED ACCIDENT AND INCONVENIENCE COSTS, AND (3) BETTER UTILIZATION OF THE RESOURCES OF LABOR, CONTRACTORS, AND THE STATE HIGHWAY COMMISSION HAVE BEEN WEIGHED AGAINST HEIGHTENED TECHNOLOGICAL DEMANDS. A HYPOTHETICAL EXAMPLE HAS BEEN DEVELOPED WHICH SHOWS THAT COLD WEATHER EARTHWORK IS FEASIBLE ON AN INTERSTATE HIGHWAY CONSTRUCTION PROJECT IN NORTHERN INDIANA AND THAT YEAR-ROUND CONSTRUCTION SCHEDULING CAN PRODUCE AN ECONOMIC BENEFIT. /AUTHOR/

Osborne, AM
Purdue & Ind State Hwy Comm Jhrp June 1967

3A 214773

COMPUTER TELLS CONTRACTORS WHEN TO BUY

A COMPUTER PROGRAM HAS BEEN DEVELOPED USING A MATHEMATICAL MODEL WHICH INCLUDES THE MANY VARIABLES AND CONSIDERATIONS INVOLVED IN EQUIPMENT BUYING. THE COMPUTER GIVES THE CONTRACTOR A SERIES OF GRAPHS THAT CLEARLY SHOW THE RELATIONSHIPS BETWEEN THE VARIABLES AND THE EXACT EFFECT OF VARIOUS ALTERNATIVES. THE PROFITS GENERATED BY THE OPERATION OF A MACHINE AND ITS REPLACEMENTS ARE QUANTIFIED BY WRITING EQUATIONS TO EXPRESS EACH REVENUE OR COST CURVE. INFLATION IS TAKEN INTO ACCOUNT BY DISCOUNTING DOLLARS BACK TO THE PRESENT TIME. COSTS ARE SUBTRACTED FROM REVENUES TO OBTAIN THE PRESENT WORTH OF PROFITS AFTER TAXES. VARIABLES ARE EXAMINED AND EQUATIONS WRITTEN FOR FACTORS SUCH AS REVENUE FROM A MACHINE, MAINTENANCE AND OPERATING COST, CAPITAL COSTS, DEPRECIATION, INFLATION, INTEREST CHARGES OR EQUIPMENT LOANS AND OVERHAUL COSTS. AFTER STUDYING MATHEMATICAL MODELS OF EQUIPMENT ECONOMICS, TWO CONCLUSIONS MAY BE DRAWN: /1/ THE ECONOMIC LIFE OF A PIECE OF EQUIPMENT IS MUCH SHORTER THAN THE LIFE OVER WHICH A PROFIT CAN BE MADE ON ITS OPERATION AND /2/ THE FLEXIBILITY OF THE MODEL LENDS IT TO READY ANALYSIS OF ALTERNATIVE.

Douglas, J *Western Construction* Sept. 1967

3A 214776

SIX-LANE TUNNEL SITS ON SACKS OF GROUT

CONSTRUCTION OF THE TINGSTAD TUNNEL TO CARRY SIX LANES OF HIGHWAY TRAFFIC UNDER THE GOTA RIVER IN GOTHENBURG, SWEDEN, IS DESCRIBED. THE TUNNEL WAS BUILT IN FIVE SECTIONS BY THE SUNKEN-TUBE METHOD. FULL WIDTH OF THE STRUCTURE IS 98 FEET. GROUT CUSHION, HUGE NYLON SACKS PUMPED FULL OF GROUT TO A FORM-FIT BETWEEN THE TUNNEL BOTTOM AND THE TOPS OF THE PILES WAS PATENTED TO TRANSFER THE TUNNEL LOADS TO THE PILES. OVER ONE THOUSAND WOOD PILES HAD TO BE DRIVEN MORE THAN SEVENTY FEET DEEP TO SUPPORT THE TUNNEL IN THE CLAY. A CLUSTER OF SIX PILES AT EACH CORNER OF EACH TUNNEL SECTION WAS CAPPED WITH TREMIE CONCRETE. THE TUNNEL SECTIONS WERE PUMPED WITH WATER AND SUNK TO THE BOTTOM. EACH SECTION RESTED ON THE CORNER PILE CLUSTER, ABOVE THE PREVIOUSLY PLACED, EMPTY GROUT BAGS. CONSTRUCTORS THEN FILLED THE BAGS WITH GROUT. AFTER GROUT WAS PLACED AND SET BETWEEN THE RUBBER STRIPS, THE PERMANENT JOINT WAS MADE BY WELDING THE STEEL SECTIONS TO-

GETHER AND CONCRETING THE WALLS, ROOF, AND FLOOR.

Engineering News-record Nov. 1967

3A 214784

HOW TO USE TRANSITS & LEVELS

THE OPTICAL LEVEL (SOMETIMES CALLED THE DUMPY LEVEL) WHICH HAS ITS TELESCOPE FIXED IN A HORIZONTAL POSITION, AND THE TRANSIT-LEVEL, WHICH TURNS NOT ONLY SIDEWAYS, BUT ALSO UP AND DOWN IS DESCRIBED. THE TRANSIT LEVEL ENABLES DETERMINATION OF PLUMBNESS OF A WALL AND ALSO ALLOWS MEASUREMENT OF VERTICAL ANGLES AND RUNNING STRAIGHT LINES. THE OPTICAL LEVEL CONSISTS OF A TELESCOPE, LEVELING SCREWS, THE VIAL OR BUBBLE AND A THREE HUNDRED SIXTY-DEGREE SCALE. AN EXAMPLE IS GIVEN OF HOW TO ESTABLISH THE FOUNDATION CORNERS OF A HOUSE. EITHER THE OPTICAL OR THE TRANSIT-LEVEL MAY PROVE TO BE THE MOST USEFUL OF THE CONTRACTOR'S TOOLS, AND IS WORTH THE TIME REQUIRED TO MASTER THE TECHNIQUES.

Concrete Construction Sept. 1967

3A 214788

ESTIMATING CONCRETE WORK-II: ESTIMATING FOUNDATION WALLS

THE PROCEDURES AND TECHNIQUES FOR ESTIMATING CONSTRUCTION OF FOUNDATION WALLS BEARING ON FOOTINGS AND DIRECTLY ON COMPACTED EARTH ARE PRESENTED. UNDERPINNING AND EXISTING FOUNDATION WALL AND ESTIMATING THE FORM AREA IN CONCRETE FOR PIERS BELOW GRADE AND FOR BUILDING SLABS ON FILL ARE ALSO DISCUSSED. IT IS POINTED OUT THAT BUILDING SLABS AND DIFFERENT ELEVATIONS SUCH AS BASEMENT FLOORS AND SLABS OF GROUND FLOOR LEVEL SHOULD BE KEPT SEPARATE BECAUSE OF THE DIFFERENT LABOR COST PER CUBIC YARD FOR PLACING THESE SLABS. IF ALL SLABS ARE OF THE SAME THICKNESS, ONLY THE QUANTITIES FOR THE AREA SHOULD BE EXTENDED AND THE CONCRETE QUANTITIES MAY BE OBTAINED BY MULTIPLYING THE TOTAL AREA BY THE SLAB THICKNESS. THIS IS A READILY USED TIME-SAVING STEP.

Lejeune, EG *Concrete Construction* July 1967

3A 214810

PROBLEMS FACED BY STATE HIGHWAY DEPARTMENTS IN DEVELOPING STATISTICAL SPECIFICATIONS

PROBLEMS WHICH MUST BE FACED BY STATE HIGHWAY AGENCIES IN APPLYING STATISTICAL PRINCIPLES TO HIGHWAY SPECIFICATIONS ARE DISCUSSED. THREE OF THE MAJOR ENGINEERING PROBLEMS IN WHICH STATISTICAL TOOLS CAN BE HELPFUL ARE: (1) ESTABLISHING NUMERICAL SPECIFICATION LIMITS, (2) PROVIDING GUIDELINES FOR PROPER SAMPLING, AND (3) ANALYZING TEST RESULTS. THE BASIC OBJECTIVE OF HIGHWAY SPECIFICATIONS IS TO ASSURE SATISFACTORY PERFORMANCE AT MINIMUM COST. UNBIASED DATA IS NEEDED WHICH DEFINES THE AVERAGE LEVEL, THE OVERALL VARIABILITY, AND THE SOURCES OF VARIABILITY OF THE SELECTIVE CHARACTERISTICS OF MATERIALS AND CONSTRUCTION ITEMS OF ACCEPTABLE QUALITY. TO PREVENT FLAT BIAS, A NON-SUBJECTIVE MEANS OF SAMPLE SELECTION SHOULD BE USED, SPECIFICALLY TABLES OF RANDOM NUMBERS. ASSUMING REALISTIC SPECIFICATION TOLERANCES, STATISTICALLY BASED SAMPLING, MEANINGFUL TEST METHODS, AND ACCURATE TESTING, IT IS THE TEST RESULTS WHICH ARE THE PRIMARY INDICATION OF THE QUALITY OF MATERIAL PRODUCED OR OF THE COMPLETE ITEM OF CONSTRUCTION. SUFFICIENT MAJOR RESEARCH WORK HAS BEEN COMPLETED TO INDICATE BOTH THE PRACTICALITY AND THE ECONOMIC NECESSITY OF THE USE OF STATISTICAL TOOLS IN MANY MAJOR ITEMS IN HIGHWAY SPECIFICATIONS. IT WILL STILL BE NECESSARY TO FOLLOW GOOD CONSTRUCTION PRACTICE, TO HAVE INSPECTORS AT ALL CRITICAL POINTS, AND TO EXERCISE GOOD INSPECTION

PRACTICES AND TO CONDUCT EVALUATION TESTS. STATISTICS WILL NOT TELL AN INDIVIDUAL WHAT CORRECTIVE ACTION TO TAKE, BUT WILL HELP TO SHOW WHERE CORRECTIVE ACTION IS NEEDED.

Van, TIL CJ

Materials Research & Development, Inc 8 pp, Feb. 1968

3A 214814

ECONOMICAL CONSTRUCTION PRACTICES INSEPARABLE FROM STRUCTURE DESIGN

MODERN TECHNOLOGY HAS MADE AVAILABLE NEW AND IMPROVED MATERIALS, EQUIPMENT, AND TECHNIQUES THAT CONTRIBUTE SUBSTANTIALLY TO MORE ECONOMICAL CONSTRUCTION OF BRIDGES. OUTSTANDING ADVANCES HAVE BEEN MADE IN SEVERAL CATEGORIES. THE FULLEST ADVANTAGE OF ECONOMICS INHERENT TO THESE TECHNOLOGICAL ADVANCES CANNOT BE REALIZED UNLESS THE DESIGNER IS FULLY AWARE OF THEM AND CREATES THE STRUCTURE DESIGN WHICH PERMITS THEIR INCORPORATION. EMPHASIS IN THIS REPORT IS PLACED UPON THE FIELDS AND CATEGORIES IN WHICH ADVANCES HAVE BEEN MADE. A DISCUSSION IS CONDUCTED OF THE ECONOMIES THAT CAN BE ACHIEVED BY A DESIGNER WITH A COMPLETE AWARENESS OF SHOP PRACTICES IN FABRICATING PLANTS, FORM BUILDING PROCESSES AND DEVICES, FALSEWORK TYPES AVAILABLE, WELDING EQUIPMENT, AND NEW MATERIALS. ANY OF THESE TECHNOLOGICAL ADVANCES MAY BE NULLIFIED BY A DESIGNER WHO CREATES PLANS AND WRITES SPECIFICATIONS THAT INHIBIT THEIR USE. /AUTHOR/

Scurr, KR *Highway Research Board Bulletin* 1962

3A 214821

FUNDAMENTAL INVESTIGATION ON THE COMPACTION OF CONCRETE ROAD SLABS BY SURFACE VIBRATION

A SYSTEMATIC ROAD INVESTIGATION WAS CONDUCTED ON THE COMPACTION CHARACTERISTICS OF VIBRATING BEAMS, SUCH AS AMPLITUDE, FREQUENCY, ACCELERATION AND RUNNING SPEED OF CONCRETE FINISHERS TO DETERMINE THE FACTORS FOR A SATISFACTORY COMPACTION OF CONCRETE ROAD SLABS BY SURFACE VIBRATION. COMPACTION CHARACTERISTICS OF CONCRETE ROAD FINISHERS ARE DISCUSSED FROM A STANDPOINT OF COMPACTION EFFECT. THE PROPAGATING CHARACTERISTICS OF ACCELERATION, FROM A VIBRATING BEAM TO FRESH CONCRETE PARTICLES WERE STUDIED TOGETHER WITH THE RELATION BETWEEN THE PROPAGATED ACCELERATION AND PROPERTIES OF HARDENING CONCRETE. SOME USEFUL INDICES ARE GIVEN FOR EVALUATING COMPACTION EFFECTS AND THEIR REASONABLE CRITERIA. IT IS DETERMINED THAT AS LONG AS THE MAGNITUDE OF ACCELERATION OF THE VIBRATING BEAM REMAINS REASONABLE FOR A PERIOD OF PARTICULAR CONSISTENCY OF CONCRETE, THE RUNNING SPEED OF THE FINISHER CAN BE RAISED UP TO 100 CM/MIN, WITHOUT ANY DISADVANTAGES TO COMPACTION OF CONCRETE ROAD SLABS. REASONABLE MAGNITUDES ARE PRESENTED OF ACCELERATION FOR CONCRETE ROAD FINISHERS' VIBRATING BEAM. THESE MAGNITUDES WILL DETERMINE THE PROPAGATING EFFICIENCY OF ACCELERATION FROM THE BEAM TO FRESH CONCRETE PARTICLES, TOGETHER WITH RELATIONSHIPS BETWEEN PROPAGATED ACCELERATION OF CONCRETE PARTICLES AND PROPERTIES OF HARDENED CONCRETE DEPENDING ON CONSISTENCY OF FRESH CONCRETE. PHYSICAL PROPERTIES ARE EVALUATED OF HARDENED CONCRETE ROAD SLABS, COMPACTIONED BY SURFACE VIBRATIONS. RATIOS ARE GIVEN FOR PROPERTIES OF CONCRETE LAYER RATIOS. THE RATIOS OF THE LOWER TO THE UPPER LAYER GIVEN ARE NOT LESS THAN 0.98 FOR WET DENSITIES AND NOT LESS THAN 0.92 FOR SPLIT (INDIRECT) TENSILE STRENGTHS, WITH CORES OF 15 CM IN DIAMETER, BEING SLICED INTO TWO LAYERS, THE UPPER AND LOWER.

Nagamori, M

Public Works Res Inst, Cm /Japan/ 1966

3A 214830

BOOKS ON ESTIMATING AND COSTS

THIS ARTICLE CONTAINS A COMPILATION OF REFERENCE BOOKS AND COMPREHENSIVE PAMPHLETS ON ESTIMATING AND COST. SUBJECTS COVERED RANGE FROM APPRAISALS TO TUNNELS, GOOD INFORMATION IS AVAILABLE ON ENGINEERED CONSTRUCTION BUILDINGS AND INDUSTRIAL PLANTS. /ASCE/

Breed, JW *Civil Engineering Asce* June 1967

3A 214832

P.C. CANTILEVER ERECTION METHOD USING PRECAST UNITS

THE P. C. CANTILEVER ERECTION METHOD USING PRECAST BOX-TYPE GIRDERS AND EPOXY RESIN INTO JOINTS IS CONSIDERED FOR THE ENGINEERING OF PRESTRESSED CONCRETE. THIS METHOD WAS USED IN JAPAN FOR THE CONTINUOUS EXPRESSWAY VIADUCT WORK WHERE THE TOKYO METROPOLITAN EXPRESSWAY CROSSES OVER RADIAL ROUTE 3. RESULTS ARE DESCRIBED OF TESTS CARRIED OUT ON SPECIMEN TO OBTAIN NEEDED DESIGN DATA, AND THE RESULTS OF EXPERIMENTS EXECUTED ON ACTUAL BRIDGE, AS WELL AS SEVERAL TECHNICAL PROBLEMS OF THE METHOD. THIS METHOD IS APPLIED SINCE: (1) THE ERECTION PERIOD CAN BE SHORTENED BECAUSE THE PRECAST BLOCKS ARE MANUFACTURED WHEN SUBSTRUCTURE WORKS ARE GOING ON, (2) THE QUALITY VARIANCE OF EACH UNIT IS LESS BECAUSE SUFFICIENT CONTROL CAN BE PERFORMED IN THE PRODUCING YARD, (3) ALMOST NO DEFORMATION, DUE TO DAY SHRINKAGE AND CREEP OF CONCRETE, IS OBSERVED BECAUSE THE CURING PERIOD BETWEEN PRECASTING AND PRESTRESSING IS LONG ENOUGH, AND (4) NO TIMBERING IS NEEDED BECAUSE OF SIMPLE ERECTING APPARATUS. /AUTHOR/

Miyauchi, N *Japan Road Association Annual Reports* 1967

3A 214833

TRENCH COMPACTION-PRACTICES AND PROBLEMS

RESEARCH IS REPORTED ON TRENCH COMPACTION AND TRENCH BACKFILL. A SURVEY OF SPECIFICATIONS CURRENTLY EMPLOYED BY 45 AGENCIES YIELD THE FOLLOWING STATISTICS: (1) 89% HAD A BACKFILL SPECIFICATION, (2) 60% HAD A SPECIFICATION, THE REQUIREMENTS OF WHICH VARIED WITH LOCATION AND DEPTH, (3) 70% HAD A MATERIAL QUALITY REQUIREMENT IN THE BACKFILL SPECIFICATION, (4) 95% HAD A COMPACTION REQUIREMENT, (5) 93% REFERRED TO JETTING FOR DENSIFYING TRENCH BACKFILL, (6) 91% HAD A MINIMUM COMPACTION REQUIREMENT WITH JETTING, AND (7) 55% GAVE GENERAL INSTRUCTIONS FOR JETTING AND 12% GAVE PRECISE REQUIREMENTS FOR JETTING. COST STUDIES SHOW THAT COMPACTION BY JETTING WAS ABOUT THE SAME WHETHER THE NATIVE MATERIAL WAS REUSED OR REPLACED BY A FREE-DRAINING GRANULAR MATERIAL. A TRENCH BACKFILL SHOULD BE DESIGNED FOR THE PARTICULAR SITUATION UNDER THREE DIFFERENT LAYERS: BEDDING INTERMEDIATE, AND TOP LAYER. THE TOP LAYER IS THE MOST IMPORTANT TO BE CONSIDERED IN TRENCH BACKFILL. JETTING IS EFFECTIVE ONLY IN FREE-DRAINING, GRANULAR MATERIAL OR WHERE COMPACTION IS NOT CRITICAL. SAND IS A POOR BACKFILL MATERIAL IN CONGESTED TRENCH AREAS SINCE FUTURE TRENCHING WILL REMOVE THE SUPPORT AND CAUSE CAVING. LOOSE BACKFILL IS USUALLY QUITE ERODIBLE. THE DEVELOPMENT OF BETTER TRENCHING AND BACKFILL EQUIPMENT IS RECOMMENDED AS WELL AS CUTTING THE COSTS FOR LIME TREATMENT OF NATIVE BACKFILL.

Lundgren, R

Itte, California University, Berkeley pp 37-38, Feb. 1967

3A 214843

BACKFILL GUIDE

FIELD INVESTIGATIONS HAVE SHOWN THAT IMPROPERLY PLACED AND COMPACTIONED BACKFILL IS COMMONLY ASSO-

CIATED WITH PAVEMENT SETTLEMENT AND THE MOVEMENT OF RETAINING STRUCTURES. THIS GUIDE IS PRESENTED TO DEMONSTRATE THE IMPORTANCE OF THE BACKFILL, TO POINT OUT THE REASONS FOR SPECIFIED BACKFILLING PROCEDURES, AND TO SHOW SOME CONSTRUCTION PRACTICES THAT SHOULD BE AVOIDED. THE NECESSITY OF COMPLYING WITH BACKFILL SPECIFICATIONS IS EMPHASIZED. BACKFILL MATERIALS AND CONSTRUCTION PRACTICES ARE DISCUSSED.

Peck, RB Ireland, HO *Am Soc Civil Engr J Structural Div* July 1957

3A 214844

A PRACTICAL APPLICATION OF THE IMPERFECT DITCH METHOD OF CONSTRUCTION

A BRIEF DISCUSSION IS PRESENTED OF THE PRINCIPLES ON WHICH MARSTON'S IMPERFECT DITCH METHOD IS BASED AND A DESCRIPTION OF THE CONSTRUCTION PLAN CARRIED OUT IN A SUCCESSFUL ATTEMPT TO MINIMIZE THE LOAD PRODUCED BY A HIGH ADDITIONAL FILL PLACED ABOVE A SEWER IN A REGRADING OF A LARGE RAILROAD FREIGHT YARD AT ATLANTA, GEORGIA. THE CONCRETE PIPE SEWER IS NOW CARRYING THE ADDITIONAL HEIGHT OF FILL WITH NO SIGNS OF DISTRESS OR OTHER EVIDENCE OF LOAD DAMAGE. /AUTHOR/

Spangler, MG *Highway Research Board Proceedings* 1958

3A 214848

NEW CONCEPTS IN BASE COURSE CONSTRUCTION WITH ASPHALTS

THE DEVELOPMENT OF ASPHALT BASES IN TODAY'S MODERN HIGHWAY SYSTEM HAS FOLLOWED A PATTERN SIMILAR TO MOST OTHER ENGINEERING ADVANCES. AS HIGHWAY PERFORMANCE DEMANDS INCREASED, THE COMBINED RESOURCES OF THE VARIOUS HIGHWAY DEPARTMENTS AND INDUSTRY DEVELOPED IMPROVED DESIGN METHODS, CONSTRUCTION PROCEDURES, AND PRODUCTS. THE DEVELOPMENT OF ASPHALT BASES IS REVIEWED FROM THEIR ORIGIN TO THEIR USE IN HEAVY-DUTY HIGHWAY SYSTEMS. THE DEVELOPMENT IS PRESENTED IN LIGHT OF CURRENT EMPIRICAL AND THEORETICAL DESIGN METHODS AS WELL AS NEW CONSTRUCTION PROCEDURES AND ASPHALT PRODUCTS. INCLUDED ARE A CLASSIFICATION SYSTEM FOR ASPHALT BASES, A REVIEW OF FACTORS IMPORTANT TO THE DESIGN OF ASPHALT BASES, THE CONCEPT OF HIGHER ASPHALT CONTENT BASES TO MINIMIZE FLEXURAL FATIGUE FAILURES, THE USE OF 'LAYER EQUIVALENCIES' AS A CONVENIENT BASIS FOR ECONOMICAL DESIGN, AND FACTORS IMPORTANT TO THE QUALITY OF ASPHALT BASES IN ASPHALT MACADAM, ASPHALT CONCRETE, ASPHALT TREATED, AND ASPHALT SOIL BASES.

Neunaber, AH Kari, WJ *Canadian Tech Asphalt Assoc Proc* 1961

ACKNOWLEDGMENT: Highway Research Board Bibliography

3A 214850

CONSTRUCTION PRACTICES-RIGID PAVEMENT

REFERENCE ARE LISTED ON RIGID PAVEMENT CONSTRUCTION PRACTICES INCLUDE MIXING, PLACING, FINISH, CURING, MATERIALS CONTROL AND BATCHING OPERATIONS, SLIPFORM PAVING, CRITICAL PATH METHOD AS APPLIED TO PAVEMENT CONSTRUCTION, FACTORS INFLUENCING CONCRETE PAVEMENT COST, ADJUSTMENT OF PAVING EQUIPMENT, DUAL DRUM PAVERS, RIDING QUALITY OF CONCRETE HIGHWAYS, PLACING DISTRIBUTED STEEL AND DOWELS IN PAVEMENT, COMPACTION OF CONCRETE SLABS, DEVELOPMENTS IN PORTLAND CEMENT PAVEMENT DESIGN AND CONSTRUCTION, A CONCRETE PAVEMENT INSPECTOR'S MANUAL, AND COORDINATION OF PAVING OPERATIONS BY A TRIAL AREA SPECIFICATION.

Highway Research Information Service

3A 214855

CONSIDERATIONS AFFECTING THE DESIGN AND CONSTRUCTION OF STABILIZED-SOIL ROAD BASES THEORIES OF THICKNESS DESIGN ARE PRESENTED, AS WELL AS EXPERIMENTAL PROJECTS. LABORATORY TESTS SUCH AS COMPRESSIVE STRENGTH, CYLINDER PENETRATION TESTS AND DURABILITY TESTS AS DEVELOPED AND USED IN BRITAIN ARE DESCRIBED. METHODS OF CONSTRUCTION AND PROJECT COST DATA ARE ALSO INCLUDED.

Maclean, DJ *Inst Hwy Engineers Journal, London /UK/, Roads & Road Construction, London /UK/* Jan. 1956

ACKNOWLEDGMENT: Highway Research Board Bibliography

3A 214864

SOME WARTIME SOIL-CEMENT CONSTRUCTION EXPERIENCES

DETAILS ARE GIVEN OF CONSTRUCTION PROCEDURES, EQUIPMENT AND ACCOMPLISHMENTS ON SOME OF THE MORE IMPORTANT SOIL-CEMENT ROAD, STREET AND AIRPORT PROJECTS CONSTRUCTED BY THE ARMY AND NAVY IN THE UNITED STATES AND CANADA. ALSO, SOME OF THE UNUSUAL WEATHER AND SUBGRADE CONDITIONS ENCOUNTERED ON SOME JOBS ARE DESCRIBED.

Catton, MD *Highway Research Board Proceedings* 1944

3A 214866

PORTLAND CEMENT-TREATED BASE AND BITUMINOUS SURFACE CONSTRUCTION IN CALIFORNIA

EXPERIENCE WITH CEMENT STABILIZATION IN CALIFORNIA IS DESCRIBED. CONSTRUCTION METHODS FOR NUMEROUS PROJECTS ARE PRESENTED.

Stanton, TE *Road Abstracts /UK/* 1947

ACKNOWLEDGMENT: Highway Research Board Bibliography

3A 214868

HIGHWAYS ARE TAILOR-MADE IN KANSAS

THE DESIGN OF BASE COURSES IS BASED ON TRIAXIAL TESTS MADE WITH CYLINDRICAL SOIL SAMPLES 2-1/2 IN. BY 8 IN. OBTAINED FROM READINGS OF APPLIED PRESSURE AND MEASURED DEFORMATION WITH THE THICKNESS COMPUTED. DATA ARE PRESENTED ON BASE COURSE, SURFACE TYPES, AND CONSTRUCTION PROCEDURES CONSIDERING GRANULAR BASE COURSES, STABILIZED OR MODIFIED SUBGRADES AND SOIL-CEMENT.

Arndt, WJ *Roads and Streets, Engineering Index* July 1948

ACKNOWLEDGMENT: Highway Research Board Bibliography

3A 214872

SUPERVISION OF CONTROL TESTS AT FERRY FRYSTON ESTATE, CASTLEFORD, U.D.C.

THIS REPORT GIVES AN ACCOUNT OF THE WORK UNDERTAKEN BY THE ASSOCIATION TO ASSIST WITH THE CONSTRUCTION OF SOIL-CEMENT BASES FOR HOUSING ESTATE ROADS AT FERRY FRYSTON, CASTLEFORD. DETAILS ARE GIVEN OF THE METHOD OF CONSTRUCTION EMPLOYED, TOGETHER WITH THE RESULTS OF FIELD TESTS ON A PRELIMINARY AREA OF APPROXIMATELY 1,350 SQ. YARDS. EXTRACTS FROM THE SPECIFICATION ARE INCLUDED.

Lilley, AA *Cement & Concrete Association Res Repts* Oct. 1954

ACKNOWLEDGMENT: Highway Research Board Bibliography

3A 214874

A SPECIFICATION FOR THE CONSTRUCTION OF SOIL-CEMENT BASES BY MIX-IN-PLACE AND STATIONARY PLANT METHODS

THIS REPORT GIVES A SPECIFICATION FOR THE CONSTRUCTION OF SOIL-CEMENT BASES ON ROADS AND AIRFIELD RUNWAYS. PART OF IT IS BASED ON A SPECIFICATION PRE-

PARED BY THE ROAD RESEARCH LABORATORY IN 1953. CLAUSES HAVE, HOWEVER, BEEN ADDED AND OTHERS REVISED IN THE LIGHT OF MORE RECENT EXPERIENCE. IN THE SPECIFICATION THE CONTRACTOR IS ALLOWED TO CHOOSE THE METHOD OF CONSTRUCTION BUT THE ENGINEER DECIDES THE CEMENT CONTENT AND THE COMPACTED DENSITY OF THE MATERIAL.

Blake, LS *Cement & Concrete Association Res Repts* Feb. 1958

ACKNOWLEDGMENT: Highway Research Board Bibliography

3A 214877

CONSTRUCTION PRACTICES-EARTHWORK

THESE REFERENCES ON EARTHWORK CONSTRUCTION PRACTICES INCLUDE CONSOLIDATION OF FINE-GRAINED SOIL BY DRAIN WELLS, BOG BLASTING FOR ROAD CONSTRUCTION, THEORIES FOR SAND DRAINS, VERTICAL SAND DRAIN INSTALLATIONS, SOIL MECHANICS IN THE DESIGN AND CONSTRUCTION OF AN AIRPORT, SETTLEMENT CORRECTION AT AN AIRPORT, TUNNEL ENGINEERING, AND PRE-WETTING EMBANKMENT SOILS.

Highway Research Information Service Feb. 1970

3A 214889

UNIQUE SUBMARINE ASSEMBLY TECHNIQUES USED FOR LAYING GIANT MARSEILLES HARBOUR TUNNEL

THE DESIGN AND CONSTRUCTION OF THE MARSEILLES HARBOUR TUNNEL, THE THREE MAIN CONSTITUENTS OF WHICH ARE TWO SUBMARINE TUBES, TWO ACCESS-GRADIENTS, AND LINK-ROADS TO THE CITY NETWORK ARE DISCUSSED. THE PREFABRICATED TUNNEL-SECTIONS ARE DESCRIBED IN DETAIL AND DIAGRAMS ARE USED TO ILLUSTRATE THE LAYING PROCEDURES ADOPTED. REFERENCE IS ALSO MADE TO VENTILATION, LIGHTING, SOUND PROOFING AND DRAINAGE. /TRRL/

Doyen, P *World Road News /Switz/* Jan. 1967

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 214891

COMPARATIVE METHODS OF SUSPENSION BRIDGE CONSTRUCTION

RECENT DEVELOPMENTS IN STRUCTURAL STEEL AND OTHER CONSTRUCTION MATERIALS AND FABRICATING AND ERECTION TECHNIQUES HAVE HAD IMPORTANT EFFECTS ON THE COSTS OF SUSPENSION BRIDGE CONSTRUCTION. SOME OF THESE DEVELOPMENTS ARE DESCRIBED FROM THE VIEWPOINT OF THE FABRICATOR AND ERECTOR SO THAT THE DESIGNER IS FULLY AWARE OF THE PRESENT DAY CAPABILITIES OF THE CONSTRUCTION INDUSTRY. SOME GUIDE LINES ARE OFFERED FOR COMPARISON OF COSTS FOR DIFFERENT GRADES OF STEEL AND FABRICATING PROCEDURES. THE FULL POTENTIAL OF SUSPENSION BRIDGE DESIGN CAN BE FULLY APPRECIATED ONLY BY TAKING ADVANTAGE OF ALL THE IMPROVEMENTS AVAILABLE TODAY IN THE CONSTRUCTION INDUSTRY. /RRL/A/

Maxwell, HM *Suspension Bridges Symposium /Portugal/* 1166

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 214909

BRITISH STANDARD CODE OF PRACTICE: COMPOSITE CONSTRUCTION IN STRUCTURAL STEEL AND CONCRETE. PART 2. BEAMS FOR BRIDGES

THIS PART DEALS WITH SIMPLY-SUPPORTED AND CONTINUOUS BRIDGE BEAMS, OTHER THAN FILLER BEAMS, COMPOSED OF EITHER ROLLED OR BUILT-UP STRUCTURAL STEEL SECTIONS, WITH OR WITHOUT CONCRETE ENCASEMENT, ACTING IN CONJUNCTION WITH AN IN-SITU REINFORCED CONCRETE SLAB, THE TWO ELEMENTS BEING INTERCONNECTED SO AS TO FORM A COMPOSITE SECTION ACTING AS A WHOLE. /TRRL/

British Standards Institution Sept. 1967

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 214911

HYDRAULIC-FILL ROAD EMBANKMENTS-DESIGN HYDRAULICS STABILITY, AND SURFACE STRENGTH WITH SPECIAL REGARD TO GRANULATION /IN GERMAN/ DURING THE CONSTRUCTION OF THE EAST BREMEN MOTORWAY, A HYDRAULIC METHOD OF CONSTRUCTING A ROAD EMBANKMENT WAS USED FOR THE FIRST TIME IN GERMANY. OBSERVATIONS MEASUREMENTS AND TESTS ARE DISCUSSED. IT WAS SEEN THAT THE SEGREGATION OF THE UNIFORM SANDS IS NEGLIGIBLE, AND CAN BE CONTROLLED IF SUITABLE MEASURES ARE TAKEN. A SMALL PROPORTION OF SILT IN THE MATERIAL CAN EVEN INCREASE THE BEARING CAPACITY OF THE SAND, AND THIS EFFECT IS NOT LOST DURING THE HYDRAULIC PROCESS. SPECIAL REQUIREMENTS ARE PLACED ON THE SURFACE. /FG/RRL/

Ginersen, VP *Strasse Und Autobahn /Germany/* 1968

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 214917

FOUNDATION ENGINEERING TEXT BOOK-PART 2: FOUNDATIONS AND SPECIAL CONSTRUCTION METHODS

THIS MANUAL DEALS WITH THE FOLLOWING: SHALLOW AND DEEP FOUNDATIONS, PILE FOUNDATIONS, AND PREFABRICATED PILES OF REINFORCED AND PRESTRESSED CONCRETE, STEEL AND WOOD; CAST-IN-SITU CONCRETE IMPACT DRIVER PILES; CALCULATION OF PILE FOUNDATIONS; SEALING; BUILDING OF SEALED STRUCTURES; PILES AND VERTICAL SHORINGS NEAR OR UNDER EXISTING BUILDINGS, AND PROTECTION AGAINST VIBRATION IN EARTHQUAKE AREAS. /RRL/

Stiegler, W
Wener Verlag, Dusseldorf /Germany/

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 214918

USE OF THE SHIELD-DRIVING METHOD IN RECENTLY BUILT TRAFFIC TUNNELS.

SINCE THIS METHOD CAUSES LEAST DISTURBANCE TO THE SURFACE, IT IS USED TO CONSTRUCT NEW TRANSPORT TUNNELS UNDER DENSELY POPULATED URBAN AREAS FOR EXAMPLE IN HAMBURG. SHIELD DRIVING BY HAND AND PARTIALLY AND FULLY MECHANIZED OPERATION ARE DESCRIBED, AND REASONS GIVEN FOR GROUND SUBSIDENCE DURING DRIVING AND WHEN THE MACHINE IS STATIONARY. TABLES GIVING TECHNICAL DETAILS RELATING TO MANY TUNNEL STRUCTURES ARE INCLUDED. /FG/RRL/

Schenck, W *Bautechnik, Berlin /Germany/* 1968

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 214921

INSTRUCTIONS FOR THE CONSTRUCTION OF BITUMINOUS SURFACINGS USING THE HOT-LAID METHOD OF CONSTRUCTION /IN GERMAN/

INFORMATION IS PRESENTED ON THE BUILDING OF THE ROAD STRUCTURE, DEFINITIONS, CONSTRUCTION PRINCIPLES, DIMENSIONING, BUILDING MATERIALS, COMPOSITION AND PRODUCTION OF THE MIX, AND PLACING AND COMPACTION. THE DIMENSIONING IS BASED ON FOUR TYPES OF TRAFFIC. /FG/RRL/

Road Research Society /Austria/ 1966

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 214922

THE DESIGN OF SUBMERGED TUNNELS

A HISTORICAL AND TECHNICAL SURVEY OF THE DIFFERENT FORMS AND METHODS OF CONSTRUCTING UNDERWATER

TUNNELS IS PRESENTED. THE CONSTRUCTION OF THESE SUBMERGED TUNNELS-CIRCULAR SECTIONS WITH STEEL SEALING, AND TUNNELS WITH RECTANGULAR CROSS-SECTIONS IS DISCUSSED AND ILLUSTRATED BY EXAMPLES OF DESIGNS. SPECIAL ATTENTION IS PAID TO THE SHAPING OF THE UNDERWATER SECTIONS, SEALING, LOWERING AND BEDDING, JOINT DESIGN, VENTILATION AND THE COSTS AND PARTS TO BE HANDLED. SPECIAL TYPES OF SUBMERGED TUNNELS, INCLUDING TUNNELS FOR RAPID-TRANSIT RAILWAYS, AND PEDESTRIAN TUNNELS ARE CONSIDERED. IN CONCLUSION, THE INCREASING IMPORTANCE OF SUBMERGED TUNNELS IS DISCUSSED. A SUMMARY OF EXISTING SUBMERGED TUNNELS WITH THEIR MOST IMPORTANT DESIGN FEATURES IS APPENDED. /RRL/A/

Simons, H *Baumaschine Und Bautechnik /Germany/* 1966

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 214927

PREFABRICATION IN CARRIAGEWAY CONSTRUCTION /IN GERMAN/

FOR TEN YEARS PREFABRICATED SLABS HAVE BEEN USED FOR THE REPAIR OF MOTORWAYS; THEY SHORTEN THE ROAD CLOSURE TIMES, ARE ECONOMIC AND CAN BE USED PRACTICALLY WITHOUT LIMITATION. AT PRESENT SLABS OF 9.99 X 3.74 M. IN SIZE AND 18 CM. THICK WITH PRESTRESSED LONGITUDINAL AND TRANSVERSE REINFORCEMENT ARE MOSTLY USED; THEY ARE PLACED ON A BITUMINOUS SUB-STRUCTURE, PRESSED DOWN WITH CEMENT MORTAR TO THE DESIRED HEIGHT AND CONNECTED WITH SCREW DOWELS. ON THE BASIS OF RECENT TESTS LONGITUDINAL AND TRANSVERSE PRESTRESSED SLABS, JOINED WITH CEMENT OR PLASTIC MORTARS AND LAID ON A REINFORCED BASE ARE NOW PROPOSED. /FG/RRL/

Eisenmann, J *Strassen Und Tiefbau /Germany/* 1967

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 214929

CONSTRUCTIONAL METHODS AND EQUIPMENT FOR MANUFACTURING ASPHALT ROADS WITH AN EVEN SURFACE /IN GERMAN/

AN IMPORTANT PREREQUISITE FOR THE EVENNESS OF THE SURFACING IS A HIGH PRELIMINARY COMPACTION BY THE FINISHER. TODAY THIS IS MORE THAN 90% AND SHOULD BE INCREASED TO 100% IF POSSIBLE. UNIFORM THICKNESS OF THE MIXTURE IS ALSO A PREREQUISITE FOR SMOOTH SURFACES; IRREGULAR THICKNESS OF THE LAYER MAY BE DUE TO THE DESIGN OF THE FINISHER, VARYING RATE OF PLACEMENT OR STOPPING OF THE FINISHER AND NON-UNIFORM TEMPERATURE OF THE MIXTURE. IRREGULARITIES IN THE LOWER LAYER MAY ALSO BE TRANSMITTED TO THE SURFACE. THESE ARE AVOIDED BY THE USE OF FINISHERS WHICH EXERT A HIGH PRELIMINARY COMPACTION; MIXTURES WITH A FLOATING PLANT AND, IN THE CASE OF GREAT IRREGULARITIES, ELECTRONICALLY-CONTROLLED LEVELLING EQUIPMENT, ARE ADVANTAGEOUS. IRREGULARITIES ALSO OCCUR DURING COMPACTION OF THE SURFACING AND THESE ARE CAUSED BY THE VERTICAL AND HORIZONTAL FORCES ACTING DURING THE ROLLING PROCESS. MEASURES FOR SUITABLE ROLLING OPERATIONS ARE DESCRIBED. SINCE MOST UNDULATIONS, AND THE LARGER UNDULATIONS, ARE FORMED DURING THE LAYING AND COMPACTION OF TRANSVERSE, LONGITUDINAL AND WORKING SEAMS, SPECIAL MEASURES ARE AGAIN NECESSARY IN THESE CASES. IN THE CASE OF INSUFFICIENT COMPACTION BY ROLLING, IRREGULARITIES OCCUR DURING COMPACTION BY TRAFFIC, PARTICULARLY IN THE TRAFFIC LANE IN THE FORM OF GROOVED TRACKS. IF THE STRUCTURE IS INSUFFICIENTLY POROUS, SUBSEQUENT COMPACTION MAY REDUCE THE RIGIDITY. /FG/RRL/

Volk, L *Bitumen /Germany/* 1967

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 214930

PREFABRICATED PRESTRESSED AND REINFORCED CONCRETE DECKS FOR HIGHWAY BRIDGES

THE USE OF PRECAST CONCRETE IN BRIDGE CONSTRUCTION IS CONSIDERED. ADVANTAGES AND DISADVANTAGES OF THE METHOD ARE DISCUSSED. DETAILS ARE GIVEN OF THE CONSTRUCTION OF THE PREFABRICATED PARTS, THE MEASURING SYSTEM, THE SUPPORTING STRUCTURE AND ASSEMBLY OF THE INDIVIDUAL PARTS. SPECIFICATIONS ARE BEING DRAWN UP FOR THE USE OF PREFABRICATED CONCRETE. /TRRL/

Beck, J *Strasse Und Autobahn /Germany/* Jan. 1967

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 214933

MACHINE FOR THE TRANSVERSE ROUGHENING TREATMENT AND PULVERIZING A CURING COMPOUND ON FRESH CONCRETE /IN FRENCH/

DETAILS ARE GIVEN OF A PROTOTYPE MACHINE, DEVELOPED BY THE CENTRE DE RECHERCHES ROUTIERES, FOR TRANSVERSE ROUGHENING OF CONCRETE ROADS AND FOR PULVERIZING CURING COMPOUND ON FRESH CONCRETE. THE MACHINE IS FULLY AUTOMATIC, AND THE ROUGHENING DEVICE CAN HAVE METAL BLADES OR TUFFS OF METAL, COCONUT FIBRE OR P.V.C. SPECIAL DEVICES CONTROL THE QUANTITY OF CURING COMPOUND APPLIED, PREVENT THE CLOGGING OF THE JETS, ENSURE A CONSTANT HOMOGENIZATION OF THE CURING COMPOUND AND PREVENT IT FROM BEING BLOWN AWAY BY THE WIND. THIS ROUGHENING FACILITATES THE RAPID DRAINAGE OF SURFACE WATER, AND GIVES A HIGH DEGREE OF ROUGHNESS IN WET WEATHER ENABLING VEHICLES TO TRAVEL AT HIGH SPEED. IT DOES NOT IMPAIR THE RIDING QUALITY OF THE PAVEMENT AND HAS THE ADVANTAGE OF REDUCING GLARE. /CRIC/FESR/LCPC/A/RRL/

Leyder, JP *Technique Routiere, Brussels /Belgium/* Mar. 1968

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 214947

SYNTHESIS ON CONCRETE ROUGHNESS /IN FRENCH/

RESEARCH ON THE ROUGHNESS OF A NUMBER OF EXPERIMENTAL SECTIONS OF ROAD IS OUTLINED AND FINDINGS ARE GIVEN CONCERNING THE FINISHING OF ROUGH CONCRETE SURFACINGS AND THEIR LONG TERM PERFORMANCE. RESULTS OF A SIX-YEAR INVESTIGATION INTO THE EFFECTS OF TRAFFIC ON SURFACINGS WITH DEEP TRANSVERSE GROOVES ARE PRESENTED. IN ORDER TO RETAIN A HIGH DEGREE OF ROUGHNESS, THE SURFACING MUST HAVE AN AVERAGE SURFACE TEXTURE DEPTH OF 2 MM AND NO SAND OR STONE ELEMENTS SUSCEPTIBLE TO POLISHING NEAR THE CONCRETE SURFACE. IT WAS POSSIBLE TO OBTAIN SIMILAR SURFACE TEXTURE DEPTHS USING THE ROUGHENING CURING COMPOUND SPRAYING MACHINE DEVELOPED BY THE CENTRE DE RECHERCHES ROUTIERES. ROUGHNESS MEASUREMENTS CARRIED OUT AT DIFFERENT SPEEDS (20 TO 80 KM/HOUR) SHOWED THAT THE COEFFICIENT OF TRANSVERSE FRICTION BETWEEN 20 AND 80 KM/HOUR DECREASES LINEARLY AS A FUNCTION OF THE AVERAGE SURFACE STRUCTURE DEPTH, AND IS INDEPENDENT OF THE DEGREE OF POLISHING OF THE SURFACING; BETWEEN 25 AND 30 KM/HOUR THE COEFFICIENT OF TRANSVERSE FRICTION IS INDEPENDENT OF THE AVERAGE SURFACE TEXTURE DEPTH, BUT ITS VALUE DEPENDS ON THE DEGREE OF POLISHING OF THE AGGREGATES ON THE SURFACE. THE DISPERSION OF COEFFICIENT OF TRANSVERSE FRICTION MEASUREMENTS IS DISCUSSED, AND AN ATTEMPT IS MADE TO RELATE INCREASES IN THE STANDARD DEVIATION OF THE COEFFICIENT OF TRANSVERSE FRICTION TO SPECIFIC CONSTRUCTION METHODS OR TRAFFIC CONDITIONS. /CRIC/FESR/LCPC/A/RRL/

Leyder, JP *Technique Routiere, Brussels /Belgium/* Sept. 1968

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 214954

THE CONSTRUCTION OF EARTH SUBGRADES UNDER DIFFICULT NATURAL CONDITIONS. WORK CARRIED OUT BY THE SOYUZDORNII (FEDERAL STUDY AND RESEARCH INSTITUTE IN THE USSU) /IN RUSSIAN/

THE CONSTRUCTION IS STUDIES OF EARTH ROADS ON COMPRESSIBLE SOIL, PEAT, MUD, WET BRACKISH SOIL, ETC. THE HIGH COST OF THE CONVENTIONAL CONSTRUCTION METHOD, WHICH CONSISTS IN REMOVING THE EXISTING SOIL AND REPLACING IT WITH BORROW, LED TO RESEARCH INTO THE IMPROVEMENT OF CONSTRUCTION METHODS WHICH USE COMPRESSIBLE SOIL UNDER EMBANKMENTS. FINDINGS ARE PRESENTED AND RECOMMENDATIONS ARE OUTLINED FOR THE ESTABLISHMENT OF PROJECTS FOR BUILDING EARTH SUBGRADES ON COMPRESSIBLE SOIL. THE TITLES OF THE ARTICLES ARE AS FOLLOWS: (1) PROBLEMS CONCERNING PLANNING THE CONSTRUCTION OF EARTH SUBGRADES ON COMPRESSIBLE SOIL, (2) SPECIAL FEATURES OF PROJECTS AND CONSTRUCTION OF EARTH SUBGRADES IN THE MARSHES OF WESTERN SIBERIA, (3) THE USE OF RIGID SLABS IN THE CONSTRUCTION OF ROAD EMBANKMENTS ON MARSHLAND, (4) STABILITY OF SUBGRADES BUILT ON WET BRACKISH SOIL. (5) INFLUENCE OF HIGHLY SOLUBLE SALTS ON THE PHYSICAL AND MECHANICAL PROPERTIES OF SOIL WITH A HIGH SALT CONTENT, (6) STRUCTURAL AND MECHANICAL PROPERTIES OF SOIL WITH A HIGH SALT CONTENT, (7) PRINCIPLE FOR DRAWING UP SPECIFICATIONS RELATING TO THE COMPLEMENTARY WETTING OF THE SOIL DURING THE CONSTRUCTION OF EARTH IN KAZHASTAN, AND (8) WINTER CONSTRUCTION OF EMBANKMENTS USING POWDER AND COHESIVE SOIL. /LCPC/RRL/

Trudy Soyuzdornii /Ussr/ 1967

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 214965

USE OF PREFABRICATION IN ROAD CONSTRUCTION SHORTENS MOTORWAY REPAIR TIMES /IN GERMAN/
DURING THE LAST FIVE YEARS THE OLD CARRIAGEWAY ON LARGE SECTIONS OF THE BADEN WURTEMBERG MOTORWAY HAS BEEN REPLACED BY PREFABRICATED PRESTRESSED SLABS, 10 CM LONG AND 18 CM THICK. THE CONSTRUCTION OF THE SLABS AND THE STRESSES ON THEM ARE DISCUSSED INCLUDING STRESSES AS A RESULT OF UNEVEN HEATING, WEIGHT AND TRAFFIC LOADING, AND ALSO THE PRESTRESSING OF THE SLABS. /FG/RRL/

Zeitschrift Ver Deutscher Ingen /Ger/ 1968

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 214967

URBAN UNDERGROUND TRAFFIC STRUCTURES, PART 1 CONSTRUCTION PITS /IN GERMAN/
BUILDING PITS CONSTRUCTED BY MEANS OF THE OPEN CONSTRUCTION METHOD ARE DESCRIBED. THIS METHOD IS PREFERRED FOR UNDERGROUND TRAFFIC STRUCTURES, ESPECIALLY UNDERGROUND RAILWAYS AND STATIONS, BECAUSE OF ITS SAFETY. OTHER STRUCTURES FOR WHICH IT IS USED INCLUDE PEDESTRIAN TUNNELS AND VARIOUS KINDS OF VEHICLE TUNNELS. /FG/RRL/

Winter, K
Bauingenieur - Praxis /Ger/

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 214972

VIEWS ON AND METHODS OF PRESSURE TUNNEL CONSTRUCTION /IN GERMAN/
THE BEHAVIOR OF ROCK DURING CONSTRUCTION OF A PRESSURE TUNNEL, AND THE STATES OF STRESS IN THE ROCK AND THEIR REARRANGEMENT DURING EXCAVATION IN

ELASTIC ISOTROPIC ROCK, FRACTURED ROCK AND COHESIONLESS MATERIAL ARE ILLUSTRATED DIAGRAMMATICALLY. WITH RESPECT TO THE LOADING OF THE ROCK BY INTERNAL PRESSURE, CONSIDERATIONS ARE DRAWN UP ON STRUCTURAL CHANGES AND STRESS DISTRIBUTIONS WHICH DEPEND ON NORMAL AND SHEAR STRESSES. THE INFLUENCE OF GROUND WATER WHEN IT OCCURS AS PORE WATER, AND THE ASSURANCE OF SAFETY DURING EXCAVATION BY THE PROVISION OF SUPPORTS ARE DISCUSSED. THE SECTION ON INJECTIONS DEALS WITH THE BASIC EFFECTS OF INJECTIONS, THE REARRANGEMENT OF STRESSES AS A RESULT OF INJECTIONS AND INTERNAL PRESSURE LOADING, AND WITH THE AREAS OF DEFORMATION. THE INFLUENCE OF CREEP IS ALSO CONSIDERED. /FG/RRL/

Innerhofer, G
Osterreichische Ingzeitschrift /Aust/ 1966

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 214979

METHODS USED IN THE CONSTRUCTION OF THE UNDERGROUND RAILWAY STATIONS IN BUDAPEST /IN GERMAN/

A REPORT IS MADE ON THE CONSTRUCTION OF FOUR UNDERGROUND RAILWAY STATIONS AT IMPORTANT TRAFFIC JUNCTIONS IN BUDAPEST. BECAUSE OF THE GEOLOGICAL CONDITIONS THE OPEN-CUT CONSTRUCTION METHOD WAS USED WHICH INVOLVED LOWERING OF THE GROUND WATER LEVEL AND THE SINKING OF PNEUMATIC CAISSONS. THE EXECUTION OF THE WORK IS DESCRIBED IN DETAIL. /FG/RRL/

Vajda, Z Kelemen, J *Baumaschine Und Bautechnik /Germany 1969*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 214980

TUNNEL AND GALLERY CONSTRUCTION /IN GERMAN/
AN ANNUAL SURVEY OF RECENT DEVELOPMENTS IN TUNNEL AND GALLERY CONSTRUCTION IS PRESENTED. HEADING BY MEANS OF BLASTING IS DISCUSSED, TOGETHER WITH THE CHOICE OF EXPLOSIVES AND THEIR EFFICIENCY, AND HEADING BY MEANS OF DRIVING MACHINERY AND ITS EFFECTIVENESS IN DIFFERENT TYPES OF ROCK. VARIOUS METHODS OF LINING AND INSULATING TUNNELS ARE CRITICALLY EVALUATED AND COMPARED. /FG/RRL/

Markl, W *Zeitschrift Ver Deutscher Ingen /Ger/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 214985

VEHICLE TUNNEL CONSTRUCTION, VOLUME 2: NETWORK FORMATION, OPERATIONAL FEATURES AND CONSTRUCTION METHODS /IN GERMAN/
A REFERENCE MANUAL FOR PLANNERS AND CONSTRUCTION ENGINEERS IS PRESENTED CONTAINING EXAMPLES OF ALL THE UNDERGROUND RAILWAYS IN THE WORLD, BOTH IN OPERATION AND UNDER CONSTRUCTION, AND ALSO EXAMPLES OF RAPID TRAMWAY SYSTEMS LINKING FEDERAL RAILWAYS. UNDERWATER TUNNELS ARE ALSO INCLUDED. /FG/RRL/

Mandel, G
Ernst Und John, Berlin /Germany/ 1969

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 214986

PROBLEMS IN THE DEVELOPMENT OF PRECAST SUBSTRUCTURE ELEMENTS FOR ROAD BRIDGES OF UP TO 6.0M HEADROOM /IN GERMAN/
THE USE OF PRECAST ELEMENTS FOR THE CONSTRUCTION OF ABUTMENTS, WINGS AND SUPPORTS FOR HIGHWAY BRIDGES IS DESCRIBED TOGETHER WITH THE PROBLEMS INVOLVED. /FG/RRL/

Bartnik, H Schmidt, D *Strasse, Berlin /Germany/ 1969*
 ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 214987

THE SLURRY TRENCH WALL CONSTRUCTION METHOD /IN GERMAN/

THE AUTHOR GIVES DETAILS OF THE FOLLOWING LECTURES WHICH WERE GIVEN AT CONFERENCES ORGANIZED BY THE FEDERAL ASSOCIATIONS OF THE CEMENT INDUSTRY IN FREIBURG AND COLOGNE: FAHN, R.-PROPERTIES OF BENTONITE; WEISS, F.-PROPERTIES OF SUPPORTING LIQUIDS-QUESTIONS OF STABILITY- PRINCIPLES OF THE SLURRY TRENCH WALL THEORY; SIMONS AND DYBEK-CONSTRUCTION OF SLURRY TRENCH WALLS AND THEIR ADVANTAGES; GISKE-STRUCTURAL ANCHORAGES; BATSCH- CONSTRUCTION OF AN ANCHORED SLURRY TRENCH WALL DURING THE DEVELOPMENT OF THE SCHLOSSBERG RING IN FREIBURG; AND BRAUN AND JANSSEN-THREE TRAFFIC STRUCTURES IN COLOGNE. DETAILS ARE GIVEN OF THE USE OF THE BENTONITE SUSPENSION: ITS DENSITY MUST BE ADJUSTED TO SUIT THE SOIL CONDITIONS; IT IS POURED INTO SLOTS WHICH HAVE PREVIOUSLY BEEN EQUIPPED WITH BAFFLES, AND THEN DEVELOPED IN ACCORDANCE WITH THE CONCRETING PROCESS. THE SUSPENSION CAN BE USED AGAIN AFTER RECLAMATION. THE AUTHOR DESCRIBES THE WORKING PROCEDURE, SUCCESSFUL USES OF THE METHOD, AND THE POSITIONING OF THE ANCHORAGE WHERE THIS IS REQUIRED. ADVANTAGES OF THE METHOD ARE LISTED, AND INCLUDE LOW NOISE LEVEL DURING CONSTRUCTION, VIBRATION RESISTANCE, THE ELIMINATION OF GROUND WATER LOWERING AND INDEPENDENCE OF SOIL CONDITIONS. /FG/RRL/

Muller, H *Bauwirtschaft, Weisbaden /Germany/ 1969*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 214991

PRECAST CONCRETE SUBWAY CONSTRUCTION

TWO SUBWAYS, CONSTRUCTED BY THE BASILDON DEVELOPMENT CORPORATION IN ESSEX USING THE POST-TENSIONED TECHNIQUE, ARE DISCUSSED, ALSO DETAILS OF FIVE PRECAST SUBWAYS NOW UNDER CONSTRUCTION IN READING ON THE DEE ROAD DEVELOPMENT. /RRL/

Davis, PJ *Chartered Municipal Engineer /UK/ Aug. 1968*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 214993

RIGID PAVEMENTS AND THE ADVENT OF THE SLIP FORM PAVER

THE BASIS OF DESIGN OF CONCRETE ROADS IS BRIEFLY OUTLINED, FOLLOWED BY A DISCUSSION OF THE PRESENT TECHNICAL AND ECONOMIC SITUATION, WITH PARTICULAR REFERENCE TO ITS COMPETITIVE VALUE. SOME OF THE CHARACTERISTICS AND ADVANTAGES OF USING THE SLIP-FORM PAVER ON MAJOR ROADS ARE DISCUSSED AND ALSO ITS EFFECTS ON METHODS OF CONSTRUCTION OF MINOR ROADS AND ESTATE ROADS. THE FACTORS AFFECTING THE CHOICE OF REINFORCED OR UNREINFORCED CONCRETE ROADS ARE CONSIDERED. THERE IS A BRIEF DISCUSSION WITH RECOMMENDATIONS ON THE SPECIFICATION OF JOINT ASSEMBLIES AND JOINT GROOVE FORMING METHODS AND A DESCRIPTION OF THE ADVANTAGES OFFERED BY SLIP-FORMED, WET LEAN CONCRETE AS A BASE FOR CONCRETE PAVEMENTS. /RRL/A/

Burks, AE Maggs, MF *J Inst Munic Engrs /UK/ Aug. 1968*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 214994

STAGE CONSTRUCTION OF ROAD PAVEMENTS /IN PORTUGUESE/

THE USE OF SURFACE TREATMENT OVER GRANULAR BASE COURSES AND THE PROBLEM OF THE STAGE CONSTRUCTION

OF ROAD PAVEMENTS ARE DISCUSSED, SHOWING THAT, SAVE IN SPECIAL CASES, THICKNESS DIFFERENCES IN ROAD PAVEMENTS IN THE DIFFERENT STAGES ARE NOT VERY WELL MARKED. /RRL/

Souza, ML *Bol Tech Dept Estradas Rodagem /Braz/ July 1966*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 214998

BRITISH SYSTEM FOR SLIP-FORMING CONCRETE PAVEMENT

SLABS ABOUT 12 FT WIDE ARE LAID BY THE PAVING MACHINE INTRODUCED BY BLAW KNOX LTD, AND DEVELOPED JOINTLY WITH BRITISH ROPES LTD. THE MACHINE UTILIZES HARSH CONCRETE MIXES, AND THE SLAB IS REINFORCED BY UNTENSIONED WIRESTRAND. A SIMPLE FRONT-FED SINGLE-PASS METHOD OF CONSTRUCTION RESULTS. /RRL/A/

Gill, VL Morgan, JG *Concrete /UK/ Sept. 1968*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 215015

COMPOSITE CONSTRUCTION IN STEEL AND CONCRETE

A SUMMARY IS PRESENTED OF THE TECHNIQUES OF COMPOSITE CONSTRUCTION IN STEEL AND CONCRETE AS THEY ARE APPLIED IN GERMANY, RUSSIA AND THE U.S.A., AND THESE TECHNIQUES ARE EVALUATED IN THE LIGHT OF THEIR APPLICATION UNDER INDIAN CONDITIONS. THE ADVANTAGES OF SUCH CONSTRUCTION AND DESIGN METHODS ARE DESCRIBED WITH EXAMPLES OF CALCULATIONS, AND PROBLEMS INVOLVED IN USING STEEL AND CONCRETE. THE TOPICS DEALT WITH IN DETAIL INCLUDE CREEP AND SHRINKAGE, TEMPERATURE DIFFERENCES BETWEEN STEEL AND CONCRETE, SHEAR CONNECTIONS (RIGID, FLEXIBLE, ELASTIC, AND BOND TYPES), SHEAR STRESSES, CASTING OF CONCRETE, LOAD FACTORS, PRESTRESSING, AND REINFORCEMENT OF STRUCTURES. /RRL/

Yan, HT

Orient Longmans Ltd /India/ 1965

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 215016

THE EFFECT OF CONSTRUCTION TECHNIQUES ON THE DESIGN OF ROADS

THE DEVELOPMENT IS OUTLINED OF CONSTRUCTION TECHNIQUES WITH REFERENCE TO EXCAVATION AND EARTHWORKS, DRAINAGE, AND SUB-BASE, BASE AND SURFACING CONSTRUCTION. EXAMPLES ARE QUOTED FROM CONSTRUCTION WORK ON THE N.1 MOTORWAY. DEVELOPMENTS IN CONCRETE ROAD CONSTRUCTION, PARTICULARLY THE SLIP FORM PAVER, AND ITS STEEL AND CONCRETE BRIDGES ARE DESCRIBED. A DISCUSSION IS APPENDED. /RRL/

Oliver, FR *Inst Hwy Engineers Journal, London /UK/ Mar. 1969*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 215020

PRINCIPLES OF MECHANIZATION AND AUTOMATION APPLIED TO ROAD CONSTRUCTION /IN RUSSIAN/

THE CHARACTERISTICS OF MODERN ROAD CONSTRUCTION, AND BASIC TECHNICAL CONSTRUCTION METHODS AND THEIR REQUIREMENTS DURING THE INTRODUCTION OF AUTOMATION IN THE TREATMENT OF SUBGRADES, AND LAYING OF SUBBASES AND SURFACINGS ARE CONSIDERED. THE AUTOMATION OF BITUMINOUS MIXING PLANTS AND CEMENT PLANTS IS ALSO DISCUSSED. DATA ARE PRESENTED ON AUTOMATIC CONTROL SYSTEMS, AND THE THEORY OF AUTOMATIC CONTROL IS OUTLINED. /LCPC/A/RRL/

Kaluzhskii, YA Derevyankos, N Kaminskaya, DA Kireev, VN
 Izdatelstvo Transporti, Moscow /Ussr/ 1967

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 215033

FIRST APPLICATION OF PRECAST CONSTRUCTION WITHOUT FALSEWORK IN GERMANY /IN GERMAN/
THE DESIGN AND CONSTRUCTION BY HOCHTIEF AG OF THE NEW BRIDGE OVER THE LECH AT EPFACH ARE DESCRIBED. BUILDING OF THE SUPERSTRUCTURE, INCLUDING MANUFACTURE OF THE PRECAST SECTIONS AND THEIR ASSEMBLY, IS OUTLINED. THIS WAS THE FIRST BRIDGE TO BE BUILT IN GERMANY USING THE METHOD OF CONSTRUCTION WITHOUT FALSEWORK. /RRL/

Hager, G *Bautechnik, Berlin /Germany/* Oct. 1968

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 215042

STAGE CONSTRUCTION OF TWO-LANE ROADS: ITS ECONOMY AND CONSTRUCTION TECHNIQUE (IN FINNISH)
THE ECONOMIC JUSTIFICATION IS INVESTIGATED OF STAGE CONSTRUCTION. THE FACTORS CONSIDERED ARE ROAD CROSS-SECTION, ORGANIZATION OF CONSTRUCTION WORK, TRAFFIC MEASURES DURING THE SECOND STAGE OF CONSTRUCTION, INITIAL TRAFFIC VOLUME, AND RATE OF TRAFFIC GROWTH DURING THE PERIOD STUDIED. FINDINGS SHOW THAT STAGE CONSTRUCTION IS AN ECONOMICAL PROPOSITION WHEN THE INITIAL TRAFFIC VOLUME IS LOW, AND WHEN THE CROSS-SECTION IS WIDENED TO A CONSIDERABLE EXTENT. /RRL

Sauna-aho, Koskinen, O *Tiehti, Helsinki /Finland/* Oct. 1969

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 215055

FREE-CANTILEVER CONSTRUCTION OF PRESTRESSED CONCRETE BRIDGES AND MUSHROOM-SHAPED BRIDGES
NEW CONSTRUCTION TECHNIQUES BASED ON RESEARCH, IN BOTH MATERIALS AND METHODS, ARE IMPROVING QUALITY AND SAVING COST IN THE CONSTRUCTION OF PRESTRESSED CONCRETE BRIDGES. FREE-CANTILEVER AND MOVABLE SCAFFOLD SYSTEMS SAVE TIME AND IMPROVE SAFETY BY REPLACING CONVENTIONAL SCAFFOLDS AND FALSEWORK. THE FREE-CANTILEVER METHOD PERMITS SAFE AND EFFICIENT CONSTRUCTION OF LONG SPANS WITHOUT HIGH FORMWORK COSTS. MATERIALS AND METHODS DEVELOPMENT INCLUDE THREADED PRESTRESSING BARS FOR IMPROVED ANCHORAGE, STUDIES IN STRESS-CRACK CORROSION, DIAGONAL PRESTRESSING TO SAVE DEAD WEIGHT IN LONG SPANS, AND A MOVEABLE-JOINT DESIGN THAT PERMITS USE OF CONTINUOUS ASPHALT PAVEMENT WITHOUT RUPTURE. BRIDGE TYPES DESCRIBED INCLUDE MUSHROOM, STRESS-RIBBON, AND SUSPENSION, IN ADDITION TO MANY EXAMPLES OF FREE-CANTILEVER CONSTRUCTION. /RRL/A/

Finsterwalder, U

Intl Symp Concr Bridge Des Proc /Can/ 1969

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 215056

PRESTRESSED CONCRETE BRIDGE CONSTRUCTION WITH STEPPING FORMWORK EQUIPMENT
THE PROCEDURE OF SPANWISE CONSTRUCTION IN CAST-IN-SITU CONCRETE, USING SOME MOVEABLE FORMWORK TECHNIQUE, HAS PROVED MOST SUITABLE FOR LARGER-SIZE PRESTRESSED CONCRETE BRIDGES. THE CONSTANT REPETITION OF THE WORKING RHYTHM RESULTS IN A VERY ECONOMICAL CONSTRUCTION PROGRESS. DEPENDING ON THE CIRCUMSTANCES, ANY OF THE FOLLOWING MEANS MAY BE ADOPTED: SCAFFOLDING THAT HAS TO BE PARTLY DISMANTLED, MOVED INTO NEW POSITION AND REERECTED; SLIDING SCAFFOLDING; STEPPING DORMWORK EQUIPMENT, SLIDING ON THE GROUND; CANTILEVERED STEPPING FORMOWRK EQUIPMENT. THE DEVELOPMENT OF THE PROCESS-FROM USING MOVABLE SCAFFOLDING TO EM-

PLOYING CANTILEVERED STEPPING FORMWORK EQUIPMENT-HAS BEEN ILLUSTRATED BY EXAMPLES OF THE DIFFERENT METHODS. DISTINCTION IS MADE BETWEEN STEPPING FORMWORK EQUIPMENT FOR SPANS UP TO 50 M AND FOR THOSE FROM 50 TO 150 M (160 TO 500 FT) OR FOR EVEN LARGER SPANS. THE CONSEQUENCES AND THE SCOPE OF PRESTRESSED CONCRETE BRIDGE CONSTRUCTION WITH STEPPING FORMWORK EQUIPMENT ARE BEST ILLUSTRATED IN THE FINAL EXAMPLE: THE PRIZE-WINNING DESIGN OF THE BRIDGE ACROSS THE GREAT BELT IN DENMARK. THIS BRIDGE HAS VARYING SPANS UP TO 325 M (1100 FT). /RRL/A/

Wittfoht, H

Intl Symp Concr Bridge Des Proc /Can/ 1969

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 215057

THREE-SPAN CONTINUOUS PRESTRESSED CONCRETE BRIDGE CONSTRUCTED OF PRECAST UNITS IN CANTILEVER CONSTRUCTION
DETAILS ARE GIVEN OF THE BRIDGE ACROSS THE TAF FAWR VALLEY IN WALES. THE BRIDGE IS A BOX GIRDER WITH THREE COMPARTMENTS, THE DEPTH VARYING PARABOLICALLY FROM 15 FT AT THE PIERS TO 5 FT AT MIDSPAN AND ABUTMENTS. THE WEBS WERE PRECAST AS I-SECTIONS, AND THE BRIDGE WAS CONSTRUCTED BY CANTILEVERING FROM THE TWO PIERS TOWARD THE ABUTMENTS AND THE CENTER OF THE MAIN SPAN. DURING CONSTRUCTION, THE BRIDGE PASSED THROUGH THREE DIFFERENT STATICAL PHASES: (1) SIMPLY SUPPORTED UNTIL THE CANTILEVERING REACHES THE ABUTMENTS, (2) TWO-PIN PORTAL WHEN RESTING ON ABUTMENTS BUT STILL FREE AT MID-SPAN, AND (3) THREE-SPAN CONTINUOUS WHEN JOINED IN THE MIDDLE. TWO ELECTRONIC COMPUTER PROGRAMS WERE DEvised. THE FIRST DEALT WITH THE SIMPLY SUPPORTED CONDITION AND GAVE STEP-BY-STEP STRESSES AND DEFORMATIONS AT ALL CONSTRUCTION JOINTS AS THE BRIDGE WAS BEING CONSTRUCTED AND THE PRESTRESSING FORCES WERE INTRODUCED. THE SECOND PROGRAM DEALT WITH THE INDETERMINATE STAGES AND, TO MAKE IT AS GENERAL AS POSSIBLE, WAS DESIGNED ONLY TO GIVE THE CONTRIBUTIONS TO THE COEFFICIENT MATRIX FROM BEAMS WITH VARIABLE CROSS-SECTION, THE VARIATION BEING COMPLETELY ARBITRARY AND THE BEAMS WITH OR WITHOUT END-FIXITY. /RRL/

Lundgren, A Hansen, F

Intl Symp Concr Bridge Des Proc /Can/ 1969

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 215058

DESIGN OF LONG-SPAN CONCRETE BRIDGES WITH SPECIAL REFERENCE TO PRESTRESSING, PRECASTING, ERECTION, STRUCTURAL BEHAVIOR, AND ECONOMICS
THE DESIGN OF LONG-SPAN CONCRETE BRIDGES, CONSIDERING CONDITIONS IN THE U.S.A., IS DISCUSSED WITH REFERENCE TO RECENT ADVANCES IN MATERIALS AND CONSTRUCTION TECHNIQUES. THE USE OF PRESTRESSING, PRECASTING, AND ERECTION METHODS ARE PRESENTED AS APPLIED TO DIFFERENT TYPES OF BRIDGES SUCH AS CANTILEVER, CONTINUOUS, RIGID-FRAME, TRUSS, ARCH, AND SUSPENSION STRUCTURES. DESIGN APPROACHES EMPHASIZING STRENGTH AND BEHAVIOR REQUIREMENTS ARE MENTIONED, TOGETHER WITH THE USE OF COMPUTER PROGRAMS FOR OPTIMIZATION. MATERIAL, LABOR, AND ERECTION COSTS ARE COMPARED AS INDICES OF TOTAL ECONOMY IN BRIDGE DESIGN. /RRL/A/

Lin, TY Gerwick, BC

Intl Symp Concr Bridge Des Proc /Can/ 1969

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 215059

LONG-SPAN PRECAST PRESTRESSED CONCRETE BRIDGES BUILT IN CANTILEVER

THE EVOLUTION OF CANTILEVER SEGMENTAL CONSTRUCTION, ITS FIRST APPLICATIONS AND SUCCESSIVE IMPROVEMENTS ARE SURVEYED. DETAILS ARE GIVEN OF THE CONSTRUCTION METHOD. PRESTRESSING IS APPLIED AFTER EACH SYMMETRICAL PAIR OF SEGMENTS IS PLACED IN POSITION. AS THE SEMISPANS FROM ADJACENT PIERS COME TOGETHER, THE CENTER OF THE SPAN IS CLOSED BY INSERTING A DROP-IN GIRDER SEGMENT, AND CONTINUITY IS PROVIDED BY EPOXY CEMENT, MORTAR AND STRESSED TENDONS. CONTINUOUS SPANS MINIMIZE THE DEFLECTIONS AND ANGULAR BREAK THAT WOULD BE CAUSED IN A HINGED DECK BY CREEP RELAXATION, SHRINKAGE, LIVE LOAD, AND DEVIATIONS IN MATERIAL PROPERTIES. CAREFUL APPLICATION OF PRESTRESSING STEEL IS NECESSARY IN CONTINUOUS BRIDGES, HOWEVER, TO TAKE CARE OF MOMENT REVERSALS AND TO ACHIEVE OPTIMUM STRESS DISTRIBUTION. IN LONG DECKS, EXPANSION JOINTS ARE PROVIDED PREFERABLY AT POINTS OF CONTRAFLEXURE TO MINIMIZE DEFLECTION. SEVERAL BRIDGE PROJECTS UTILIZING DIFFERENT PRECASTING AND ERECTION TECHNIQUES ARE DESCRIBED, AND TYPICAL COSTS ARE TABULATED. /RRL/

Muller, J

Intl Symp Concr Bridge Des Proc /Can/ 1969

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 215079

THE SIXTH INTERNATIONAL CONFERENCE ON PREFABRICATED CONCRETE (BIBM/969) /IN FRENCH/

THE FIRST 4 SESSIONS OF THIS CONFERENCE ARE CONCERNED WITH QUALITY CONTROL, STANDARDIZATION, MECHANIZATION, AUTOMATION, LIGHTWEIGHT STRUCTURAL CONCRETE, AND NEW PRODUCTS AND TECHNIQUES WITH EXAMPLES OF APPLICATION. THE FIFTH SESSION IS DEVOTED TO THE CONSTRUCTION OF BRIDGES BUILT WITH PRECAST CONCRETE UNITS. IN THIS SESSION, THE REPORTS PRESENTED WERE AS FOLLOWS: ATTEMPT AT STANDARDIZING HORIZONTAL CONSTRUCTION ELEMENTS FOR BRIDGES (UNDERPASSES AND OVERPASSES); PARKING STRUCTURES AND OTHERS; BRIDGE CONSTRUCTION WITH PRECAST CONCRETE UNITS; SOME PRECAST CONCRETE BRIDGES IN SWEDEN; CONSTRUCTION OF PRECAST CONCRETE BRIDGES IN SPAIN. DETAILS ARE GIVEN OF BRIDGE CONSTRUCTION METHODS USING PRECAST REINFORCED OR PRESTRESSED CONCRETE ELEMENTS. /LCPC/RRL/

Venuat, M *Rev Matls Constr & Trav Publics /Fr/* Aug. 1969

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 215081

STATE OF THE ART OF THE USE OF SLIDING FORMS

A REVIEW IS PRESENTED OF THE USES OF SLIDING FORMS. THE BASIC TECHNICAL ASPECTS OF THIS CONSTRUCTION METHOD ARE OUTLINED, AND MENTION IS MADE OF THE PRECAUTIONS TO TAKE TO OBTAIN A CONCRETE OF PLEASING APPEARANCE. /TRRL/

Adam, M

La Construction Moderne /France/ No. 2, Mar. 1970, pp 22-5, 1 Fig, 9 Phot

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 215102

REPORT OF THE TECHNICAL COMMITTEE ON LOW COST ROADS

CONTENTS: GENERAL ACTIVITY REPORT MANUAL AND MECHANICAL METHODS FOR HIGHWAY CONSTRUCTION AND MAINTENANCE REGIONAL AND NATIONAL SURVEYS OF ROADMAKING MATERIALS INFLUENCE OF ENVIRONMENT

ON THE DESIGN OF ROADS VARIOUS QUESTIONS AND INFORMATION UNESCO MANUAL ON THE CONSTRUCTION AND MAINTENANCE OF ROADS IN DEVELOPING COUNTRIES CONCLUSIONS

Perm Intl Assoc Road Congresses Proc 1967

3A 215106

TWO WAYS TO BUILD SUBWAY STATIONS

THE BAY AREA RAPID TRANSIT SYSTEM IS USING TWO DIFFERENT UNDERGROUND CONSTRUCTION METHODS AT THE MONTGOMERY ST. AND POWELL ST. STATIONS. BOTH STATIONS WILL BE SIMILAR WITH ALMOST THE SAME DIMENSIONS AND VOLUME OF DIRT TO BE EXCAVATED. AT POWELL ST., THE CONTRACTOR IS COMPLETING THE 30-INCH CONCRETE WALL AROUND THE STATION BEFORE BEGINNING THE MAJOR EXCAVATION. IT ELIMINATES THE NECESSITY OF DEWATERING. AT MONTGOMERY ST., THE CONTRACTOR ELECTED TO HOLD THE WALLS OF THE EXCAVATION WITH SOLDIER PILES AND TIMBER LAGGING. HE HAD TO DEWATER AND UNDERPIN 11 BUILDINGS, BUT HE COULD START MOVING DIRT EARLY. DESCRIBED ALSO IS THE EQUIPMENT USED BY BOTH CONTRACTORS.

Pacific Road Builder & Engineering Rev June 1968

3A 215109

CONCRETE DOWN THE SPOUT

EQUIPMENT, CONSTRUCTION TECHNIQUES AND PRIMARY REQUIREMENTS FOR THE SUCCESSFUL PLACEMENT OF TREMIE CONCRETE ARE DESCRIBED. TREMIE CONCRETE IS A NAME GIVEN TO THE METHOD OF PLACING CONCRETE UNDER WATER BY MEANS OF A PIPE CALLED A TREMIE PIPE. CONCRETE OF HIGH SLUMP IS NECESSARY IN ORDER TO ACHIEVE HIGH-QUALITY CONCRETE WITH THIS METHOD. CONCRETE MUST BE POURED BELOW THE SURFACE OF THE WATER AND THEN INTRODUCED BELOW THE PREVIOUSLY PLACED FRESH CONCRETE IN A CONTINUOUS OPERATION, CAUSING AN OUTWARD AND UPWARD FLOW. ADVANTAGES OF TREMIE CONCRETE ARE: (1) IT IS UNNECESSARY TO DE-WATER THE CAISSON OR COFFERDAM, (2) IT IS POSSIBLE TO PLACE LARGE VOLUMES OF CONCRETE VERY QUICKLY AT GREAT DEPTHS, (3) THE CURING CONDITIONS ARE PERFECT, AND (4) VOIDS AND HONEYCOMBS ARE ELIMATED PROVIDED THE TREMIE SEAL IS NOT BROKEN.

Concrete Construction July 1968

3A 215111

INVESTIGATION OF STRENGTH, FROST-RESISTANCE AND IMPERMEABILITY OF CONCRETE CONSTRUCTION JOINTS

THE LIFE SPAN AND RELIABILITY OF MONOLITHIC CONCRETE STRUCTURES DEPENDS TO A GREAT DEGREE ON CORRECT METHODS OF PLACING CONCRETE DURING CONSTRUCTION. THE STRENGTH OF CONNECTION OF CONCRETE WITH CONSTRUCTION JOINTS AND INTERVAL BETWEEN CONCRETING UP TO 8 HOURS DECREASES UP TO 12%, IN THE CASE WITH NO SPECIAL TREATMENT OF THE JOINT SURFACE. THE STRENGTH OF CONNECTION OF CONCRETE WITH CONSTRUCTION JOINTS AND INTERVAL BETWEEN CONCRETING OF 16 HOURS TO 15 DAYS DECREASES BY 18 TO 29% BY COMPARISON WITH STRENGTH OF TEST PIECES WITHOUT JOINTS, IN THE CASE WITH CORRECT AND CAREFUL TREATMENT OF JOINT SURFACES. FOR EACH TYPE OF CEMENT ONE SHOULD CAREFULLY ASCERTAIN MAXIMUM ALLOWABLE TIME BETWEEN STAGES OF CONCRETING WITHOUT FORMATION OF CONSTRUCTION JOINTS, THAT IS, WITHOUT TREATMENT OF THE JOINT SURFACE. THE FROST-RESISTANCE OF CONCRETE WITH CONSTRUCTION JOINTS, IF PREPARED BY AN ACCEPTED METHOD ENSURES ADEQUATE LIFE-SPAN FOR MONOLITHIC REINFORCED-CONCRETE STRUCTURES. THE COMPOSITION OF THE CLINKER HAS NO REAL EFFECT ON STRENGTH OF CONNECTION OF CONCRETE JOINTS, NOR ON FROST-RESISTANCE (WHEN TESTED UP TO 300 CYCLES), NOR ON IMPERMEABILITY. HOWEVER, THE PERSENCE IN THE

CEMENT OF A LARGE AMOUNT OF GYPSUM (IN THE FORM OF A SEMIHYDRATE) CAUSES RAPID STIFFENING AND LESS OF WORKABILITY OF CONCRETE MIXES, AND THIS MAKES FOR DIFFICULT CONCRETE PLACING AND MAY HARM THE STRUCTURE OF THE CONCRETE. /AUTHOR/

Trinker, BD *Hydrotechnical Construction* Sept. 1967

3A 215121

NEW DEVELOPMENTS IN PAVEMENT JOINTING

HISTORY IS BRIEFLY REVIEWED ON CONCRETE PAVEMENT CONSTRUCTION IN MICHIGAN. CHANGES IN PAVEMENT JOINT CONSTRUCTION INCORPORATED IN THE 1940 STANDARD SPECIFICATIONS REFLECT CONCLUSIONS REACHED FROM STUDIES ON THE PREVIOUS BEHAVIOR UNDER LOAD AND ALSO THE STRUCTURAL EFFECTIVENESS OF TYPICAL LONGITUDINAL AND TRANSVERSE JOINT DESIGNS. A STUDY OF FAILED JOINTS DISCLOSED THAT THE MAIN RESPONSIBILITY FOR FAILURE RESTED ON TWO OR THREE OF THE FOLLOWING FACTORS: (1) MISALIGNMENT OF THE DOWEL BARS VERTICALLY OR HORIZONTALLY DUE TO BASKET WEAKNESS, (2) LOCKING OF JOINTS BECAUSE OF IMPROPER COATING OF BARS PRIOR TO PLACEMENT, (3) LOCKING OF JOINTS CAUSED BY INFILTRATION OF WATER, (4) CARELESS PLACEMENT OF THE DOWEL ASSEMBLY DURING CONSTRUCTION, AND (5) INFILTRATION OF SOIL INTO THE JOINT OPENING AT THE SIDES AND BOTTOM OF THE SLAB DUE TO THE RUPTURING OF THE SUBSTITUTE BASE PLATE MATERIAL. IN 1952, A DOWEL BASKET ASSEMBLY WAS FABRICATED IN ACCORDANCE WITH A MODIFICATION OF AN ASSEMBLY SUPPLIED BY THE BETHELEHEM STEEL COMPANY. THIS BASKET DESIGN MADE PROVISION FOR THE CENTER WIRES OF THE BASKET TO STRADDLE THE BASE PLATE PARTING STRIP AND HOLD IT IN PROPER POSITION DURING CONCRETE PLACEMENT. DOWEL ALIGNMENT HAS BEEN GREATLY IMPROVED AND DELAYS IN PAVING OPERATIONS TO PERMIT CORRECTION OF IMPROPERLY PLACED BASKET ASSEMBLIES ARE NEGLIGIBLE. ANOTHER DESIGN CHANGE SUBSTITUTED SAW LONGITUDINAL JOINT CONSTRUCTION IN PLACE OF THE PRE-MOLDED TYPE LONG USED. TESTS ARE REPORTED ON SEALING COMPOUNDS. STYROFOAM AND CORRUGATED PAPERBOARD WERE TESTED TO FORM CONTRACTION JOINT GROOVES. THE STYROFOAM METHOD APPEARED TO BE A SUBSTITUTE FOR SAWED TRANSFER JOINTS AT REASONABLE COST AND WITHOUT THE RISK OF RANDOM CRACKING. PROBLEMS NOW UNDER STUDY ARE: FREEZING OF JOINTS DUE TO BOND BETWEEN THE CONCRETE AND LOW TRANSFER BARS, AND EROSION OF CONCRETE AROUND THE LOW TRANSFER BAR.

Laird, CB *Highway Research Board Bulletin* 57

3A 215122

INSULATED FORMS FOR WINTER CONSTRUCTION OF BRIDGES

THE THESIS IS DEVELOPED THAT BRIDGE CONSTRUCTION IN THE NORTH TEMPERATE ZONE STATES OF THE UNITED STATES HAS BEEN TRADITIONALLY SUBJECT TO THE DISADVANTAGE OF A SHORT CONSTRUCTION SEASON, DUE TO THE COLD WEATHER CONDITIONS EXISTING DURING FIVE MONTHS OF THE YEAR. THE ONLY ALTERNATIVE TO THE SHORT CONSTRUCTION SEASON HAS BEEN THE EXPENSIVE ALTERNATE OF USING EXTERNAL HEAT AND HOUSINGS OVER THE MASS OF CONCRETE TO BE POURED. FURTHERMORE, RECENT IMPROVEMENT IN TYPES OF INSULATING MATERIALS HAS OPERATED TO REDUCE THE ADDITIONAL COST OF WINTER CONSTRUCTION WITH NO ADVERSE EFFECTS ON THE CONCRETE STRUCTURES PRODUCED AND WITH AN ATTENDANT ELIMINATION OF HAZARD BY FIRE. THE GREATLY EXPANDED HIGHWAY CONSTRUCTION PROGRAM EMPHASIZING THE INTERSTATE SYSTEM, WITH A DISPROPORTIONATELY LARGE NUMBER OF STRUCTURES, CREATES SUCH A DEMAND ON THE EXISTING CONSTRUCTION PLANT THAT THE PROGRAM CANNOT BE ACCOM-

PLISHED IN A SHORT CONSTRUCTION SEASON AND THE AVAILABLE PLANT MUST BE ECONOMICALLY USED FOR A FULL TWELVE MONTHS IF INTERESTS OF THE STATES AND OF THE CONTRACTORS THEMSELVES ARE TO BE PROPERLY SERVED. THE ILLUSTRATIONS USED ARE FROM PROJECTS INITIATED IN SOUTH DAKOTA IN 1952 AND 1953 AND ARE INTENDED TO SHOW THAT PROPER USE OF MODERN INSULATION IN CONNECTION WITH FORMS OF BRIDGE STRUCTURES OFFERS A SOLUTION WHICH IS SUFFICIENTLY ECONOMICAL TO JUSTIFY YEAR-ROUND CONSTRUCTION. THE EXPERIENCE OF THIS STATE, SOUTH DAKOTA, INDICATES THAT LOW TEMPERATURES ALONE ARE NOT SUFFICIENT JUSTIFICATION TO SUSPEND CONSTRUCTION OPERATIONS IN THE CASE OF THE MAJORITY OF CONCRETE STRUCTURES OF THE GIRDER OR SLAB TYPE AND IN THE CASE OF FOUNDATIONS FOR STRUCTURES OF ANY TYPE. /AUTHOR/

Scurr, KR *Highway Research Board Bulletin* 1957

3A 215123

NUCLEAR EXCAVATION RESEARCH

RESEARCH TO DATE HAS CONFIRMED THE BASIC THEORIES OF CRATERING APPLICABLE TO NUCLEAR EXCAVATION. CONTINUING ADVANCES AND IMPROVED TECHNIQUES ARE EXPECTED, AS WELL AS NUMEROUS NEW APPLICATIONS. STUDIES SO FAR INDICATE A VARIETY OF REALISTIC USES FOR NUCLEAR EXPLOSIVES IN CONSTRUCTION. SOME OFFER ECONOMIES AND OTHERS SHOW POSSIBILITIES FOR THE CONSTRUCTION OF PROJECTS CONSIDERED IMPRACTICAL BY OTHER MEANS. INTEREST SHOWN BY THE ENGINEERING PROFESSION WILL BE A MAJOR FACTOR IN THE DEVELOPMENT AND APPLICATION OF NUCLEAR EXPLOSIVES AS A NEW AND POWERFUL CONSTRUCTION TOOL. /AUTHOR/

Kurtz, MK *Military Engineer* Sept. 1968

3A 215128

A BIBLIOGRAPHY ON WINTER CONSTRUCTION-1940-1967

REFERENCES CONTAINED IN THIS BIBLIOGRAPHY WERE DERIVED PRIMARILY FROM A SEARCH OF THE U. S. ARMY COLD REGIONS RESEARCH AND ENGINEERING LABORATORY, THE ARCTIC BIBLIOGRAPHY, THE BIBLIOGRAPHY ON SNOW, ICE AND PERMAFROST, THE POLAR BIBLIOGRAPHY, THE INDUSTRIAL ARTS INDEX AND THE APPLIED SCIENCE AND TECHNOLOGY INDEX. AN AUTHOR INDEX IS PRESENTED OF THE 751 REFERENCES CONTAINED.

Fulwider, CW Stearman, JH *Crrrel Special Reports, Army Dept /US/* Apr. 1968

3A 215135

TRIGONOMETRIC CONSTRUCTION STAKING (TRIGSTAK)

TRIGSTAK (ACRONYM FOR TRIGONOMETRIC STAKING) IS A METHOD OF CONSTRUCTION STAKING BY HORIZONTAL AND VERTICAL INTERSECTION LINES OF SIGHT FROM TWO OR MORE THEODOLITES STRATEGICALLY LOCATED AT THE CONSTRUCTION SITE OR ROAD ALIGNMENT. IT IS ACTUALLY AN EXTENSION OF THE AUTOMATION ALREADY ACHIEVED IN THE MAPPING AND DESIGN OF MOUNTAIN HIGHWAYS. PHOTOGRAMMETRIC DIGITIZING IS USED TO OBTAIN A MATHEMATICAL MODEL OF THE EARTH'S SURFACE OVER THE ENTIRE AREA OF THE PROPOSED CONSTRUCTION. THIS DIGITAL TERRAIN MODEL IS STORED IN A COMPUTER ALONG WITH THE HORIZONTAL AND VERTICAL GEOMETRY AND ROADBED TEMPLATE OF THE PROPOSED HIGHWAY TO OBTAIN A MASS DIAGRAM AND AN EARTHWORK SUMMARY. INPUT OF THE TRIGSTAK PROGRAM ITSELF INCLUDES COORDINATES OF THE TRIANGULATION STATIONS, THE STATION (PLUSES) OF SLOPE STAKES TO BE SET FROM EACH TRIANGULATION STATION, AND VERTICAL CONTROL DATA. TRIGSTAK IS ALSO USED TO CHECK PHOTOGRAMMETRIC MAPS AND DIGITIZING USING THE TERRAIN DATA ONLY. /AUTHOR/

Stipp, DW *Surveying and Mapping* Sept. 1968

3A 215142

FEASIBILITY OF COLD-WEATHER EARTHWORK

MOST EARTHWORK OPERATIONS ARE MORE COSTLY IN THE COLD SEASON THAN IN THE WARM. HOWEVER, THE BENEFITS OF KEEPING CONSTRUCTION FORCES AND EQUIPMENT OPERATIVE MORE OF THE TIME, PLUS ADVANCING THE COMPLETION DATE OF A MODERN, SAFER FACILITY, MAY MORE THAN COMPENSATE FOR THE INCREASE IN UNIT COSTS. THE COLD-WEATHER EARTHWORK EXPERIENCES OF THE NORTHERN STATES OF THE UNITED STATES, THE PROVINCES OF CANADA, AND THE SCANDINAVIAN COUNTRIES HAVE BEEN STUDIED IN THE LITERATURE AND BY BRIEF QUESTIONNAIRES. THIS EFFORT HAS SERVED TO DEFINE (1) THE MANNER IN WHICH THE WINTER WEATHER AND SOIL CONDITIONS RESTRICT THE LENGTH OF THE CONSTRUCTION SEASON, (2) THE DESIGNS AND CONSTRUCTION PRACTICES EMPLOYED TO COPE WITH THE WINTER CONDITIONS, AND (3) AN ESTIMATE OF THE RELATIVE UNIT COSTS FOR VARIOUS WINTER OPERATIONS. THE ADVANTAGES OF COLD-WEATHER EARTHWORK HAVE BEEN DEFINED IN A SIMPLE LINEAR ECONOMIC MODEL. AN ASSESSMENT OF DETERRENENTS AND BENEFITS LEADS TO THE CONCLUSION THAT COLD-WEATHER EARTHWORK IS ECONOMICALLY AS WELL AS TECHNICALLY FEASIBLE ON MANY HIGHWAY PROJECTS IN THE FROST AREA OF NORTH AMERICA. /AUTHOR/

Lovell, CW Osborne, AM *Highway Research Record, Hwy Res Board* 1968

3A 215144

CONSTRUCTION TECHNIQUES AS RELATED TO BRIDGE DECK ROUGHNESS

TECHNIQUES AND PROCEDURES USED DURING THE CONSTRUCTION OF BRIDGE DECKS WERE SURVEYED AND RECORDED TO IDENTIFY THOSE FACTORS MOST CLOSELY RELATED TO THEIR ROUGHNESS. DATA FROM ROUGHNESS TESTS PERFORMED AFTER COMPLETION OF THE DECKS WERE RELATED TO THE CONSTRUCTION VARIABLES AS WELL AS TO OTHER DESIGN AND GEOMETRIC FACTORS. THE SCREEDING TECHNIQUE USED DURING CONSTRUCTION PROVED TO BE THE MOST SIGNIFICANT FACTOR RELATED TO THE ROUGHNESS OF THE COMPLETED BRIDGE DECKS. IT WAS FOUND THAT LONGITUDINAL MECHANICAL OSCILLATING TYPE SCREEDING FOLLOWED BY LONGITUDINAL BELTING AND/OR BURLAP DRAG CONSISTENTLY PRODUCED THE SMOOTHEST DECKS ON SIMPLE SPAN TYPE BRIDGES. LONGITUDINAL FLOATING OPERATIONS FOLLOWING TRANSVERSE TYPE SCREEDING REDUCED DECK ROUGHNESS BY AS MUCH AS 25 PERCENT. ISSUANCE IN 1964 OF SPECIAL PROVISIONS FOR THE CONSTRUCTION OF BRIDGE DECKS BY THE VIRGINIA DEPARTMENT OF HIGHWAYS ENCOURAGED MORE UNIFORM CONSTRUCTION PROCEDURES, REQUIRED MECHANICAL SCREEDING MACHINES, AND STATED A PREFERENCE FOR THE USE OF LONGITUDINAL TYPE SCREEDING. STUDIES SHOW THAT RECENTLY CONSTRUCTED BRIDGES HAVE BETTER RIDING QUALITIES THAN THOSE CONSTRUCTED PRIOR TO 1964. THE CONSIDERABLE VARIATION IN RESULTS OBTAINED, HOWEVER, SUGGESTS THAT A HIGH STANDARD OF WORKMANSHIP AND EQUIPMENT MUST BE MAINTAINED TO OBTAIN OPTIMUM RESULTS. /AUTHOR/

Hilton, MH *Highway Research Record, Hwy Res Board* 1968

3A 215164

INSTANT COST ACCOUNTING

AUTOMATED DATA SERVICES (ADS), OPERATED OUT OF ST. PAUL, MINNESOTA, ENABLES A CONTRACTOR TO KEEP ACCURATE INDIVIDUAL JOB COSTS, ANALYZE WORK IN PROGRESS, AND KEEP IN TOUCH WITH THE MONTHLY FINANCIAL CONDITION OF HIS COMPANY. THE COMPUTER SERVICE PERMITS CONTROL OF CURRENT ACCOUNTS PAYABLE NOT ONLY BY JOB BUT BY VENDOR. ADS PROVIDES EACH OF ITS CUSTOMER-CONTRACTORS WITH A CASH BOOK, BILLINGS REGISTER, ACCOUNTS PAYABLE REGISTER, AND A GENERAL JOURNAL.

THE CONTRACTOR KEEPS THESE DOCUMENTS UPDATED AND SENDS THE CARBON COPIES TO ADS FOR PREPARATION OF THE COMPUTERIZED REPORTS. THE CONTRACTOR RECEIVES THE FOLLOWING OUTPUT FORMS: BALANCE SHEET, INCOME STATEMENT, ACCOUNTS RECEIVABLE AND PAYABLE, JOB COSTS RECORDS FOR EACH CONSTRUCTION PROJECT, & A TRIAL BALANCE AND GENERAL LEDGER. IN ADDITION TO THESE BASIC REPORTS, THE CUSTOMER-CONTRACTOR CAN CONTRACT FOR THE FOLLOWING OPTIONAL REPORTS: (1) A JOB ACTIVITY REPORT, (2) AN EQUIPMENT REPORT, AND (3) AN ACCOUNT ANALYSIS REPORT. THIS SERVICE PROVIDES A SAVING IN TIME AS WELL AS MONEY.

Davis, J *Constructor* pp 34-36, Jan. 1969

3A 215173

PLASTIC TENT HAS INTERESTING POSSIBILITIES IN CANADIAN INDUSTRY

A PLASTIC, INFLATABLE BUBBLE, OR AIR SHELTER IS BEING TESTED IN TORONTO. THE SHELTER IS AIR SUPPORTED, MADE OF HEAVY-GAUGE PLASTIC, AND DESIGNED TO COMBAT WINTER WEATHER. IT WAS DEVELOPED AND TESTED IN SWEDEN WHERE IT IS USED WIDELY BY INDUSTRY, SPORTS AND THE MILITARY, FOR A WAREHOUSE OR A GARAGE. THE BUILDING INDUSTRY USES IT EXTENSIVELY TO PROTECT BOTH WORKERS AND BUILDINGS FROM WINTER WEATHER. MADE OF STRONG SYNTHETIC PLASTIC FIBRES, THE BUBBLE, OR ENVELOPE, IS PREFABRICATED BY MEANS OF HIGH-FREQUENCY WELDING. IT IS ABSOLUTELY FIREPROOF. ENTERED THROUGH TWO DOORS, WHICH SERVE AS AN AIR-LOCK, THE SHELTER HAS HOT AIR UNITS (INFLATION FANS), WHICH NOT ONLY PROVIDE THE REQUIRED VOLUME OF AIR TO KEEP THE DOME STANDING, BUT ALSO SUPPLY THE NECESSARY HEATING. PRODUCED IN SECTIONS, WHICH MAKES EXTENSIONS TO THE SHELTER RELATIVELY SIMPLE, THE NORDIC AIR SHELTER MAY BE ERECTED IN ONLY A FEW DAYS TIME, OFTEN FORTY-EIGHT HOURS OR LESS. IT TAKES LESS THAN A DAY TO DEFLATE THE SHELTER AND PREPARE IT FOR STORAGE. IT IS ANTICIPATED THAT THE SHELTER WILL BE USED FOR WINTER CONSTRUCTION SITES. IT WILL CERTAINLY PERMIT THE POURING OF CONCRETE IN COLD WINTER MONTHS.

Canadian Pit and Quarry Jan. 1969, 18

3A 215175

ILLINOIS DEPARTMENT TO TEST NEW BRIDGE BUILDING TECHNIQUES

NEW TECHNIQUES IN BRIDGE CONSTRUCTION WILL BE TESTED IN SIDE-BY-SIDE COMPARISONS WITH CONVENTIONAL METHODS IN TWO RESEARCH PROJECTS PROPOSED BY THE ILLINOIS DIVISION OF HIGHWAYS. THE PROPOSAL CALLS FOR CONSTRUCTION OF BRIDGE STRUCTURES AT TWO DIFFERENT SITES. A FOUR-SPAN, DUAL-STRUCTURE CONCRETE BRIDGE WITH GALVANIZED REINFORCEMENT IN THE CONCRETE DECKING IS PROPOSED FOR ONE OF THE PROJECTS WHICH WILL TEST THE EFFECTIVENESS OF GALVANIZED REINFORCING STEEL AS A DETERRENT TO SPALLING IN CONCRETE BRIDGE DECKS. IN THE DUAL STRUCTURES, ONLY THE TOP REINFORCING STEEL WILL BE GALVANIZED; IN THE OTHER, BOTH TOP AND BOTTOM STEEL WILL BE GALVANIZED. THE OTHER PROJECT WILL COMPARE MAINTENANCE COSTS FOR GALVANIZED AND UNGALVANIZED STEEL IN A STRUCTURAL STEEL BRIDGE. IT ALSO WILL BE A DUAL STRUCTURE BRIDGE, WITH STEEL IN ONE STRUCTURE TO BE GALVANIZED. THE COMPANION STRUCTURE BUILT ALONGSIDE WILL RECEIVE THE STATE'S STANDARD SYSTEM. /AUTHOR/

Hwy Bldr, Associated Penn Constructors Feb. 1969

3A 215183

HIGHWAY SHOULDERS CONSTRUCTION PRACTICES

A BRIEF REVIEW IS PRESENTED OF SHOULDER PRACTICES DURING THE LAST TWENTY YEARS IN OHIO. THE POLICY FOR NEW CONSTRUCTION PROVIDES STABILIZED SHOULDERS

ALONG THE OUTSIDE PAVEMENT EDGE OF ALL DIVIDED PAVEMENT HIGHWAYS, AND ALONG EACH EDGE OF ALL TWO-LANE PAVEMENTS WITH MORE THAN 200 HEAVY COMMERCIAL VEHICLES PER DAY. SEATED EARTH SHOULDERS ARE STILL GENERALLY USED ON LOW TRAFFIC ROADS. THE PRESENT STANDARD FOR STABILIZED SHOULDERS CONSISTS OF A FOUR-FOOT WIDTH OF STABILIZED CRUSHED AGGREGATE, SIX-INCH COMPACTED DEPTH, FINISHED FLUSH WITH THE PAVEMENT SURFACE, WITH A SLOPE OF 3/4 INCH PER FOOT. MATERIALS FOR THIS COURSE ARE CRUSHED LIMESTONE, CRUSHED SLAG OR CRUSHED GRAVEL. SHAPING THE SUBGRADE FOR THE STANDARD STABILIZED SHOULDER COURSE IS USUALLY DONE WITH A MOTOR GRADER, OFTEN WITH A SPECIAL BLADE OF PROPER DIMENSIONS FOR THE PURPOSE. AFTER THE SUBGRADE IS SHAPED AND COMPACTED, THE CRUSHED AGGREGATE IS SPREAD UPON THE SUBGRADE IN LAYERS NOT TO EXCEED SIX INCH COMPACTED THICKNESS. FOR INITIAL COMPACTION OF THE STABILIZED SHOULDER MATERIAL, SPECIFICATIONS PERMIT THE USE OF ANY SUITABLE EQUIPMENT APPROVED BY THE ENGINEER. EFFECTIVE COMPACTION CONTROL PROCEDURES AND CONTINUAL INSPECTION DURING CONSTRUCTION ARE NECESSARY TO INSURE ADEQUATE COMPACTION OF STABILIZED SHOULDERS AND THE SUBGRADES. TO IMPROVE PRACTICES FOR THE CONSTRUCTION OF FLEXIBLE PAVEMENTS, IT HAS BEEN PROPOSED TO KEEP ALL HEAVY CONSTRUCTION EQUIPMENT OFF THE PAVEMENT AND TO USE THE SHOULDERS. IT IS ANTICIPATED THAT SUCH REQUIREMENTS WILL CREATE PROBLEMS IN SHOULDER CONSTRUCTION. ON HEAVILY TRAVELLED PRIMARY ROADS, THERE IS AN UNQUESTIONABLE NEED FOR STABLE SHOULDERS WITH SOME TYPE OF PAVED SURFACE TO PROVIDE SURFACE DRAINAGE. TO MEET FUTURE NEEDS ON PRIMARY ROADS, IT IS INDICATED THAT STABILIZED SHOULDERS, PROVIDED DURING CONSTRUCTION WITH SOME TYPE OF BITUMINOUS SURFACE, WILL BE NECESSARY.

Shepard, CH *Highway Research Board Bulletin* 1957

3A 215186

NEW TECHNIQUE 'EXTRUDES' FOAM BUILDINGS

AN IDEA IS PRESENTED FOR EXTRUDING FOAMED-IN-PLACE INTEGRAL SKIN SANDWICH STRUCTURES. THE MIDWEST APPLIED SCIENCE CORPORATION (MASC) HAS CHOSEN A TWO-COMPONENT, FILLED EPOXY AS MOST SUITABLE FOR BUILDING CONSTRUCTION. THE ERECTOR CONSISTS OF AN ARTICULATED BOOM SYSTEM ON WHICH THE TRAVELING MOLD IS MOUNTED AND THROUGH WHICH MATERIAL COMPONENTS ARE FED TO THE HEAD AT THE MOLD. IT ALSO CARRIES COOLING LINES TO THE MOLD. FOAMING EQUIPMENT AND SUPPLY TANKS MOUNTED ON THE TRUCK COMPLETE THE SELF-CONTAINED SYSTEM. THE MOST UNIQUE COMPONENT IS THE TRAVELING MOLD WHICH BASICALLY WILL CONSIST OF TWO 36 IN. LONG STEEL PLATES AND TWO ENDLESS, EMBOSSED, MYLAR RELEASE BELTS. WITH SUCCESSIVE PASSES, ANY DESIRED HEIGHT CAN BE ACHIEVED FROM FOAMED IN PLACE SEGMENTS 9-12 IN. HIGH. NO TRIMMING WILL BE NECESSARY BETWEEN PASSES.

Plastics Technology July 1968

3A 215187

TEXTURING OF CONCRETE PAVEMENT

PRELIMINARY WORK BY CALIFORNIA ON TEXTURING OF CONCRETE PAVEMENTS IS DESCRIBED. THE PROBLEM HAS RESOLVED INTO TWO GENERAL AREAS: SECURING ADEQUATE TEXTURE DURING CONSTRUCTION, AND MAINTAINING TEXTURE, AS BUILT, BY USING MATERIALS AND CONSTRUCTION PRACTICES THAT INSURE DURABLE SURFACE MORTAR. VARIOUS TEXTURE PATTERNS WERE FORMED INTO THE SURFACE OF LABORATORY-CAST SLABS USING A VARIETY OF PROTOTYPE DEVICES. SKID TESTS WERE PERFORMED ON THESE SLABS. A PROMISING PATTERN WAS SELECTED AND USED ON SHORT SECTIONS OF THREE FREE-

WAYS. SOME OF THE RESULTS WERE DISAPPOINTING. A UNIFORM TEXTURE OVER A LARGE AREA COULD NOT BE ACHIEVED BECAUSE OF VARYING MORTAR PROPERTIES. IT WAS ALSO DISCOVERED THAT THE PATTERN SELECTED, WHEN FORMED TOO DEEPLY, CAUSED AN ADVERSE REACTION BY SOME VEHICLES. ADDITIONAL WORK IS PLANNED USING OTHER TEXTURE PATTERNS. OTHER SURFACE TREATMENTS INCLUDED BROADCASTING OF SLAG AND SELECTED COARSE SAND PARTICLES ON THE SURFACE WHILE DRAGGING WITH BURLAPS, AND BROOMING. SKID TESTS ARE BEING PERFORMED ON A PERIODIC BASIS, BUT IT IS TOO SOON TO DRAW CONCLUSIONS REGARDING THE LONG-TERM SKID RESISTANCE AS AFFECTED BY TRAFFIC AND WEATHER. NEW CURING COMPOUNDS AND SO-CALLED SURFACE HARDENERS WERE APPLIED TO SHORT TEST SECTIONS OF FREEWAYS IN AN ATTEMPT TO IMPROVE MORTAR DURABILITY. LABORATORY TESTS PREVIOUSLY PERFORMED INDICATED THAT SOME IMPROVEMENT COULD BE EXPECTED FROM THE USE OF BETTER CURING COMPOUNDS AND HARDENERS. AGAIN, THESE TEST SECTIONS HAVE NOT BEEN IN SERVICE LONG ENOUGH TO FORM ANY CONCLUSIONS REGARDING THEIR EFFECTIVENESS. PLANNED FUTURE WORK INCLUDES A CONTINUATION OF TEXTURING STUDIES, A SEARCH FOR EFFECTIVE SURFACE TREATMENTS, A STUDY OF FIELD PRACTICES THAT AFFECT SURFACE MORTAR QUALITY AND TEXTURE, AND ADDITIONAL WORK ON GROOVING OF OLDER PAVEMENTS TO OBTAIN OR RESTORE ADEQUATE SKID RESISTANCE. SPECIFICATIONS WILL BE DEVELOPED AS WORK PROGRESSES TO IMPROVE CHARACTER AND DURABILITY OF THE SURFACE TEXTURE. /AUTHOR/

Spellman, DL *Highway Research Board Special Reports* 1969

3A 215188

CONSTRUCTION OF NONSKID PAVEMENT SURFACES

CONSTRUCTION PROCEDURES ARE REVIEWED THAT ARE USED IN CALIFORNIA FOR THE CONSTRUCTION OF SKID-RESISTANT PAVEMENTS. CONSTRUCTION PRACTICES IN USE WITH ASPHALT-CONCRETE PAVING, PORTLAND CEMENT CONCRETE PAVING, AND GROOVING EXISTING CONCRETE PAVEMENT ARE REVIEWED. THE CONSTRUCTION ASPECTS THAT CAN BE EXPECTED TO AFFECT PERFORMANCE OF NEW PORTLAND CEMENT CONCRETE PAVEMENT SURFACE TEXTURE SEEM TO BE: (1) NATURE OF THE CONCRETE AGGREGATE, (2) AMOUNT OF MIXING WATER USED, (3) NATURE AND AMOUNT OF ANY ADMIXTURES USED, (4) CEMENT FACTOR, (5) NATURE AND AMOUNT OF SURFACE MANIPULATION IN FINISHING, (6) AMOUNT OF ADDITIONAL WATER USED DURING FINISHING, (7) AMOUNT OF BLEED WATER MIXED INTO SURFACE MORTAR, (8) TIMING OF FINISHING OPERATIONS, (9) METHOD AND DEPTH OF TEXTURING, (10) ORIENTATION OF TEXTURE SERRATIONS, (11) TIMING OF THE CURING OPERATION, (12) EFFECTIVENESS OF CURING MATERIALS AS APPLIED, (13) EXTENT OF CURING PERIOD BEFORE PAVEMENT IS OPENED TO TRAFFIC, (14) AMOUNT OF ABUSE BY CONSTRUCTION EQUIPMENT IN CONSTRUCTING APPURTENANT FACILITIES, AND (15) EXTENT OF BUMP CUTTING TO MEET SMOOTHNESS REQUIREMENTS. THE FEATURES OF GROOVING THAT CAN BE EXPECTED TO AFFECT SKID RESISTANCE ARE: (1) WIDTH AND DEPTH OF GROOVES, (2) SPACING OF GROOVES, (3) AMOUNT OF LANE WIDTH GROOVED, (4) ORIENTATION SPREADING AND COMPACTING ASPHALT-CONCRETE PAVEMENT IN CALIFORNIA APPEAR TO HAVE A VERY MINOR EFFECT ON THE RESULTING SKID RESISTANCE. AGGREGATES AVAILABLE IN CALIFORNIA FOR ASPHALT-CONCRETE MIXES ARE RELATIVELY POLISH RESISTANT. HOWEVER, EXPERIENCE INDICATES THAT SURFACE TREATMENTS SOMETIMES LEAD TO LOSS OF SKID-RESISTANCE VALUE.

Spickelmire, LS *Highway Research Board Special Reports* 1969

3A 215202

SLURRY-TRENCH CONSTRUCTION FOR BASEMENT WALL OF WORLD TRADE CENTER

NEW YORK CITY'S WORLD TRADE CENTER PROJECT IN MANHATTAN HAS A HUGE BASEMENT 70 FT. DEEP AND 11 ACRES IN AREA. IN BUILDING THE EXTERIOR WALL FOR THIS HOLE, THE SLURRY-TRENCH METHOD WAS EMPLOYED. THIS TECHNIQUE WAS CHOSEN BECAUSE CONVENTIONAL CONSTRUCTION METHODS WOULD HAVE BEEN DIFFICULT. AMONG THE PROBLEMS WERE (1) SUBSURFACE OBSTACLES SUCH AS OLD BURIED WHARVES, (2) DEEP LOWERING OF THE WATER TABLE OUTSIDE OF THE SITE HAD TO BE AVOIDED, (3) IT WAS DESIRABLE TO LEAVE GAPS IN THE WALL DURING UTILITY RELOCATION, AND (4) A WATERPROOF WALL EXTENDING DOWN INTO BEDROCK (AS PROVIDED BY THE SLURRY-TRENCH METHOD) WOULD MEAN A NONBUOYANT BASEMENT THE SLURRY-TRENCH METHOD AS APPLIED TO THIS PROJECT IS DESCRIBED AND THE ADVANTAGES OF THE METHOD ARE PRESENTED. BUILDING DEMOLITION OCCURRED SIMULTANEOUSLY WITH THE WALL CONSTRUCTION. COMPLETION OF THE WALL IN EFFECT SEALED OFF THE BASEMENT FROM THE OUTSIDE EXCAVATION CONTINUED INSIDE, WITH ONLY PUMPING REQUIRED TO REMOVE THE EXISTING ENTRAPPED WATER.

Kapp, MS *Civil Engineering Asce* Apr. 1969

3A 215207

LOW COST, LOW TYPE ASPHALT SURFACED ROADS IN THE WESTERN REGIONS OF THE U.S.A.

MAJOR HIGHWAYS BUILT IN THE U.S.A. ARE SURFACED WITH A HIGH TYPE ASPHALTIC CONCRETE PAVEMENT OR A PORTLAND CEMENT CONCRETE PAVEMENT WHEN HIGH TRAFFIC VOLUMES ARE EXPECTED. HOWEVER, WHEN NEW HIGHWAY ROUTES ARE CONSTRUCTED, HIGH TRAFFIC VOLUMES MAY NOT DEVELOP FOR A NUMBER OF YEARS. IN SUCH CASES, STAGE CONSTRUCTION STARTING WITH LOW TYPE ASPHALT SURFACES MAY SERVE TRAFFIC EFFECTIVELY AND AT LOWER COSTS. ADDITIONAL THICKNESSES OF PAVEMENT CAN BE ADDED WHEN HIGH TRAFFIC VOLUMES DEVELOP. IT IS ESSENTIAL THAT ALL ROADS OF ANY IMPORTANCE HAVE ALL WEATHER, DUSTLESS SURFACES. IN MOST AREAS, LOCAL AGGREGATES SUITABLE FOR BASE COURSES AND LOW TYPE, LOW COST ASPHALT SURFACES CAN BE FOUND AND USED. THESE LOW COST SURFACES ON ADEQUATE BASE COURSES WILL GIVE GOOD SERVICE TO LOW OR MEDIUM TRAFFIC VOLUMES RANGING FROM 50 TO 250 VEHICLES PER DAY. INTERMEDIATE CLASSES OF ASPHALT PAVEMENTS SUCH AS BITUMINOUS PENETRATION MACADAM MATS OR PLANT MIX SURFACES CAN CARRY TRAFFIC VOLUMES UP TO 500 OR 600 VEHICLES PER DAY. THE BENEFITS ARE REVIEWED OF ASPHALT SURFACE ROADS. /AUTHOR/

Schwegler, RM

Pavement Association /Brazil, Inst Pesquisas Rodoviaras Symp /Braz/ July 1969

3A 215208

SELECTED BIBLIOGRAPHY ON IMMERSSED TUBES

THE MOST IMPORTANT FEATURE OF THE DEVELOPMENT OF THE TECHNIQUE OF IMMERSSED TUBE TUNNELLING IS THE CHANCE IT OFFERS OF PROVIDING A DRY WATER CROSSING WHERE, FORMERLY, EITHER A BRIDGE OR TUNNEL HAS BEEN MADE PROHIBITIVELY COSTLY BY GROUND CONDITIONS. ALTHOUGH NOT ALWAYS COMPETITIVE WITH BORED TUNNEL OR BRIDGE, WHERE BOTH ARE POSSIBLE, THE PREFABRICATED TUNNEL SHOULD ALWAYS BE GIVEN AT LEAST CURSORY CONSIDERATION BY ENGINEERS INVESTIGATING THE VIABILITY OF A WATER CROSSING. SURPRISINGLY FEW OF THOSE WHO HAVE NOT BEEN DIRECTLY CONCERNED WITH THE DESIGN AND CONSTRUCTION OF A SUNKEN TUBE KNOW THE EXTENT TO WHICH THIS TECHNIQUE HAS BEEN USED. THIS BIBLIOGRAPHY IS THE RESULT OF REFERENCES SELECTED FROM THE LITERATURE OVER A TEN YEAR PE-

RIOD. IT IS REPRESENTATIVE OF EVERY KIND OF IMMERSSED TUBE TUNNEL SO FAR STARTED OR COMPLETED, AND OF EVERY TECHNIQUE EMPLOYED. FOREIGN LANGUAGE REFERENCES HAVE BEEN OMITTED EXCEPT WHERE THEY GIVE DETAILS NOT AVAILABLE IN ENGLISH. /AUTHOR/

Pequignot, CA *Tunnels and Tunneling /UK/* July 1969

3A 215212

CONSTRUCTION PRACTICES FOR PLACING 48-INCH PRECAST, PRESTRESSED CONCRETE PILING IN DEEP WATER

THE PROPOSAL TO CONSTRUCT A STRUCTURE ACROSS MORE THAN A MILE OF OPEN WATER UP TO 80 FT DEEP WAS THE BEGINNING OF AN EXTENSIVE ENGINEERING ECONOMIC ANALYSIS TO DETERMINE THE TYPE AND LENGTH OF STRUCTURE TO FIT THE SITE. A COMPOSITE I-BEAM STRUCTURE 5655.5 FT. LONG SUPPORTED ON A DRIVEN PILE BENT WAS CHOSEN. THE PILE BENTS CONSISTED OF EITHER 8 OR 12 PILES, WITH EACH PILE 48 IN. IN DIAMETER. EACH OF THE 276 PILES WOULD BE A PRESTRESSED, PRECAST CONCRETE CYLINDER PILES. SOIL BORINGS INDICATED THE LENGTH WOULD VARY FROM 25 TO 176 FT. TO WITHSTAND HANDLING AND DRIVING, THE WALL THICKNESS WOULD BE 5 IN. WITH SPIRAL REINFORCING, STRESSING TENDONS AND 8 NO. 4 BARS. EACH OF THE SIXTEEN 7/16-IN. DIAMETER PRESTRESSING CABLES WAS TENSIONED TO STRESS THE 7000-PSI CONCRETE TO 1100 PSI. DRIVING SPECIFICATIONS REQUIRED THE PILING TO BE SEATED WITH 50 BLOWS PER INCH BY A 60,000 FT-LB HAMMER IN NIOBRARA CHALK. THE CONTRACTOR ELECTED TO CAST THE PILING AT THE SITE. THE FIRST METHOD OF PILE PLACEMENT USED A THREE-FINGER JET TO PLACE THE PILING NEAR CHALK AND A HAMMER TO DRIVE THE PILE INTO CHALK. THIS METHOD PROVED INEFFECTIVE, AND SUBSEQUENTLY A SINGLE JET WAS ATTACHED TO THE PILE AND THE PILE JETTED AND DRIVEN SIMULTANEOUSLY WITH THE FINAL SEATING FOR BEARINGS AFTER REMOVAL OF THE JETS. AFTER EACH BENT WAS DRIVEN THE PILES WERE BACKFILLED WITH SAND, CLASS C AND CLASS A CONCRETE. SOME OF THE PILES WERE DRIVEN A TOTAL OF 7000 BLOWS. AFTER THE BENTS WERE COMPLETED, CRACKS WERE OBSERVED IN THE PILING IN JANUARY 1964. INSPECTION REVEALED 52 PILES THAT WOULD REQUIRE REPAIR. THE DAMAGED PILES WERE OPENED UP, CLEANED AND BACK-FILLED WITH DRY-PACK CONCRETE, AND A STEEL REINFORCING SHELL WAS EPOXIED AND BOLTED INTO PLACE. SUCCESSFUL USE OF THESE PILES REQUIRE A KNOWLEDGE OF THE LENGTH TO CAST EACH PILE AND AN ACCURATE BEARING ESTIMATION. DURING CONSTRUCTION, PROPER SUPERVISION MUST BE EXERCISED TO INSURE A SOUND PILE. /AUTHOR/

Grimes, WW *Highway Research Record, Hwy Res Board* 1969

3A 215214

FABRICATION AND ERECTION OF POPLAR STREET ORTHOTROPIC-PLATE DECK GIRDER BRIDGE

THIS PAPER DESCRIBES DESIGN CONCEPTS CONCERNING CONSTRUCTION, AND THE FABRICATION AND ERECTION TECHNIQUES EMPLOYED ON THE FIRST MAJOR ORTHOTROPIC-PLATE DECK GIRDER BRIDGE UNDERTAKEN IN THE UNITED STATES. THE BRIDGE WAS COMPLETED IN NOVEMBER 1967. EXCEPT FOR A SMALL AMOUNT OF STRUCTURAL SHAPES, THE BRIDGE IS COMPOSED OF PLATES OF VARIOUS TYPES OF STEEL. THE ARTICLE DESCRIBES THE JIGS AND SPECIAL HANDLING EQUIPMENT USED TO FABRICATE AND ASSEMBLE LARGE ORTHOTROPIC-PLATE DECK SECTIONS AND LARGE WELDED BOX GIRDERS. IT ILLUSTRATES THE SPECIAL MOUNTING OF WELDING EQUIPMENT USED TO PERFORM THE MILES OF AUTOMATIC SUBMERGED-ARC WELDING, AND IT DESCRIBES THE SHOP-ASSEMBLY PROCEDURES. ERECTION SEQUENCES, ERECTION EQUIPMENT AND SUSPENDED TROLLEY PLATFORMS ARE DESCRIBED AND ILLUSTRATED. IT WAS LEARNED THAT PRECISE AND ACCU-

RATE FABRICATION METHODS, COUPLED WITH GOOD SUPPORTING EQUIPMENT, PERMITTED EXTENSIVE USE OF AUTOMATIC WELDING EQUIPMENT FOR THE MILES OF WELDING REQUIRED ON THE BRIDGE. ANOTHER CONCLUSION WAS THAT LARGE UNITS OF DECK SECTIONS AND GIRDER SECTIONS COULD BE ECONOMICALLY FABRICATED AND ERECTED. /AUTHOR/

Shields, EJ Schmidt, AE *Highway Research Record, Hwy Res Board* 1969

3A 215217

AGC SEASONALITY IN CONSTRUCTION CONFERENCE-1968
 CONTENTS: WELCOMING REMARKS, FRED W. MAST SEASONALITY-SCOPE AND EXTENT DISCUSSION LEADER, ARTHUR J. FOX, JR. SPEAKER, D. QUINN MILLS OVERCOMING SEASONALITY DISCUSSION LEADER, SAUL HOROWITZ, JR. SPEAKER, ALLAN TURNER BONE WHO'S RESPONSIBLE? DISCUSSION LEADER, JOHN E. HEALY, II SPEAKER, W.E. NAUMANN.

Associated General Contractors America Nov. 1968

3A 215226

AMPHIBIOUS MOTOR TAKES ON REPAIR, SALVAGING UNDERWATER

AN ELECTRIC-POWER UNDERWATER TOOL HAS BEEN DEVELOPED WHICH IS INTENDED TO SERVE AS A UNIVERSAL POWER SOURCE. THE SEAPOWER UNIT, AS THE TOOL IS CALLED, DEVELOPS 5/8 HP, WORKS IMMERSSED, CONVERTS EASILY FOR USE AS A DRILL, SAW, TAP, NUT TIGHTENER, ETC. SEAPOWER WAS TESTED UNDER WATER FOR 70 DAYS IN OPERATION TEK TITE, AN UNDERSEA RESEARCH PROJECT CONDUCTED IN THE VIRGIN ISLANDS. TOOLS CAN BE ATTACHED TO THE ELECTRIC-POWER UNIT WITH A SIMPLE ADAPTOR, EITHER IN OR OUT OF THE WATER. THE LINEAR IMPACTOR CONVERTS ROTARY MOTION INTO RECTILINEAR MOTION FOR SAWING, CHIPPING, FILLING, SCRAPING, AND OTHER LINEAR MOTIONS. THIS SEAPOWER UNIT PROMISES TO REVOLUTIONIZE METHODS FOR UNDERSEA SALVAGING, CONSTRUCTION, AND REPAIR.

Product Engineering July 1969

3A 215230

(A) TECHNICAL COMMITTEE ON LOW COST ROADS, (B) TECHNICAL COMMITTEE ON WINTER MAINTENANCE
 CONSIDERING THE GREATEST NEED FOR LOW COST ROADS EXIST IN DEVELOPING COUNTRIES, THE COMMITTEE SELECTED 3 OF THE MORE PERTINENT SUBJECTS FOR STUDY: (1) COMPARISON OF MANUAL AND MECHANICAL METHODS FOR HIGHWAY CONSTRUCTION AND MAINTENANCE, (2) REGIONAL AND NATIONAL SURVEYS OF ROAD MAKING MATERIALS, AND (3) INFLUENCE OF ENVIRONMENT ON PAVEMENT DESIGN. M. ODIER OF FRANCE, WHO DESCRIBED THE STUDY PROGRAM, ANNOUNCED THE PUBLICATION OF A ROAD CONSTRUCTION MANUAL FOR DEVELOPING COUNTRIES PREPARED IN COLLABORATION WITH UNESCO. SUBJECT AREAS 2 AND 3 WERE DISCUSSED BY DR. MILLARD OF GREAT BRITAIN AND MR. DOS SANTOS OF PORTUGAL RESPECTIVELY. MR. GRACE OF GREAT BRITAIN DESCRIBED PROBLEMS CONCERNING DESERT ROADS. OTHER SPEAKERS OFFERING COMMENTS ON THE GENERAL REPORT INCLUDED MR. FERREIRA OF PORTUGAL, MR. ITO OF JAPAN, MR. GAJKOWICZ OF POLAND, MR. BEAVIS OF AUSTRALIA, MR. OWENS OF GREAT BRITAIN, AND M. REMILLON OF FRANCE. ECONOMIC ASPECTS OF ROAD CONSTRUCTION PROBLEMS WERE DISCUSSED BY TWO REPRESENTATIVES OF THE WORLD BANK, MR. HARDY AND MR. IRIAN. CONSIDERATION OF THE REPORT OF THE WINTER MAINTENANCE COMMITTEE WAS OPENED BY M. JOUVENT OF FRANCE WHO EMPHASIZED THE FOLLOWING TOPICS: (1) DURATION, NATURE, AND MAGNITUDE OF WINTER SERVICE; (2) TIMING OR ORDER OF MAJOR AND SECONDARY ROAD CLEARANCE; (3) MATERIALS USED (SALTS VS. GRITTY MATERIALS); (4) EXPENDITURES; AND (5) MEASUREMENTS OF PAVEMENT SLIPPERINESS. MR. ONO OF JAPAN, MR.

FARRAR OF GREAT BRITAIN, MR. BLEMENFELD OF ROMANIA, AND DR. FAGGIA OF ITALY EACH DESCRIBED WINTER MAINTENANCE PRACTICES AND SERVICES IN HIS COUNTRY. A SUMMARY OF THE CONTRIBUTIONS OF EACH SPEAKER WAS PRESENTED BY M. JOUVENT.

Perm Intl Assoc Road Congresses Proc 1967

3A 215233

CERAMICS MINIMIZE WEAR

A METHOD IS REPORTED OF BONDING ALUMINUM OXIDE CERAMIC, ONE OF THE TOUGHEST WEAR RESISTANT MATERIALS KNOWN, TO AND INTO ORGANIC MATERIALS SUCH AS RUBBER, URETHANES, AND PLASTICS. THE RESULT IS A MATERIAL THAT COULD REDUCE MANY WEAR PROBLEMS IN CONSTRUCTION EQUIPMENT AND DRASTICALLY CUT MAINTENANCE COSTS.

Mann, WP *Construction Methods & Equipment* Nov. 1969

3A 215235

APPLICATION OF CONSTRUCTION MANAGEMENT TO THE PAVING PROCESS

THE APPLICATION OF CONSTRUCTION MANAGEMENT TO THE PAVING PROCESS BY THE CONTRACTOR CONSISTS OF THE FOLLOWING OPERATIONS: INTERPRETING THE SPECIFICATIONS, OBTAINING, ORGANIZING AND CONTROLLING MAN, EQUIPMENT, AND MATERIALS TO CONSTRUCT A PAVEMENT AT THE RIGHT COST. EVERY STEP OF THE PAVING PROCESS MUST BE PLANNED FROM THE MOMENT OF AWARD UNTIL ACCEPTANCE BY THE AWARDED AGENCY. A PAVING OPERATION SCHEDULE SHOULD BE DETAILED AND EXACT TO THE LAST MINUTE DETAIL. A SAFETY PROGRAM MUST BE DESIGNED TO PREVENT ACCIDENTS AND AVOID INJURIES, AND MUST BE CONSISTENTLY EMPLOYED AND ENFORCED IN EVERY PHASE OF THE PAVING PROCESS. SUPERVISION MUST BE PROVIDED THAT HAS EXPERIENCE, DRIVE, DETERMINATION, & THE ABILITY TO COMMUNICATE, TO INTERPRET SPECIFICATIONS, CARRY OUT THE PAVING PROCESS, STAY ON SCHEDULE, AND MAINTAIN A SAFE OPERATION.

Porter, RL

Sixth Paving Conference Proc pp 107-113, 1968

3A 215237

SOMETHING NEW ON THE E4 HIGHWAY
 CONSTRUCTION PRACTICES BEING USED ON THE SWEDISH E4 HIGHWAY JUST SOUTH OF STOCKHOLM AKE REVIEWED. BECAUSE OF THE POOR NATURE OF THE CLAY SOIL, A CONSIDERABLE AMOUNT OF LECK IS USED FOR THE EMBANKMENTS. THIS LIGHTWEIGHT MATERIAL HELPS TO PREVENT EXCESSIVE SETTLEMENT. IT IS GENERALLY PLACED IN A LAYER 50 CM THICK, TOPPED WITH 30 CM OF GRAVEL AND COMPACTED BY 3-4 TON TRACTOR-DRAWN VIBRATING ROLLERS MAKING SIX PASSES. AFTER THE BASE COURSE IS PUT DOWN IT IS COVERED WITH A LAYER OF FINES AND A WATER TRUCK SPRINKLES IT DOWN. THE TANKER USES DETERGENTS IN THE WATER TO GIVE THE WATER 2 TO 3 TIMES MORE COVERAGE. THE CONTRACTOR IS USING A BARBER-GREENE SR40 PAVER, A 10-TON STATIC ROLLER AND A 10-TON VIBRATING ROLLER. A LAYER OF PAPER IS SPREAD BETWEEN EACH LAYER OF ASPHALT AT THE CUT OFF POINT EACH DAY. THE NEXT DAY, BEFORE LAYING IS RECOMMENCED, THE MEN CUT ACROSS THE WIDTH OF THE ROAD WITH A COBRA PETROL-POWERED PAVEMENT BREAKER AND ROLL THE LAYERS BACK CLEANLY. THIS MAKES FOR SMOOTH TRANSITIONARY SURFACE AND GOOD ADHESION BETWEEN ADJACENT SECTIONS. THE CONTRACTORS LAY ABOUT 500 TONS OF ASPHALT PER 11-12 HOUR DAY. THE ASPHALT HAULERS HAVE ONE RATE OF PAY FOR THE RUN TO THE SITE, AND A LOWER RATE FOR THE EMPTY RUN BACK TO THE PLANT. THE IDEA IS TO ENCOURAGE A HASTY RETURN.

World Construction Nov. 1969

3A 215239

HEAVY ROAD GRADING JOB PIONEERED FROM ONE END
A 6-1/2-MILE HIGHWAY GRADING JOB THROUGH TIMBERED MOUNTAIN TERRAIN WAS STARTED BY PIONEERING EQUIPMENT TRAILS ALL THE WAY THROUGH FROM A SINGLE END. THE ACCESS ROADS FOR CONSTRUCTION OF THE SEGMENT OF HIGHWAY 181 STAYED STRICTLY WITHIN THE RIGHT-OF-WAY. AS EQUIPMENT BEGAN WORKING AT THE VARIOUS HILLTOP AND CULVERT LOCATIONS, THE TRAILS WERE PROGRESSIVELY IMPROVED, INTO HAUL-WAYS. THREE STATE ROADS CUT ACROSS THE PROJECT LINE. HOWEVER, LOAD LIMITS AND NARROW WIDTHS OF BRIDGES RULED THEM OUT FOR HEAVY-EQUIPMENT ACCESS. UNDERDRAINS PROVED DIFFICULT TO INSTALL THROUGH THE MARSHY, SPRINGFED GROUND, WHICH AFFORDED INSUFFICIENT FOOTING FOR BACKHOES AND TRUCKS, EVEN DURING FREEZING WEATHER. BY SPRING, EQUIPMENT NEEDED AT THE VARIOUS SITES WAS ON LOCATION, AND THE DRILLSHOT AND EXCAVATION WORK AT HILLTOPS STARTED. THE HEAVY EQUIPMENT USED IS DESCRIBED. TIMBER ALONG THE RIGHT-OF-WAY WAS LOGGED AND STUMPED AS THE JOB ADVANCED. DRILL-SHOOT METHODS ARE PRESENTED. EQUIPMENT FOR DRILLING IN SOLID ROCK IS DESCRIBED. ROCK CUTS ARE NOT PRESPLIT, BUT BATTERED BACK TO A SAFE ANGLE. OF THE PROJECT'S 5 MILLION CUBIC YARDS ABOUT 4-1/2 MILLION MUST BE BLASTED. THE STATE ROADS MUST REMAIN OPEN DURING CONSTRUCTION.

World Construction Sept. 1969

3A 215240

TRANS-PENNINE MOTORWAY TAXES CONSTRUCTORS INGENUITY

A HIGHWAY CONSTRUCTION PROJECT IN ENGLAND IS DESCRIBED. WHEN COMPLETED THE NEW HIGH SPEED ROAD WILL HAVE DUAL THREE LANES TO CARRY TRAFFIC ACROSS THE PENNINE CHAIN (A LONG HILL RANGE KNOWN AS THE BACKBONE OF ENGLAND) AT AN AVERAGE ELEVATION OF 1000 FEET ABOVE SEA LEVEL. THE ROUTE CHOSEN CLIMBS THROUGH A SERIES OF EMBANKMENTS AND CUTTINGS AND HAS BEEN DESIGNED TO BE PASSABLE IN MID-WINTER. FROM TRIALS IT WAS FOUND THAT WHERE THE HIGHWAY EMBANKMENT SIDE SLOPES WERE 1:5, MINIMUM SNOW WAS DEPOSITED ON THE HIGHWAY, MOST OF IT BEING BLOWN CLEAR. SIDE SLOPES OF THIS RATIO WERE ADOPTED TO A WIDTH OF 25 FT. ON BOTH SIDES OF THE HIGHWAY, AND FROM THIS POINT THE NORMAL EMBANKMENT SIDE SLOPES OF 1:2 WERE USED. THE MAIN CUTTINGS WERE WINDY HILL (120 FT DEEP X 2,500 FT LONG), DEANHEAD (180 FT DEEP X 2,600 FT LONG), CROFT HOUSE (90 FT DEEP X 1,700 FT LONG), AND WHOLESTONE (50 FT DEEP X 5,000 FT LONG). SOME OF THE MATERIAL EXCAVATED WILL BE USED IN THE CONSTRUCTION OF SCAMMONDEN DAM. ON COMPLETION, SCAMMONDEN DAM WILL BE 240 FT HIGH AND 1,220 FT WIDE AT THE BASE. THE ARTICLE DESCRIBES THE CONSTRUCTION EQUIPMENT BEING USED AND THE METHODS FOR DEALING WITH UNDERGROUND WATER.

Mead, HT *World Construction* Oct. 1969

3A 215242

CONQUERING CONNEAUT MARSH

THE PITTSBURGH-TO-ERIE SECTION OF INTERSTATE 79 HAD TO GO OVER CONNEAUT MARSH WHICH IS ABOUT A MILE WIDE IN SOME PLACES AND ABOUT 12 MILES LONG FROM EAST TO WEST. PIPE PILE BENTS OR PIERS WERE DESIGNED TO SUPPORT THE TWO-LANE BRIDGES CROSSING THE MARSH. A CHANNEL WAS DREDGED ACROSS THE SWAMP TO ACCOMMODATE FLOATING EQUIPMENT. PILES WERE HELD IN POSITION FOR DRIVING BY TWO FLOATING TEMPLATES WHICH WERE THE ONLY PIECES OF EQUIPMENT THAT HAD TO BE BUILT ESPECIALLY FOR THE PROJECT. WHEN THE PILE DRIVING WAS COMPLETED AT A BENT, THE BEAM ATTACHED TO THE PREVIOUSLY DRIVEN BENT WAS REMOVED, ANGLES

THAT HAD BEEN PLACED ACROSS THE SLOTS TO LOCATE INDIVIDUAL PILES WERE RELEASED, AND THE TEMPLATE WAS FLOATED AHEAD TO THE SITE FOR THE NEXT BENT. THE DRIVEN PILES WERE FILLED WITH READY MIXED CONCRETE AND BENT CAPS FILLED. THE CONCRETE BRIDGE DECKS WERE CAST-IN-PLACE ON FIVE CONCRETE GIRDERS WHICH WERE PRESTRESSED OF HOLLOW BOX CONSTRUCTION. COMPLETION OF THE BRIDGES IS SCHEDULED BY MID- 1970.

Goff, JS *Civil Engineering Asce* May 1969

3A 215244

LARGE AGGREGATE SHOTCRETE CHALLENGES STEEL RIBS AS A TUNNEL SUPPORT

LARGE AGGREGATE SHOTCRETE IS THOUGHT TO BE AN ECONOMICAL, RAPID AND EFFECTIVE MEANS OF TUNNEL LINING. SPRAYED ON THE TUNNEL SURFACE CLOSE BEHIND THE EXCAVATION, IT PREVENTS AIR SLAKING OF ROCK. YIELDING ELASTICALLY AT A DECREASING RATE AS IT GAINS STRENGTH, IT PERMITS FORMATION OF A SELF-SUPPORTING ARCH ABOVE THE TUNNEL. A DEVELOPED GROUND ARCH CAN SUBSTANTIALLY REDUCE THE LOAD FOR WHICH A LINING NEED BE DESIGNED. SHOTCRETE EXHIBITS A HIGH ADHESION OR BOND TO THE ROCK. WITH SHOTCRETE A NUMBER OF FEATURES COMBINE TO GIVE THE BEST PRACTICABLE GROUND SUPPORT CONDITIONS: EARLY SUPPORT BY THIN, STRONG FLEXIBLE LINER UNDER CONTINUOUS BLOCKING CONDITIONS, GENERATING AN EFFECTIVE GROUND ARCH AROUND THE OPENING AND AUGMENTING THE SELF-SUPPORTING PROPERTIES OF THE NATIVE GROUND MATERIAL. CONSTRUCTION PROCESSES IN USE ARE THE WET PROCESS AND THE DRY PROCESS. THE TERM WET PROCESS IS USED WHEN ALL MATERIALS ARE MIXED WITH THE REQUIRED WATER OF HYDRATION BEFORE AIR OR PUMP TRANSPORTATION TO THE POINT OF APPLICATION. THIS MIX IS BLOWN INTO PLACE BY AIR PRESSURE AT THE NOZZLE. THE DRY PROCESS CONSISTS OF MIXING ALL MATERIALS, INCLUDING ACCELERATORS, IN A DAMP STATE BEFORE AIR TRANSPORTATION TO THE POINT OF APPLICATION. THE ADDITIONAL WATER IS ADDED AT THE GUN. THE SUCCESSFUL APPLICATION OF SHOTCRETE DEPENDS ON RIGID OBSERVANCE OF THE FOLLOWING RULES: (1) THE DISTANCE BETWEEN THE NOZZLE AND THE POINT OF APPLICATION IS CRITICAL. GENERALLY A DISTANCE OF 3 TO 4 FT., (2) WATER SEEPAGE AREAS AND CONSIDERABLE FLOWS OF WATER CAN BE HANDLED SUCCESSFULLY BY THE PLACING OF A DRAIN PIPE AND PLACEMENT OF SHOTCRETE AROUND IT, (3) SHOTCRETE IMPACTS AT BETWEEN 300 AND 500 FPS WHICH VELOCITIES ARE NECESSARY TO PRODUCE A DENSE, HIGH QUALITY SHOTCRETE, (4) IN ORDER TO KEEP REBOUND, IT IS NECESSARY TO KEEP THE ANGLE OF IMPACT NORMAL TO THE SURFACE, AND (5) NORMAL CONTROL PRACTICE IS TO SPECIFY FABRICATION OF TEST PANELS USING SEVERAL MIXES. GOOD DESIGN USES THE ADVANTAGES OF A NEW MATERIAL COMPLETELY. WITH SHOTCRETE THIS MEANS A TUNNEL SECTION WHICH PRODUCES A MINIMUM OF BENDING MOMENT IN THE SUPPORT. THE SPEED OF APPLICATION OF SHOTCRETE MAY WELL BE THE GREATEST ADVANTAGE.

Sutcliffe, H McClure, CR *Civil Engineering Asce* Nov. 1969

3A 215253

UNDERWATER JOINING AND CUTTING

IN MOST CASE, LAND TECHNIQUES HAVE BEEN AND ARE BEING APPLIED TO PIPELINE AND OTHER UNDERWATER WORK EVEN THOUGH ENVIRONMENTAL CONDITIONS ARE SIGNIFICANTLY DIFFERENT, AND RESULTS HAVE NOT BEEN COMPLETELY SATISFACTORY BECAUSE OF RELATIVELY SLOW SPEED, HIGH COSTS, AND OTHER FACTORS. THIS ARTICLE DESCRIBES THE CURRENTLY USED METHODS FOR BOTH WET AND DRY WELDING UNDERWATER, AND DISCUSSES THE PROBLEMS INVOLVED IN OBTAINING HIGHQUALITY JOINTS. MOST WELDING IN UNDERWATER SALVAGE AND EMERGENCY REPAIR IS DONE WET WITH THE CONVENTIONAL

MANUAL SHIELDED METAL-ARC PROCESS, COMMONLY KNOWN AS STICK ELECTRODE WELDING, UNDERWATER DRY WELDING CAN BE DONE WITH EITHER OF TWO CONVENTIONAL LAND TECHNIQUES-THE GAS-METAL-ARC (GMA) AND GAS-TUNGSTEN-ARC (GTA) PROCESSES. SEVERAL OTHER PROCESSES COULD BE OR ARE BEING USED FOR MAKING JOINTS UNDERWATER: PLASMA-ARC WELDING, BRAZING, ADHESIVE BONDING, EXPLOSIVE WELDING, AND MECHANICAL JOINING. TWO BURNING PROCESSES-FLAME AND ARC CUTTING-ARE APPLIED COMMERCIALY TO CUT METALS UNDERWATER.

Mishler, HW Randall, MD
Battelle Research Outlook 1969

3A 215257
CONSTRUCTION OF A FILL BY A MUD DISPLACEMENT METHOD

A HIGHWAY FILL WAS CONSTRUCTED ACROSS AN OPEN WATER COVE ON THE WEST SIDE OF SAN FRANCISCO BAY BY DISPLACING THE UNDERLYING SOFT MUD TO DEPTHS OF AS MUCH AS 60 FT. BY THE WEIGHT OF THE PLACED FILL. VARIOUS CONSTRUCTION METHODS WERE ATTEMPTED AND A METHOD OF OBTAINING REASONABLY UNIFORM MUD DISPLACEMENT DEVELOPED. THE FILL FAILURES WERE ANALYZED AND THE FACTORS AFFECTING THESE FAILURES EVALUATED. THE MEASURED SETTLEMENTS AND PORE PRESSURES ARE PRESENTED AND EVALUATED. THE PERFORMANCE OF THE HIGHWAY AFTER THREE YEARS OF USE IS GIVEN. /AUTHOR/

Weber, WG *Highway Research Board Proceedings* 1962

3A 215261
THE INFLUENCE OF INVESTMENT CREDIT ON THE ECONOMIC LIFE OF CONSTRUCTION EQUIPMENT
A STUDY WAS CONDUCTED TO DETERMINE THE INFLUENCE OF THE INVESTMENT TAX CREDIT ON THE ECONOMIC LIFE OF CONSTRUCTION EQUIPMENT. ANALYSIS OF EQUIPMENT LIFE FALLS INTO THREE CATEGORIES: (1) ECONOMIC LIFE TOO SHORT TO BE INFLUENCED BY INVESTMENT CREDIT, (2) ECONOMIC LIFE OF FOUR TO EIGHT YEARS, WHERE THE INVESTMENT CREDIT INFLUENCES THE OPTIMUM LIFE OF THE EQUIPMENT, AND (3) WHEN EQUIPMENT LIFE IS SO LONG THAT INVESTMENT CREDIT HAS NO APPRECIABLE EFFECT ON THE OPTIMUM LIFE, BUT MAY AFFECT THE PROFITS. SOME ANALYTICAL EXPRESSIONS WERE DEVELOPED BY WHICH TO COMPUTE INVESTMENT CREDIT AND INCLUDE THEM IN THE MATHEMATICAL MODEL THAT DETERMINES THE ECONOMIC LIFE OF THE EQUIPMENT. THE EQUATIONS ARE APPLIED TO A REAL-LIFE CASE BY USING A COMPUTER PROGRAM. THIS STUDY WAS CONCERNED WITH A PARTICULAR TYPE OF EQUIPMENT, TRANSMIXERS, BUT IT SHOWS A CONSTRUCTION EQUIPMENT OWNERS SHOULD BE AWARE OF THE TRUE EFFECTS OF INVESTMENT CREDIT. IN THE PAST, IT HAS LED THEM TO DELAY REPLACEMENT IN ORDER TO RECEIVE THE CREDIT. THIS POLICY MAY NOT ALWAYS RESULT IN INCREASED PROFITS. THEREFORE, A CAREFUL ANALYSIS USING THE MODEL DESCRIBED SHOULD BE MADE BEFORE DECIDING TO DELAY REPLACEMENT IN ORDER TO OBTAIN INVESTMENT CREDIT.

Herrero-a, C
Stanford University Nov. 1967

3A 215262
OCCUPATIONAL HEALTH IN THE CONSTRUCTION INDUSTRY
OCCUPATIONAL HEALTH IS DEFINED AS THE PREVENTION OF WORK-CAUSED DISEASES AND DISABILITIES BY THE CONTROL OF THE WORK ENVIRONMENT. THE REQUIREMENTS ARE DISCUSSED FOR AN OCCUPATIONAL HEALTH PROGRAM AND SPECIFIC TOPICS THAT ARE CAUSING MAJOR PROBLEMS WITHIN THE INDUSTRY. IT IS FELT THAT THE CONSTRUCTION INDUSTRY DOES NOT RECOGNIZE THAT ITS WORKERS ARE

NOW SUFFERING DIRECTLY AND INDIRECTLY FROM JOB-INDUCED HEALTH HAZARDS AND THAT NEW HAZARDS ARE EMERGING WITH THE INDUSTRY'S INCREASING TECHNOLOGICAL ADVANCES. DISEASES RESULTING FROM OCCUPATIONAL HAZARDS IN THE CONSTRUCTION INDUSTRY PRIMARILY INVOLVE THE SKIN, THE LUNGS, SYSTEMIC POISONINGS, AND HEARING LOSS. SPECIFICALLY DISCUSSED ARE THE FOLLOWING OCCUPATIONAL HAZARDS BROUGHT ABOUT BY: DUST, HEAT, NOISE, AND NOXIOUS AGENTS. TECHNOLOGICAL ADVANCE OF THE CONSTRUCTION INDUSTRY INTO THE AREA OF MACHINES AND CHEMICALS HAS CREATED THE BY-PRODUCT OF AN OCCUPATIONAL HEALTH PROBLEM. IT IS FELT THAT OCCUPATIONAL HEALTH WITHIN THE CONSTRUCTION INDUSTRY WAS NEGLECTED FOR TOO LONG AND IS STILL BEING NEGLECTED.

Destwolinski, LW
Stanford University May 1969

3A 215265
CONSTRUCTION-EQUIPMENT POLICY: INFLUENCE OF INCOME TAX LAW ON ECONOMIC LIFE
STUDY WAS TO CONDUCTED TO EXAMINE THE INFLUENCE OF THE TAX LAWS ON THE MATHEMATICAL MODEL PREVIOUSLY DEVELOPED BY THE AUTHOR IN HIS TECHNICAL REPORT NO. 61. THE TWO PRINCIPAL INFLUENCES OF THE TAX LAWS ON THE ECONOMIC LIFE OF CONSTRUCTION EQUIPMENT ARE (1) THE PROHIBITION AGAINST USING DOUBLE DECLINING BALANCE DEPRECIATION FOR AN EQUIPMENT LIFE OF LESS THAN THREE YEARS, AND (2) THE STIPULATION THAT A PIECE OF EQUIPMENT SHOULD NOT BE DEPRECIATED BELOW A REASONABLE SALVAGE VALUE. EQUATIONS HAVE BEEN DEVELOPED TO SUBSTITUTE STRAIGHT LINE DEPRECIATION FOR LIVES OF LESS THAN THREE YEARS AND TO RECAPTURE INCOME WHEN THE ASSET HAS BEEN DEPRECIATED MORE THAN A REASONABLE ALLOWANCE. THE CONCLUSION OF THE REPORT IS THAT INCOME TAX PROBLEMS CAN BE TREATED IN THE COMPUTATION OF ECONOMIC LIFE BY DIGITAL COMPUTER. BY MODIFYING THE ALGORITHM IN TECHNICAL REPORT NO. 61 WITH THE EQUATIONS DEVELOPED IN THIS REPORT, THE ANALYST IS PROVIDED WITH AN ADDED TOOL FOR DETERMINING THE ECONOMIC LIFE OF VARIOUS TYPES OF CONSTRUCTION EQUIPMENT. /AUTHOR/

Douglas, J
Stanford University

3A 215266
OBSOLESCENCE AS A FACTOR IN THE DEPRECIATION OF CONSTRUCTION EQUIPMENT
THE EFFECTS OF EQUIPMENT OBSOLESCENCE WERE STUDIED ON OWNERSHIP POLICY, PARTICULARLY AS IT AFFECTS THE CONSTRUCTION INDUSTRY. AN INDUSTRY SURVEY WAS CONDUCTED WHICH CONSISTED OF A QUESTIONNAIRE AND PERSONAL INTERVIEWS. A THEORETICAL ANALYSIS WAS CONDUCTED TO SIFT OUT THE VARIOUS ECONOMIC EFFECTS OF TECHNOLOGICAL IMPROVEMENT. THESE WERE TRANSLATED INTO A MATHEMATICAL THEORY TO EXPRESS THE INTER-RELATION OF OBSOLESCENCE, INFLATION, AND OTHER ECONOMIC FACTORS AND TO APPRAISE THEIR INFLUENCE ON THE ECONOMIC LIFE OF CONSTRUCTION EQUIPMENT. A MATHEMATICAL MODEL WAS USED WITH A DIGITAL COMPUTER ANALYSIS TO DEMONSTRATE THE THEORETICAL APPROACH TO OBSOLESCENCE. THE COSTS OF OWNING AND OPERATING A CRAWLER TRACTOR IN THE 200 HORSEPOWER CLASS WERE FED INTO THE COMPUTER PROGRAM. RESULTS SHOWED THAT THE ECONOMIC LIFE OF THE CRAWLER TRACTOR WAS SHORTENED BY THE PRESSURE OF TECHNOLOGICAL IMPROVEMENTS IN REPLACEMENT MACHINES.

Douglass, J
Stanford University Feb. 1968

3A 215267

AN ANALYSIS OF TWO-LINK MATERIAL HANDLING SYSTEMS WITH ONE CARRIER IN ONE OF THE LINKS
 A COMMON MATERIAL HANDLING SYSTEM IN THE CONSTRUCTION INDUSTRY CONSISTS OF 2 LINKS OF INTERACTING EQUIPMENT WHERE ONE OF THE LINKS HAS ONLY ONE UNIT OF EQUIPMENT AND THE OTHER HAS TYPICALLY MORE THAN ONE. FOUR MATHEMATICAL APPROACHES ARE DESCRIBED TO CALCULATE THE PRODUCTION RATE OF SYSTEMS. TWO OF THESE METHODS ASSUME THAT CYCLE TIMES ARE CONSTANT AND TWO ASSUME THAT THEY ARE RANDOM VARIABLES. ALL METHODS ASSUME THAT THE CONTRACTOR HAS KNOWLEDGE OF THE NON-DELAY CYCLE TIMES AND THE EFFICIENCY OF THE EQUIPMENT IN BOTH LINKS. ALL MODELS ARE COMPARED TO THE RESULTS OF A COMPUTER SIMULATION MODEL WHICH IS ACCEPTED AS THE BEST AVAILABLE METHOD OF PREDICTING THE PRODUCTION RATE OF THE SYSTEMS UNDER ANALYSIS. THE MODEL WHICH COMES CLOSEST TO THE SIMULATION RESULTS IS A QUEUING OR WAITING LINE TYPE. THE EFFECT IS ALSO INVESTIGATED OF ADDING A SOURCE OF TEMPORARY STORAGE AT THE POINT OF TRANSFER BETWEEN THE TWO LINKS. CURVES ARE PRESENTED WHICH ENABLE THE CONTRACTOR TO ESTIMATE THE EFFECT OF ADDING A GIVEN SIZE HOPPER TO A DIRECT-TRANSFER SYSTEM.

Teicholz, P
 Stanford University Aug. 1963

3A 215269

HUMAN FACTORS AS THEY AFFECT METHODS IMPROVEMENT IN CONSTRUCTION

SOME OF THE HUMAN PROBLEMS THAT THE CONTRACTOR AND HIS MANAGEMENT MUST SOLVE IN THE FIELD ARE DISCUSSED. INFORMATION IS PRESENTED ON TWO TOPICS THAT ARE PERTINENT TO THE HUMAN PROBLEMS BEING FACED: (1) THE EXPERIENCE OF MANUFACTURING INDUSTRY WHEN SCIENTIFIC MANAGEMENT WAS INTRODUCED, AND (2) THE KNOWLEDGE OF HUMAN BEHAVIOR THAT HAS BEEN DISCOVERED BY SYSTEMATIC SCIENTIFIC STUDY. THESE TWO TOPICS ARE RELATED TO THE SPECIFIC PROBLEMS OF CONSTRUCTION. THE DEGREE TO WHICH AN OPERATION CAN BE IMPROVED BY SYSTEMATIC METHODS IMPROVEMENT WILL DEPEND ON: (1) THE METHOD IMPROVEMENT TECHNIQUE USED, (2) THE TIME AND EFFORT DEVOTED TO IT, AND (3) THE SKILL, CREATIVITY AND EXPERIENCE OF THE PEOPLE DEVELOPING THE NEW METHODS. THE PROBLEMS OF IMPLEMENTATION AND THE ACCEPTANCE OF NEW METHODS WERE INVESTIGATED. FINDINGS OF THE BEHAVIORAL SCIENCES OF CHANGING A MAN'S ESTABLISHED WORK HABITS ARE REPORTED. THESE FINDINGS, BY SHOWING HOW A WORKMAN GAINS SATISFACTION FROM HIS JOB, ILLUSTRATE HOW CHANGES WHICH INCREASE A WORKMAN'S JOB SATISFACTION CAN BE ACCEPTABLE TO HIM. IT IS CLAIMED THAT AN EVEREXPANDING KNOWLEDGE OF HUMAN BEHAVIOR IS A VALUABLE ASSET FOR ANY CONSTRUCTION SUPERVISOR, AND THAT THE BEHAVIORAL SCIENCES NOW PROVIDE AN ALTERNATIVE TO SITE EXPERIENCE AS A SOURCE OF LEARNING ABOUT HUMAN BEHAVIOR.

Jones, WL
 Stanford University Sept. 1964

3A 215271

CONSTRUCTION-EQUIPMENT POLICY: THE ECONOMIC LIFE OF EQUIPMENT

THE PURPOSE WAS TO DEVELOP AND APPLY A MATHEMATICAL MODEL FOR THE ANALYSIS OF THE ECONOMIC LIFE OF CONSTRUCTION EQUIPMENT. THE MATHEMATICAL MODEL USED IN THE AUTHOR'S PREVIOUS STUDIES OF OBSOLESCENCE WAS REORIENTED AND AUGMENTED IN ORDER TO STUDY ECONOMIC LIFE. NEW VARIABLES WERE INTRODUCED TO ACCOUNT FOR MONOTONICALLY DECREASING DISCRETE COSTS OF MAINTENANCE AND OPERATION--IT WAS BELIEVED

THAT THESE COSTS MIGHT HAVE A SIGNIFICANT EFFECT IN TRIGGERING MAJOR OVERHAULS AND THE REPLACEMENT OF EQUIPMENT. IN ADDITION TO THE NEW EQUATIONS, EQUATIONS ALREADY DEVELOPED WERE REWRITTEN WITH NEW VARIABLE NAMES TO SIMPLIFY THE NUMBERING SYSTEM AND TO MAKE THE VARIABLES MORE COMPATIBLE WITH THE COMPUTER-PROGRAM VARIABLES. AFTER DEVELOPMENT OF THE MODEL, PROGRAMS WERE WRITTEN IN FORTRAN IV TO SOLVE THE ALGORITHMS AND TO PLOT THE RESULTS ON THE CALCOMP PLOTTER. IT WAS BELIEVED THAT THESE GRAPHIC RESULTS WOULD BE MORE IMPRESSIVE AND EASIER TO ANALYZE. LIAISON WAS ESTABLISHED WITH A LARGE READY-MIX OPERATOR IN THE SAN FRANCISCO BAY AREA. WITH HIS COOPERATION, COSTS WERE DEVELOPED AND STUDIED THAT COULD BE USED IN A COMPUTER ANALYSIS TO DETERMINE THE ECONOMIC LIFE OF THE TRANSMIXERS IN HIS OPERATION. THE FOLLOWING CONCLUSIONS WERE DRAWN ON THE FEASIBILITY OF UTILIZING THE COMPUTER-RUN MODEL TO AID THE OPERATOR IN MAKING POLICY DECISIONS ABOUT THE ECONOMIC LIFE OF HIS EQUIPMENT: (1) COMPUTER ANALYSIS OF EQUIPMENT ECONOMIC PROBLEMS IS FEASIBLE AND RELATIVELY INEXPENSIVE, (2) THE MATHEMATICAL MODEL IS FLEXIBLE AND ADAPTABLE TO REAL-LIFE SITUATIONS, (3) THE ECONOMIC LIFE OF TRANSMIXERS IN THE USE OF THE COMPANY STUDIED IS SOMEWHERE BETWEEN THREE AND FIVE YEARS, (4) FURTHER RESEARCH IS NEEDED TO DEVELOP THE PARAMETERS FOR APPLICATION OF THE MATHEMATICAL MODEL FOR ESTABLISHMENT OF EQUIPMENT POLICY AND (5) GOOD COST KEEPING IS NECESSARY FOR A THOROUGH AND ACCURATE ANALYSIS OF EQUIPMENT. GOOD COST KEEPING APPEARS TO BE THE EXCEPTION, HOWEVER, RATHER THAN THE RULE. /AUTHOR/

Douglas, J
 Stanford University July 1966

3A 215273

FORMWORK FOR CONCRETE SHELL STRUCTURES

ALTHOUGH THIN CONCRETE SHELL CONSTRUCTION IS GAINING SOMEWHAT WIDER ACCEPTANCE IN THIS COUNTRY, IT IS STILL NOT BEING USED IN ALL SITUATIONS WHERE IT WOULD BE THE BEST ARCHITECTURAL AND STRUCTURAL SOLUTION. REASONS COMMONLY ASSOCIATED WITH THE LIMITED ACCEPTANCE OF THIS STRUCTURAL FORM INCLUDE: (1) THE RELUCTANCE OF THE BUILDING INDUSTRY TO CHANGE FROM CONVENTIONAL PRACTICES; (2) THE BUILDING INDUSTRY'S LACK OF FAMILIARITY WITH THE INHERENT ADVANTAGES; AND (3) THE HIGH COST AND COMPLEXITY OF FORMWORK. THIS REPORT IS PRIMARILY AN INVESTIGATION OF THE LAST TWO PROBLEMS. CHAPTER ONE IS CONCERNED WITH THE STRUCTURAL, ARCHITECTURAL, AND ECONOMIC ADVANTAGE (AND DISADVANTAGES) COMMON TO ALL TYPES OF THIN CONCRETE SHELLS. CHAPTER TWO IS A BRIEF OUTLINE OF THE CONSTRUCTION PROCEDURES EMPLOYED IN CAST-IN-PLACE AND PRECAST THIN CONCRETE SHELL CONSTRUCTION. CHAPTER THREE IS AN EXAMINATION OF ELEMENTS IN THE STRUCTURAL DESIGN OF CENTERING. CHAPTER FOUR IS A DISCUSSION OF VARIOUS TYPES OF SHELLS USED IN ARCHITECTURAL PRACTICE AND OF SPECIFIC FORMWORK SOLUTIONS USED IN THEIR CONSTRUCTION. THE INTENTION OF THIS REPORT IS TO PRESENT AN IMPARTIAL EXPOSITION OF THE ADVANTAGES AND DISADVANTAGES OF THIN CONCRETE SHELLS AND THUS TO ASSIST IN OVERCOMING THE RELUCTANCE OF THE BUILDING INDUSTRY TO CHANGE. A FURTHER PURPOSE IS TO DIRECT ATTENTION TO THE PROBLEMS OF FORMING SUCH STRUCTURES BY PROVIDING GENERAL INFORMATION IN THE PAPER AND BY LISTING A LARGE NUMBER OF BIBLIOGRAPHICAL REFERENCES. BECAUSE THE SUBJECT DISCUSSED HERE IS SO BROAD, THE COVERAGE OF A PARTICULAR TOPIC IS NECESSARILY SOMEWHAT BRIEF. FOR THIS REASON, THE BIBLIOGRAPHY IS SO ORGANIZED THAT THE INTERESTED READER CAN EASILY INVESTIGATE THE DE-

TAILED REFERENCES. WITH THE ADDITION OF THE THIN CONCRETE SHELL TO THE ARCHITECT'S VOCABULARY, A STRUCTURAL ELEMENT APPEARS WHICH IS AT ONCE FUNCTIONAL AND EXPRESSIVE, ECONOMIC AND BEAUTIFUL. HOWEVER, DESPITE ITS GREAT POSSIBILITIES, THE THIN CONCRETE SHELL IS NOT A UNIVERSAL SOLUTION TO ALL ARCHITECTURAL PROBLEMS. ITS APPLICATION SHOULD BE JUSTIFIED, IN EACH SPECIFIC INSTANCE, ON THE BASIS OF THE RELATIVE STRUCTURAL, ARCHITECTURAL, AND ECONOMIC FACTORS INVOLVED. /AUTHOR/

Merchant, DH
Stanford University May 1963

3A 215283

URBAN PAVING IN STATE ROADS COMMISSION, DISTRICT 3 (MONTGOMERY AND PRINCE GEORGES COUNTIES)

EXAMPLES ARE GIVEN OF HIGH TYPE URBAN HIGHWAYS CONSTRUCTED OF FLEXIBLE PAVEMENTS IN THE PAST FEW YEARS. ACTIVITIES DISCUSSED ARE: (1) UTILITY PREPARATION AND REQUIREMENTS, (2) MAINTENANCE AND CONTROL OF TRAFFIC DURING CONSTRUCTION, (3) VARIOUS PAVEMENT DESIGNS AND THEIR PLACE IN URBAN PAVING, (4) CONSTRUCTION TECHNIQUES AND REQUIREMENTS FOR SUCCESSFUL PAVING EFFORT, AND (5) ACTIVITIES SUBSEQUENT TO PLACING THE URBAN PAVING AND TRAFFIC ON THE FINISHED ROADWAY. THOSE PAVEMENTS DESIGNED AND CONSTRUCTED USING MAINLY BITUMINOUS CONCRETE HAVE PROVIDED THE QUICKEST, MOST STRUCTURALLY CAPABLE, EFFICIENT, ECONOMICAL, AND SATISFYING CONSTRUCTION EFFORTS. ADVANTAGES OF USING THESE PAVEMENTS ARE: (1) LESS EXCAVATION, (2) LESS CONSTRUCTION TIME, (3) SAME EQUIPMENT AND MEN CAN BE USED ON THE BULK OF THE WORK, (4) INSPECTION FORCES HAVE LESS DIFFERENT TYPE OF MATERIALS TO INSPECT, (5) MAINTENANCE OF TRAFFIC IS SIMPLIFIED AND LESS COSTLY, (6) ONCE BITUMINOUS CONCRETE BASE COURSE IS PLACED THERE ARE NO DELAYS AFTER INCLEMENT WEATHER, (7) NO WAITING FOR A SECOND, THIRD, OR FOURTH TYPE OF MATERIAL, AND (8) NO EXTENDED CURING PERIOD. IT IS SHOWN THAT THE USE OF OLD PAVEMENT AS A PART OF THE PAVEMENT SECTION WAS BENEFICIAL IN THE URBAN PROJECTS. TWO RECOMMENDATIONS ARE MADE TO EXPEDITE CONSTRUCTION AND SAVE MONEY ON URBAN PROJECTS: (1) SIMPLIFY PAVEMENT DESIGNS BY ELIMINATING THE MULTITUDE OF THE VARIOUS GRADED AGGREGATE COURSE, AND (2) ELIMINATE THE CALENDAR DATES FOR BITUMINOUS CONCRETE PAVING, EXCEPT FOR SURFACE COURSES.

Caltrider, MS *Maryland Asphalt Paver* Apr. 1970

3A 215287

ROTATING LASER GUIDES TRENCHERS

Dickey, GL *Western Construction* May 1970

3A 215293

CONSTRUCTION EXPEDITING

EXPEDITING CONSTRUCTION PROJECTS IS MORE THAN PREPARING BAR CHARTS OR NETWORKS. IT REQUIRES PERSONNEL THAT POSSESS CERTAIN INTELLIGENCE, SPECIAL EXPERIENCE, AND UNIQUE PERSONALITY TRAITS. IN ADDITION, WHO DOES THE PLANNING? WHAT ARE THE TROUBLE SPOTS OF IMPLEMENTING A PLAN? WHAT MAKES A GOOD EXPEDITER? THESE ARE EXAMINED. THE EXPEDITING PROCEDURE IS PERHAPS THE MOST IMPORTANT SINGLE PHASE OF THE CONSTRUCTION PROGRAM. CONSTRUCTORS WERE SURVEYED FOR THEIR VIEWS OF EXISTING PRACTICES. THE RESULTS SUGGESTED TWO AREAS OF FURTHER STUDY IN ADDITION TO POINTING OUT SOME EXISTING PROBLEMS. /AUTHOR/

Monsey, A *Am Soc Civil Engr J Construction Div* June 1970

3A 215299

CONSTRUCTION PLANNING, EQUIPMENT, AND METHODS

MANY OF THE ASPECTS OF CONSTRUCTION MANAGEMENT AND PLANNING ARE COVERED AS WELL AS MOST OF THE MAJOR TYPES OF CONSTRUCTION ACTIVITY USUALLY CLASSIFIED IN THE ENGINEERING FIELD. THIS EDITION INCLUDES NEW CHAPTERS ON OPERATIONAL ANALYSIS, SOIL STABILIZATION, AND COMPACTION. THE IMPORTANCE OF VALUE ENGINEERING, CRITICAL PATH METHOD, AND THE TIME VALUE OF MONEY IS COVERED IN DETAIL. NEW METHODS AND MATERIALS USED IN BLASTING ROCK AND DRIVING PILES ARE DEALT WITH. THERE IS A TREATMENT OF THE DEPRECIATION OF CONSTRUCTION EQUIPMENT. AN APPENDIX GIVES FIGURES ON THE COST OF OWNING AND OPERATING MANY TYPES OF CONSTRUCTION EQUIPMENT. /AUTHOR/

Peurifoy, RL
Mcgraw Hill Book Company 696 pp. 1970

3A 215301

COLORADO STRAIGHT CREEK TUNNEL-I-70

THE COLORADO DIVISION OF HIGHWAYS IS BUILDING A 1.7 MILE VEHICULAR TUNNEL UNDER THE CONTINENTAL DIVIDE AT AN ELEVATION OF SLIGHTLY OVER 11,000 FEET. IT IS THE WORLD'S HIGHEST VEHICULAR TUNNEL, THE LONGEST VEHICULAR ROCK BORE IN NORTH AMERICA, AND THE WORLD'S HIGHEST MECHANICALLY VENTILATED TUNNEL. THE PROJECT INCLUDES DRIVING THE FIRST OF WHAT WILL EVENTUALLY BE TWIN BORES, CONSTRUCTING COMBINATION VENTILATION AND PORTAL STRUCTURES FOR BOTH TUNNELS. STUB SECTIONS OF WHAT WILL BE THE SECOND TUNNEL, THREE CROSS PASSAGE WAYS BETWEEN THE VEHICULAR AND PIONEER TUNNEL AND OTHER ITEMS NECESSARY TO PRODUCE AN OPERATIONAL TUNNEL BY 1971. THE WESTBOUND TUNNEL WILL BE USED FOR TWO-WAY TRAFFIC UNTIL THE PIONEER BORE IS ENLARGED LATER TO BECOME THE EASTBOUND TUNNEL. THIS LINK IN I-70'S PROGRESS WILL SAVE THE HIGHWAY USER TEN MILES AND AS MUCH AS FORTY MINUTES. BEDROCK IN THE STRAIGHT CREEK TUNNEL AREA CONSISTS OF ABOUT 75% GRANITE AND ABOUT 25% METASEDIMENTARY GNEISS AND SCHIST OF PRECAMBRIAN AGE. THE TUNNEL AREA IS WITHIN THE LOVELAND FAULT ZONE, AND THE BEDROCK IS CUT BY NUMEROUS FAULTS AND SHEER ZONES RANGING FROM LESS THAN A FOOT TO 600 FEET, SEPARATED BY LESS INTENSIVELY SHEARED ROCK. THE EAST PORTAL AREA OFFERED ANOTHER PROBLEM: A BIG LANDSLIDE LIES ON THE SLOPE TO THE NORTH OF THE PORTAL. DURING CONSTRUCTION OF THE PILOT BORE, GROUNDWATER FLOWS WERE ENCOUNTERED IN MODERATELY SHEARED ROCK. THE PILOT TUNNEL HAS OFFERED A BONUS FUNCTION IN ADDITION TO THAT OF ENGINEERING GEOLOGY: DRAINAGE. COMPUTATION AND TESTS WERE MADE OF CARBON MONOXIDE POUNDS EMITTED PER MINUTE BY AN IDLING MOTOR AND CARBON MONOXIDE POUNDS PER MILE BY THE POWER PLANTS OF MOVING VEHICLES. THE APPROXIMATE AVERAGE CARBON MONOXIDE EMISSION WAS COMPUTED. VENTILATION SYSTEMS WILL BE OF A TRANSVERSE DESIGN TO DELIVER FRESH AIR AT THE ROADWAY LEVEL. EXHAUST AIR WILL BE DRAWN INTO THE EXHAUST DUCT THROUGH CEILING OPENINGS. TRAFFIC CONTROL DEVICES WILL OPERATE TELEVISION SURVEILLANCE WHEREBY THE TRAFFIC MOVEMENT CAN BE MONITORED AT ALL TIMES. A WALKWAY CAR FOR RAPID TRANSIT OF PERSONNEL TO THE SCENE OF AN ACCIDENT OR STOPPAGE WILL BE PART OF THE TUNNEL EQUIPMENT. CONVENTIONAL CONSTRUCTION METHODS ARE BEING USED TO ACCOMPLISH THE TOP HEADING AND BENCH PORTIONS OF THE EXCAVATION THROUGH APPROXIMATELY 7,100 FEET OF COMPETENT ROCK. LESS TRADITIONAL METHODS ARE USED IN THE 1,085 FEET OF EXTREMELY BAD GROUND IN THE CENTER OF THE MOUNTAIN. THEY ENTAIL THE USE OF A HUGE SHIELD THAT ALLOWS THE DRIVING TO CONTINUE FULL FACE.

Shumate, CE *American Highways* Oct. 1969

3A 215305

THOMPSON-ARTHUR EXPERIMENTS WITH LINKED PAVERS
AN EXPERIMENT WITH TWO PAVERS LINKED TOGETHER AS ONE MACHINE WITH ONE OPERATOR IS PROVING SUCCESSFUL ON VIRGINIA'S INTERSTATE HIGHWAY 85 CONSTRUCTION. LINKED PAVERS ARE PERFORMING WELL AND CUTTING COSTS ON THE JOB. AN ATTACHED Z BAR HOLDS THE PAVERS IN ACCURATE ALIGNMENT AND IS ADJUSTABLE FOR EITHER 4-FOOT OR 6-FOOT SPACING. THE LINKED PAVERS SAVE PERSONNEL BY USING ONLY ONE OPERATOR AND TWO LESS RAKERS, AND IT ELIMINATES THE CENTER JOINT. THE SUBGRADE IS PREPARED MICACIOUS CLAY, WITH A SUBGRADE COURSE OF SIX INCHES OF CRUSHED STONE. FULL DEPTH ASPHALT BASE OF SEVEN AND A HALF INCHES WITH A ONE AND A HALF-INCH SURFACE COURSE WILL SUPPORT THIS ROADWAY.

Paving Forum /Napa/ July 1970

3A 215312

METHODS OF VIBRATION OF CONCRETE ACCORDING TO FRENCH PRACTICE

FRENCH PRACTICE WENT IN FOR HEAVY VIBRATING OR TAMPING OF PAVEMENT CONCRETE. BRIEF DESCRIPTIONS OF SEVERAL MACHINES WERE GIVEN, SOME OF WHICH RAN ON SIDE RAILS AND OTHERS RESTED DIRECTLY UPON THE FRESH CONCRETE. A FEATURE OF THE PRACTICE WAS A BRUSHING MACHINE FOR ROUGHENING THE SURFACE TO MAKE IT SKID PROOF BY REMOVING THE FINE MATERIAL DURING THE SETTING AND HARDENING PERIOD. ONE BELIEF WAS IN USING LEAN MIXTURES WITH ENOUGH VIBRATION OR RAMMING TO FORCE THE INDIVIDUAL PIECES OF LARGE SIZE AGGREGATE INTO SUCH INTIMATE POSITIONS THAT WERE SECURELY BONDED TO EACH OTHER BY A MINIMUM AMOUNT OF CEMENT. ALMOST NO CRACKING AND LITTLE WEAR WAS OBSERVABLE ON TEN YEAR OLD PAVEMENTS, IN THE HEART OF PARIS, LAID BY THESE METHODS. /AUTHOR/

Crandell, JS Highway Research Board Proceedings 1937

3A 215317

INSTRUCTIONS FOR THE EXECUTION OF CONCRETE PAVEMENTS BY MECHANICAL METHODS

THE PRESENT INSTRUCTIONS ARE EXAMINED BY STUDYING THE "TECHNICAL CONTROL" BY MEANS OF STATISTICAL ANALYSIS AND THE "RECEIVING CONDITIONS" WITH APPLICATION OF REDUCTION OF THE PRICES IN THE STRETCHES WHERE THE CONTRACTS CONDITIONS WERE NOT MET. THE WORK INCLUDES THE USUAL ITEMS OF INSTRUCTIONS FOR PAVING. /RRI/

Vieira, JC Belotti, G Lerner, JG Pinto, HM
Road Research Institute /Brazil/

ACKNOWLEDGMENT: Road Research Institute /Brazil/

3A 215325

REVTMENT CONSTRUCTION BY FABRIFORM PROCESS

THE FABRIFORM PROCESS EMPLOYS HIGH STRENGTH, WATER-PERMEABLE SYNTHETIC FABRIC AS A CONCRETE FORMING MATERIAL. WATER/CEMENT RATIO IS REDUCED BY FORCING VEHICLE WATER THROUGH FABRIC, CAUSING SUBSTANTIAL INCREASE IN STRENGTH AND VERY RAPID STIFFENING. PROPER FABRIC DESIGN IS ESSENTIAL TO AVOIDING MORTAR LOSS. APPLIED TO CONSTRUCTION OF EROSION-CONTROL REVETMENTS, DUAL WALL FABRIC IS PLACED ON THE SURFACE TO BE PROTECTED AND FILLED WITH MORTAR. THE TWO LAYERS OF FABRIC MAY BE WOVEN TOGETHER AT REGULAR INTERVALS TO FORM FILTER POINTS PORVIDINGS RELIEF FROM HYDROSTATIC UPLIFT. A UNIFORM CROSS SECTION IS ALSO AVAILABLE, CONTAINING INTERNAL FIBER REINFORCING. /ASCE/

Lamberton, BA Am Soc Civil Engr J Construction Div July 1969

3A 215335

TIMBER-ARCH FALSEWORK FOR CONCRETE ARCH BRIDGES
SIX RECENTLY BUILT 201-FT. TO 540-FT. SPAN AUSTRIAN HIGHWAY BRIDGES ARE MULTI-BOX CONCRETE ARCH STRUCTURES. THE FALSEWORK FOR ALL THESE BRIDGES CONSISTED OF PARTIALLY PREASSEMBLED TWO-TIER AND THREE-TIER TRUSSED TIMBER ARCHES. THEY WERE BUILT SUFFICIENTLY STRONG TO CARRY THE WEIGHT OF THE ARCHED BOTTOM PANEL OF THE MULTI-BOX CONCRETE ARCH. AFTER THIS CONCRETE PANEL HAD CURED, IT CARRIED THE WEIGHT OF THE WEBS AND TOP PLATE OF THE BOXED CONCRETE ARCH. WITHIN EACH TRUSSED TIMBER ARCH, NO CARPENTER JOINTS, MECHANICAL FASTENERS OR ADHESIVES WERE USED. FRICTION BETWEEN ASSEMBLIES OF 8-3/8 IN. BY 2 IN. TIMBER PLANKS RESISTED THE INTERNAL FORCES. THUS THE FALSEWORK COULD BE DISMANTLED INTACT FOR REUSE. /AUTHOR/

Stern, EG Civil Engineering Asce Feb. 1970

3A 215340

INADEQUACIES AND NEEDED IMPROVEMENTS IN TECHNOLOGY FOR ROCK TUNNELING

DATA PRESENTED WERE DERIVED FROM THE RESULTS OF THE QUESTIONNAIRE TO THE OECD COUNTRIES. ATTENTION IS FOCUSED ON THE INADEQUACIES OF ROCK TUNNELING AND THE IMPROVEMENTS NEEDED. THE COUNTRIES ARE OF THE UNANIMOUS OPINION THAT IMPROVEMENTS ARE NEEDED IN EVERY PHASE OF THE TUNNEL CONSTRUCTION PROCESS. IT IS FELT THAT RESEARCH AND DEVELOPMENT EFFORTS SHOULD BE DIRECTED TOWARD FINDING WAYS TO INCREASE THE RATE OF TUNNEL CONSTRUCTION WHILE, AT ALL TIMES, BEING AWARE OF THE NEED TO REDUCE COSTS, MAINTAIN SAFE AND HEALTHY WORKING CONDITIONS, AND PRESERVE THE QUALITY OF THE ENVIRONMENT. IT IS FELT THAT THE BASIC CONSTRAINT TO THE ADVANCEMENT OF ROCK TUNNELING TECHNOLOGY IS DIRECTLY RELATED TO THE STATUS OF ROCK DISINTEGRATION METHODS. MORE SOPHISTICATED ROCK DISINTEGRATION TECHNIQUES ARE NEEDED WHICH ELIMINATE OR MINIMIZE THE EFFECT OF TIME-WASTING CYCLIC PATTERNS AND ARE READILY ADAPTABLE TO AUTOMATION. EXCAVATION AND CONSTRUCTION METHODS ARE HIGHLY DEPENDENT UPON GEOLOGICAL AND HYDROLOGICAL CONDITIONS. AN EFFORT SHOULD BE MADE TO: (1) DEVELOP METHODS TO ACCURATELY PREDICT ROCK CONDITIONS AND PROPERTIES AND TO EVALUATE THEIR ENGINEERING SIGNIFICANCE, (2) STANDARDIZE NOMENCLATURE AND TESTS SO THAT THE RESULTS WILL BE UNDERSTANDABLE AND USEFUL, AND (3) ENCOURAGE GREATER USE OF PRE-CONSTRUCTION EXPLORATION TECHNIQUES BY REDUCING THEIR COST AND EMPHASIZING POTENTIAL SAVINGS IN CONSTRUCTION COSTS. THE POTENTIAL FOR GREATLY REDUCING THE TIME AND MONEY REQUIRED FOR UNDERGROUND EXCAVATION SEEMS TO LIE IN THE DEVELOPMENT OF TECHNIQUES TO RAPIDLY ADVANCE THE EXCAVATION, SUPPORT THE OPENING, AND REMOVE THE WASTE IN A SINGLE HIGHLY AUTOMATED CONTINUOUS OPERATION. THE DRILL AND BLAST METHOD OF TUNNEL EXCAVATION IS THE MOST FREQUENTLY USED. WIDESPREAD USE OF THE TUNNELING MACHINE METHOD IS DESIRABLE IF THE MACHINES CAN BE INCREASED IN VERSATILITY PARTICULARLY WITH RESPECT TO THE ABILITY TO OPERATE EFFICIENTLY IN VARIOUS GROUND CONDITIONS AND TO BORE DIFFERENT SIZES AND SHAPES OF OPENINGS. IMPROVEMENTS IN DESIGN AND FABRICATION OF CUTTERS AND OTHER MACHINE PARTS TO PROVIDE GREATER RELIABILITY AND TO REDUCE THE MAINTENANCE COSTS ARE ALSO NEEDED.

Howard, TE
Oecd, Paris /France/ June 1970

CFSTI PB 193286, HRIS 33 213476, HRIS 33 213475, 1P33213477, HRIS 33 213479, HRIS 33 213478, HRIS 33 213480

3A 215341

INADEQUACIES AND NEEDED IMPROVEMENTS IN THE TECHNOLOGY OF IMMERSSED TUNNELS

THE TERM "IMMERSSED TUNNELS" MEANS TUNNELS COMPOSED OF ELEMENTS CONSTRUCTED IN A DRY-DOCK OR ON A SLIPWAY AND SUBSEQUENTLY TRANSPORTED TO THE CONSTRUCTION SITE, WHERE THEY ARE SUNK, PLACED ON A FOUNDATION AND CONNECTED TOGETHER UNDER WATER. THIS METHOD OF CONSTRUCTION OFFERS ADVANTAGES ONLY IN A RELATIVELY LIMITED FIELD. VIRTUALLY NO COUNTRY HAS BUILT A LARGE NUMBER OF IMMERSSED TUNNELS. STANDARDIZATION OF CONSTRUCTION METHODS AND DEVELOPMENT OF SPECIAL EQUIPMENT HAS BEEN ALMOST NON-EXISTENT. DURING THE LAST TEN YEARS EXPERIENCE HAS BEEN MAINLY CONCENTRATED IN THE UNITED STATES, BELGIUM, DENMARK AND THE NETHERLANDS. UNITED STATES TECHNOLOGY IS MOSTLY BASED ON CIRCULAR STEEL TUNNEL HULLS CONSTRUCTED ON SLIPWAYS. THE CONCRETE IS PLACED WHILE THE HULLS ARE IN A FLOATING POSITION AND THEY ARE SUBSEQUENTLY LOWERED ONTO AN ACCURATELY-FINISHED FOUNDATION BED. IN THE LOW-LYING COUNTRIES OF EUROPE REINFORCED-CONCRETE TUNNEL ELEMENTS, MOSTLY OF A RECTANGULAR CROSS-SECTION, ARE CONSTRUCTED IN A DRY-DOCK. THEY ARE FOUNDED ON PILES OR PLACED ON TEMPORARY FOUNDATIONS AND SAND-JETTED. IN BOTH THESE PARTS OF THE WORLD, THERE IS RELATIVE SATISFACTION WITH THE PRESENT-DAY STATE OF TECHNOLOGY. THE MOST IMPORTANT NEED FOR IMPROVEMENTS APPEARS TO LIE IN THE FIELD OF BASIC KNOWLEDGE OF GEOLOGY, HYDROLOGY AND SOIL MECHANICS AND DREDGING AND MEASURING TECHNIQUES. IN THE CASE OF BASIC KNOWLEDGE, THE FUNDAMENTAL RESEARCH IN MOST CASES IS BEING DONE BY UNIVERSITIES, WHEREAS RESEARCH INSTITUTES CARRY OUT INVESTIGATIONS FOCUSED ON APPLICATIONS. THERE IS NO CO-ORDINATION OF THESE ACTIVITIES, AND INTERNATIONAL EXCHANGES ARE INSUFFICIENT. THE MOST IMPORTANT NEEDS ARE FOR: (1) A STANDARD CLASSIFICATION OF ROCKS AND SOILS TO ACHIEVE A COMMON UNDERSTANDING OF GEOLOGICAL CONDITIONS, (2) IMPROVED TECHNIQUES FOR DETERMINING BED-LOAD TRANSPORT AND FOR PREDICTING THE RATE AND EXTENT OF SILTING OF TRENCHES, (3) IMPROVED TECHNIQUES FOR DETERMINING THE EFFECT OF WAVES AND CURRENTS, (4) IMPROVED LABORATORY TESTS FOR DETERMINING PERMEABILITY, COMPRESSION AND SWELLING CHARACTERISTICS, EARTH PRESSURE AT REST, AND SOIL BEHAVIOR DURING EARTHQUAKES, (5) IMPROVED METHODS OF CORRELATING LABORATORY AND FIELD TESTS TO PREDICT THE BEHAVIOR OF THE IN-SITU GROUND, AND (6) IMPROVED METHODS OF PREDICTING THE STABILITY OF TRENCH SLOPES. THE DREDGING OF TUNNEL TRENCHES INVOLVED SPECIAL PROBLEMS FOR WHICH THE EQUIPMENT AT PRESENT AVAILABLE IS INADEQUATE AND OFTEN RESULTS IN HIGH COSTS. SUITABLE EQUIPMENT FOR DIGGING TRENCHES AT DEPTH EXCEEDING 40 METERS IS NOT YET AVAILABLE. THE METHODS COMMONLY USED FOR MEASURING DEPTH RELY ON THE ECHO SOUNDER AND THE MARINER'S SOUNDING LEAD.

Oecd, Paris /France/ June 1970

CFSTI PB 193286, HRIS 33 213477, HRUS 33 213476, 1P33213478, HRIS 33 213479, HRIS 33 213475, HRIS 33 213480

3A 215346

THE COMPUTER AS A CONSTRUCTION TOOL

THE REAL POTENTIAL OF THE COMPUTER IN CONSTRUCTION LIES IN ITS ABILITY TO COMMUNICATE; TO RECORD, RECALL, CALCULATE AND SELECTIVELY DISSEMINATE INFORMATION. AS THE FIRST STEP IN EFFECTIVELY COMMUNICATING WITHIN THE LIMITATIONS OF AVAILABLE DATA PROCESSING EQUIPMENT, IT IS NECESSARY TO ESTABLISH A COMPREHENSIVE DATA BASE IN WHICH ALL COMPONENTS OF CONSTRUCTION ARE DEFINED AND BROKEN DOWN INTO THEIR

FUNDAMENTAL WORK-ITEMS UNITS. THE PROBLEMS OF DETAILED QUANTITY SURVEYING WERE ACKNOWLEDGED AT THE BEGINNING OF THE PROJECT AND A TECHNIQUE PRODUCED WHICH WOULD MAKE IT PRACTICAL TO TAKE OFF PROJECT REQUIREMENTS AT ANY STAGE OF THE DESIGN/CONSTRUCTION CYCLE. ONCE DESIGN DECISIONS ARE RECORDED AND STORED WITHIN THE MEMORY OF THE COMPUTER, ALMOST ANY DESIRED TYPES OF OUTPUTS ARE AVAILABLE. CONCLUSIONS OF THE STUDY INDICATE THAT THE DEVELOPMENT OF A CONSTRUCTION MANAGEMENT INFORMATION SYSTEM IS NOT ONLY FEASIBLE, BUT ALSO POTENTIALLY VERY SIGNIFICANT TO THE TOTAL CONSTRUCTION PROCESS. THE IMPROVEMENT IN COMMUNICATIONS AND THE INCREASED CONTROL DURING DESIGN AND CONSTRUCTION, WHICH THIS SYSTEM MAKES POSSIBLE WILL ASSIST THE CONSTRUCTION ENGINEER TO TURN OUT BETTER PROJECTS AT LESS COST.

Early, WC *Military Engineer* Sept. 1970

3A 215352

THE APPLICATION OF TIME-LAPSE PHOTOGRAPHY IN WORK SIMPLIFICATION STUDIES OF CONSTRUCTION OPERATIONS

THE REPORT DESCRIBES THE USE OF TIME-LAPSE PHOTOGRAPHY IN WORK SIMPLIFICATION STUDIES OF CONCRETE BRIDGE DECK CONSTRUCTION. THE INVESTIGATION WAS FUNDED BY THE INDIANA STATE HIGHWAY COMMISSION THROUGH THE PURDUE JOINT HIGHWAY RESEARCH PROJECT, AND WAS PERFORMED WITH THE COOPERATION OF SEVERAL BRIDGE CONSTRUCTION CONTRACTORS. ITS FINDINGS INDICATED THAT COMMONLY USED METHODS FOR BRIDGE DECK CONSTRUCTION CONTAINED INEFFICIENCIES THAT WARRANTED FORMAL WORK SIMPLIFICATION STUDIES AND COULD BENEFIT THEREFROM. ANALYSES IN SUPPORT OF THIS CONCLUSION ARE INCLUDED IN THE RESEARCH REPORT. THE INVESTIGATOR RECOMMENDS THAT CONSTRUCTION MANAGERS BE ENCOURAGED TO MAKE USE OF TIME-LAPSE PHOTOGRAPHY AS A BASIS FOR WORK SIMPLIFICATION STUDIES OF SELECTED CONSTRUCTION OPERATIONS. GENERALIZED WORK SIMPLIFICATION FINDINGS ARE OF QUESTIONABLE VALUE TO CONSTRUCTION MANAGERS BECAUSE OF THE CHANGING NATURE OF THEIR WORK. HOWEVER, SPECIFIC APPLICATIONS OF WORK SIMPLIFICATION TECHNIQUES CAN BE OF SUBSTANTIAL BENEFIT TO EACH CONSTRUCTION ORGANIZATION. THE REPORT INCLUDES, AS AN APPENDIX, A GUIDE MANUAL FOR THE APPLICATION OF TIME-LAPSE PHOTOGRAPHY TO WORK METHOD STUDIES OF CONSTRUCTION OPERATIONS. /ARTICLE/

Jacobson, JA *Highway Research Record, Hwy Res Board* 1970

3A 215361

ECONOMICS OF THE CONSTRUCTION INDUSTRY

THE CONTRACT CONSTRUCTION INDUSTRY IS DEFINED, AND ITS IMPACT ON THE NATIONAL ECONOMY IS MEASURED, TO ASSESS THE BARRIERS TO ENTRY AND NEW COMPETITION. THE ANALYSIS FOCUSES ON THE STRUCTURE OF THE INDUSTRY. AN EXAMINATION OF THE FACTORS INFLUENCING THE RISE OF CONSTRUCTION COSTS DISCLOSES THAT GAINS IN LABOR PRODUCTIVITY WERE MORE THAN OFFSET BY RISING WAGE RATES. THE ANALYSIS OF THE PERFORMANCE OF THE CONSTRUCTION INDUSTRY CONCENTRATED ON THE ASSESSMENT OF ECONOMIC EFFICIENCY AND THE ECONOMIC FORCES RESPONSIBLE FOR THE OBSERVED BEHAVIOR. THE IMPENDING VAST OUTLAYS IN TRANSPORTATION FACILITIES AND URBAN RENEWAL OFFER AN UNUSUAL OPPORTUNITY FOR LARGE-SCALE CONSTRUCTION. THE SUGGESTION IS OFFERED THAT THE GOVERNMENT, ON AN EXPERIMENTAL BASIS AT LEAST, INCORPORATE IN THE DESIGN OF THESE PROJECTS INNOVATING FEATURES THAT MIGHT LEAD TO THE ADOPTION OF NEW CONSTRUCTION MATERIALS AND TECHNIQUES BY THE CONSTRUCTION INDUSTRY. /AUTHOR/

Cassimatis, PJ
National Industrial Conference Board

3A 215371

STATISTICAL QUALITY CONTROL OF HIGHWAY CONSTRUCTION AND MATERIALS

EXISTING LOCAL PRACTICES USED IN ESTABLISHING AND ENFORCING HIGHWAY SPECIFICATIONS AND CONSTRUCTION PROCESSES ARE REVIEWED AND COMPARED WITH PROCEDURES BASED ON STATISTICAL QUALITY CONTROL CONCEPTS. IN ORDER THAT STATISTICAL QUALITY CONTROL CONCEPTS MAY BE PROPERLY USED WHERE APPLICABLE, THE FIRST PART OF THIS REPORT CONSIDERS THE GENERAL THEORY UNDERLYING THE USE OF STATISTICAL CONTROL METHODS AND THE DEVELOPMENT OF DIFFERENT TYPES OF ACCEPTANCE PLANS WHICH MAY BE USED IN THE HIGHWAY CONSTRUCTION INDUSTRY. THE SECOND PORTION OF THE REPORT IS CONCERNED WITH ANALYZING AND COMPARING KENTUCKY'S CURRENT SPECIFICATION REQUIREMENTS WITH TYPICAL QUALITY CONTROL REQUIREMENTS ESTABLISHED USING BASIC STATISTICAL THEORY. SPECIFICATIONS USED BY SOME OTHER AGENCIES WHICH ARE BASED ON STATISTICAL PRINCIPLES ARE PRESENTED TO ILLUSTRATE THE USE BEING MADE OF THIS TYPE OF ACCEPTANCE PLAN. /AUTHOR/

Venable, JB
Kentucky Department Highways Dec. 1970

3A 215373

HIGH RISE "SYSTEMS BUILDING" IN THE HUDSON VALLEY
THE USE OF "SYSTEMS BUILDING" TECHNIQUES IS DISCUSSED FOR AN URBAN RENEWAL PROJECT IN POUGHKEEPSIE, N. Y. THE PROJECT CONSISTS OF A CENTRAL 18-STORY BUILDING SURROUNDED BY SMALLER BUILDINGS PROVIDING ABOUT 1000 DWELLING UNITS. ALSO CONSTRUCTION IS DESCRIBED OF THE CENTRAL BUILDING WHICH COMBINES CAST-IN-PLACE ELEVATOR AND STAIRWELL CORES AND SHEAR WALLS WITH PRECAST CONCRETE ELEMENTS, SOME OF WHICH WERE CAST ON-SITE. PRECASTING OPERATIONS ARE DESCRIBED AND ERECTION PROCEDURES DISCUSSED. IN THE LATTER, CAST-IN-PLACE WORK AND PRECAST FLOOR ERECTION PROCEEDED TOGETHER FLOOR BY FLOOR FOLLOWED SHORTLY BY ERECTION OF PRECAST EXTERIOR PANELS. SHEAR WALLS AND FLOOR PANELS WERE ERECTED AT A RATE OF ONE FLOOR PER WEEK. /ACIJP/

Corbetta, RH Wilson, RE *Am Concrete Inst Journal & Proceedings* Jan. 1971

3A 215380

CURRENT CONSTRUCTION PRACTICES IN THE INSTALLATION OF HIGH-CAPACITY PILING

STRUCTURAL AND ECONOMIC CONSIDERATIONS ARE CAUSING A TREND TOWARD THE USE OF HIGH-CAPACITY PILING FOR HIGHWAY BRIDGES. THEY ARE BEING EMPLOYED IN COMBINED LOADING TO RESIST BEARING UPLIFT, AND LATERAL FORCES WITH DESIGN LOADS FROM 200 TO 1,500 TONS. THESE PILES MUST BE INSTALLED TO PENETRATIONS IN SOIL SUFFICIENT TO DEVELOP THEIR CAPACITY, AND THIS REQUIRES SPECIAL TECHNIQUES AND EQUIPMENT. INSTALLATION TECHNIQUES INCLUDING WEIGHTING, DRIVING, VIBRATION, JETTING, DRILLING, ROTATION, AND LUBRICATION. BECAUSE THE CAPACITY OF A PILE IS DETERMINED BY THE STRUCTURAL CAPACITY OF THE PILE AND THE CAPACITY OF THE SOIL, I.E., THE PILE-SOIL SYSTEM, INSTALLATION TECHNIQUES MUST NOT PERMANENTLY DECREASE THE SOIL-SUPPORTING CAPACITY. AFTER INSTALLATION, PILE-SOIL CAPACITIES MAY BE IMPROVED BY CONSOLIDATION OF SURROUNDING SOILS, CONCRETE PLUGS, GROUT INJECTION, AND EXPANSION OF THE PILE TIP. A REVIEW OF IMPORTANT RECENT INSTALLATIONS OF HIGH-CAPACITY PILES OF VARIOUS TYPES IS INSTRUCTIVE IN ILLUSTRATING THE VARIOUS COMBINATIONS OF TECHNIQUES THAT HAVE

BEEN SUCCESSFULLY EMPLOYED. A REVIEW AND ANALYSIS OF PROBLEMS ALSO DIRECTS ATTENTION TO THOSE AREAS REQUIRING FURTHER DEVELOPMENT. THE VARIABLES FACING BOTH THE DESIGNER AND THE CONTRACTOR INCLUDE CHARACTER OF THE SOILS, DEPTH OF WATER OR SOFT MATERIAL, LOADS TO BE CARRIED, ACCESS FOR EQUIPMENT, MAGNITUDE OF THE JOB, AVAILABLE EQUIPMENT FOR TRANSPORTING, LIFTING, AND INSTALLING, AND AVAILABLE FACILITIES FOR FABRICATIONS OR MANUFACTURE. IT IS ESSENTIAL THAT THE DESIGN AND INSTALLATION BE INTEGRATED IF SUCCESS IS TO BE OBTAINED WITH THESE HIGH-CAPACITY PILES. THUS, THE MAXIMUM BENEFITS OF HIGH-CAPACITY PILES CAN BE MADE MORE WIDELY AVAILABLE TO THE BRIDGE ENGINEERING PROFESSION. /AUTHOR/

Gerwick, BC *Highway Research Record, Hwy Res Board* 1970

3A 215393

A STUDY OF THE EFFECTS OF CONSTRUCTION PRACTICES ON BRIDGE DECK CONSTRUCTION

DURING THE PERIOD OF 1964 THROUGH 1966 SEVEN CONCRETE BRIDGE DECKS WERE OBSERVED UNDER CONSTRUCTION IN PENNSYLVANIA. SLUMPS AND AIR CONTENTS WERE RECORDED FOR EVERY TRUCKLOAD OF CONCRETE THAT WENT INTO THE DECKS. ALSO, THE PRECISE LOCATION OF PLACEMENT OF EVERY TRUCKLOAD OF CONCRETE WAS RECORDED, AND NOTE WAS TAKEN OF CONSTRUCTION PRACTICES THAT MIGHT ADVERSELY AFFECT THE PERFORMANCE OF CONCRETE. THE 7 BRIDGE DECKS WERE SUBSEQUENTLY INSPECTED DURING THE PERIOD OF 1967 THROUGH 1969, AND THE VARIOUS FORMS OF DETERIORATION WERE OBSERVED AND RECORDED. IN THIS WAY IT HAS BEEN POSSIBLE TO DETERMINE RATES OF DETERIORATION AND TO RELATE CONCRETE PROPERTIES AND CONSTRUCTION PRACTICES TO OBSERVED DETERIORATION. DETAILS OF BRIDGE CONSTRUCTION PERTINENT TO DURABILITY AND OBSERVATIONS MADE DURING SUBSEQUENT INSPECTIONS ARE COVERED FOR EACH DECK. THE CONSTRUCTION DIFFICULTIES THAT LEAD TO DURABILITY PROBLEMS, BASED ON THE OBSERVATIONS MADE IN THIS STUDY, ARE SUMMARIZED. /AUTHOR/

Cady, PD Theisen, JC *Highway Research Board Special Reports* 1970

3A 215399

CONSTRUCTION PRACTICES

DURING THE 1920'S THE DEFENSE DEPARTMENT PIONEERED THE GENERAL DEVELOPMENT AND APPLICATION OF STATISTICAL-BASED PROCESS CONTROL AND ACCEPTANCE CONCEPTS TO INDUSTRIAL PRODUCTS. THE FIRST USE OF THE METHODOLOGY BY HIGHWAY ENGINEERS WAS A RECORD SAMPLING PROGRAM. A LONG SLOW PERIOD OF ADOPTION FOLLOWED. ONLY IN RECENT YEARS HAS REALISTIC PROGRESS BEEN MADE IN THE USE OF STATISTICAL METHODS. NOW, A TOTAL OF 36 STATES HAVE ACTIVELY BEEN ENGAGED IN SOME FORM OF STUDY OR APPLICATION OF STATISTICALLY ORIENTED SPECIFICATION, FOR CONTROL AND ACCEPTANCE OF CONSTRUCTION, AND MORE THAN 1/3 OF THESE STATES ARE USING A STATISTICALLY DESIGNED SPECIFICATION, AS THEIR STANDARD OR PROVISIONAL SPECIFICATION. A NUMBER OF PLANS HAVE PROVED SOUND; YET THE GENERAL CONSENSUS SEEMS TO BE THAT THE APPLICATION OF STATISTICAL CONCEPTS TO HIGHWAY USE IS NOT FEASIBLE AT THIS TIME.

Deyoung, CE *Highway Research Board Special Reports* 1971

3A 215417

COORDINATION OF CONCRETE PAVING OPERATIONS BY A TRIAL AREA SPECIFICATION

THE START OF LAYING CONCRETE PAVEMENT ON A NEW CONTRACT IS REGARDED AS A TRIAL DURING WHICH THE CONTRACTOR'S ORGANIZATION, CREW AND EQUIPMENT MUST BE BROUGHT INTO WORKING COORDINATION WITH THE DESIGN CONCRETE MIX SO AS TO ACHIEVE THE SPECI-

PIED CONCRETE AND RIDING QUALITY FOR THE PAVEMENT. A SYSTEMATIC METHOD IS DESCRIBED WHICH SHOULD ENSURE THAT THE PAVING OPERATION AS A WHOLE REACHES ITS FINAL AND MOST SATISFACTORY FORM AS QUICKLY AS POSSIBLE. A SPECIFICATION FOR THIS, AS USED WITH GREAT SUCCESS IN ONTARIO, CALLS FOR A TRIAL PAVEMENT AREA 1,000 FT LONG TO BE LAID AHEAD OF THE MAIN PAVING. THIS TRIAL AREA AFFORDS AN OPPORTUNITY FOR ANY NECESSARY CHANGES IN THE ORGANIZATION OF THE JOB, FOR ANY ADJUSTMENTS TO THE EQUIPMENT OR ALTERATIONS IN THE DESIGN MIX PROPORTIONS TO SUIT WORKING CONDITIONS, AND FOR THE TRAINING OF INEXPERIENCED MEN. TO CHECK THE QUALITY OF THE PAVEMENT AS QUICKLY AS POSSIBLE, ACCELERATED TESTS ARE UNDER DEVELOPMENT TO ESTABLISH THE STRENGTH AND COMPACTION OF THE CONCRETE WITHIN A FEW HOURS. IN ADDITION, THE RIDING QUALITY OF THE PAVEMENT IS MEASURED. IF THE RESULT OF THESE TESTS ARE SATISFACTORY AND THE TRIAL AREA WAS SUCCESSFUL, THE CONTRACTOR IS ALLOWED TO PROCEED AND THE TRIAL AREA BECOMES PART OF THE PAVEMENT. IF NOT, THE CONTRACTOR IS HELD UNTIL NECESSARY CORRECTIONS ARE MADE; ANY SLABS IN THE TRIAL AREA NOT MEETING THE SPECIFICATION ARE REMOVED AND REPLACED AT THE CONTRACTOR'S EXPENSE. THE BACKGROUND, CONTRACTUAL AND PRACTICAL ADVANTAGES, TOGETHER WITH THE RESULTS ACHIEVED BY SUCH A TRIAL AREA SPECIFICATION, ARE DISCUSSED. /AUTHOR/

Smith, P *Highway Research Board Proceedings* 1961

3A 215421

SOME CONSIDERATIONS OF SUBMERGED TUNNELLING
THE TRENCH AND PRECAST TUNNEL IS THE USUAL CONSTRUCTION METHOD OF UNDERWATER TUNNELING. THE LENGTH OF THE ELEMENTS HAS INCREASED TO MORE THAN 100 M, THE WIDTH TO MORE THAN 40 M, AND THE WEIGHT TO ABOUT 50,000 TONS. THERE IS A MORE OR LESS HISTORICAL DIFFERENCE IN SUBMERGED TUNNELING METHODS IN THE US AND THE REST OF THE WORLD, ALTHOUGH THERE IS A TENDENCY FOR BOTH METHODS TO GROW TOWARDS ONE ANOTHER, PARTICULARLY WITH REGARD TO EXECUTION. THE AMERICAN TUNNEL IS BASED ON THE CYLINDRICAL CROSS SECTION WITH TWO TRAFFIC LANES; THE EUROPEAN TUNNEL HAS A RECTANGULAR CROSS SECTION WHICH CAN EASILY BE ADAPTED TO THE REQUIRED NUMBER OF TRAFFIC LANES (2X3 OR 3X2 FOR INSTANCE). BECAUSE OF THE FINANCING SYSTEM AND RIGOROUS PREFABICATION, THE CONSTRUCTION TIME OF THE CYLINDRICAL TUNNEL IS MUCH LESS THAN THAT OF THE RECTANGULAR TUNNEL. THE JOINT CONNECTION OF RECTANGULAR TUNNELS HAS BEEN MUCH SIMPLIFIED BY THE APPLICATION OF A RUBBER GASKET, WHICH HAS BEEN USED ALSO FOR RECENT AMERICAN TUNNELS. THE FOUNDATION OF THE TUNNEL ELEMENTS IS GENERALLY DIRECTLY ONTO THE SUBSOIL, BUT SOMETIMES THE SOIL CONDITIONS ARE SO BAD THAT A PILE FOUNDATION HAS TO BE USED. SOME IDEAS ARE GIVEN ABOUT POSSIBLE DEVELOPMENTS OF LONG TUNNEL CROSSINGS AND BRIDGE-TUNNEL COMBINATIONS. /AUTHOR/

Brakel, J *Inst Civil Engineers Proc, London /UK/* Apr. 1971

3A 215434

LONG-SPAN PRECAST PRESTRESSED GIRDER BRIDGES
FABRICATION, HANDLING, AND TEMPORARY CONSTRUCTION LOADS, AS WELL AS THE STRUCTURAL REQUIREMENTS FOR SHEAR AND FLEXURE, INFLUENCE LONG-SPAN PRECAST PRESTRESSED GIRDER DIMENSIONS AND DETAILS. AN ANALYSIS OF THE DISTRIBUTION OF WHEEL LOADS TO GIRDERS IS PRESENTED. VARIOUS TYPES OF ERECTION PROCEDURES ARE DESCRIBED. /JPCI/

Libby, JR *Prestressed Concrete Institute Journal* July 1971

3A 215441

APPROACH ROADS, GREENLAND 1958-59
PROJECT 1, APPROACH ROADS, GREENLAND R&D PROGRAM, WAS ORGANIZED IN 1954 TO DEVELOP METHODS, TECHNIQUES AND CRITERIA FOR CONSTRUCTING ROADS ON BOTH GLACIAL ICE SURFACES AND ADJACENT ICE-FREE TERRAIN. ACTIVITIES FOR THE YEARS 1958 AND 1959 CONSISTED OF CONSTRUCTION OF ADDITIONAL ROADS AND CULVERTS AND AN ANNUAL ASSESSMENT OF THE PERFORMANCE OF THE VARIOUS ROADS AND OTHER STRUCTURES ON THE ICE CAP. SPECIAL MEASUREMENTS WERE MADE OF ICE SURFACE MOVEMENT, SUBSURFACE TEMPERATURE AND MELT-WATER RUNOFF. /AUTHOR/

Davis, RM *Crel Technical Reports, Army Dept /US/* June 1971

3A 215451

A COMPUTER PROGRAM FOR ESTIMATING COSTS OF HARD ROCK TUNNELLING (COHART)
A COMPUTER PERFORMS ALL LOGIC AND COMPUTATIONS CUSTOMARILY DONE BY HAND IN PREPARATION OF ENGINEER'S ESTIMATES OR CONTRACTOR'S BIDS ON TUNNEL-SHAFT SYSTEMS. THE PROGRAM DESCRIBED IS BASED ON CONSTRUCTION METHODS, WORK FORCES AND EQUIPMENT SELECTIONS CORRESPONDING TO THE CURRENT STATE OF THE ART OF TUNNELING. THE PROGRAM CONTAINS LOGIC TO PERMIT THE ESTIMATE, THE PROGRAM WILL ACCOMMODATE A LARGE NUMBER OF VALUES OR CHANGES IN THE VALUES OF THE FACTORS THAT AFFECT COSTS, SUCH AS TUNNEL SHAPE AND SIZE, SHAFT DEPTH, ROCK CHARACTERISTICS, AND CONSTRUCTION METHOD. TO PROVIDE GREAT FLEXIBILITY, THE USER OF THE PROGRAM IS PROVIDED WITH THE OPTION OF SELECTING LINING TYPE AND THICKNESS, PROFIT AND OVERHEAD MARGINS, AND OTHER INPUT DATA. SUGGESTIONS FOR SELECTING AN APPROPRIATE VALUE FOR THESE INPUTS ARE CONTAINED. COMPLETE OPERATING INSTRUCTIONS AND AN ILLUSTRATIVE EXAMPLE ARE PRESENTED. /AUTHOR/

Wheby, FT Cikanek, EM
Harza Engineering Company May 1970

NTIS PB 193 272, 3P33220660

3A 215487

EARTH MOVING AND COMPACTION EQUIPMENT-A PANEL DISCUSSION
IN VIEW OF THE PROPOSED ACCELERATION OF THE NATIONAL ROAD BUILDING PROGRAM, IT IS IMPERATIVE THAT THE CONTRACTOR, THE ROADWAY EQUIPMENT MANUFACTURER, AND THE HIGHWAY ENGINEER POOL THEIR TALENTS IN WORKING OUT A SOLUTION TO MUTUAL PROBLEMS IF THE TASK AHEAD IS TO BE ACCOMPLISHED. TO MEET THE CHALLENGE THAT LIES AHEAD, IMPROVED HIGHWAY DESIGN AND CONSTRUCTION SPECIFICATIONS, THE DEVELOPMENT OF NEW AND BETTER CONSTRUCTION EQUIPMENT, AND A MORE EFFECTIVE USE OF EXISTING EQUIPMENT MUST BE MET. DESIGN STANDARDS HAVE, OF NECESSITY, BEEN CHANGED TO REQUIRE BETTER ALIGNMENT, BOTH HORIZONTAL AND VERTICAL, A MORE LEVEL GRADIENT, FLATTER CROSS SLOPES, WIDER DITCHES, BETTER SIGHT DISTANCES, ETC. THESE IMPROVEMENTS IN DESIGN HAVE PERMITTED A MORE ECONOMICAL USE OF LARGER AND MORE VARIED PIECES OF GRADING AND EARTH MOVING EQUIPMENT. HOWEVER, TO PERMIT THE MOST EFFICIENT USE OF NEW AND EXISTING EQUIPMENT, IT IS NECESSARY TO CONTINUE TO KEEP CONSTRUCTION SPECIFICATIONS ABREAST OF EQUIPMENT DEVELOPMENT AND TO IMPROVE DESIGN WITHIN THE LIMITS OF GOOD CONSTRUCTION PRACTICES. A PERFECT DESIGN AND A PERFECT SET OF CONSTRUCTION SPECIFICATIONS, ALTHOUGH IDEAL FOR AN OBJECTIVE, ARE NOT ENOUGH TO ASSURE THE SUCCESSFUL COMPLETION OF THE HIGHWAY CONSTRUCTION PROGRAM THAT LIES AHEAD. THE EQUIPMENT DESIGNER AND MANUFACTURER, THE CONTRACTOR, AND THE ENGINEER MUST

WORK AS A TEAM TO ACCOMPLISH SUCH A PROGRAM.
/AUTHOR/

Back, WV *Highway Res Abstracts Hwy Res Board* July 1956

3A 215490

FACTORS IN EFFICIENT USE OF POWER SHOVELS

SELECTION OF THE PROPER EQUIPMENT TO SUIT THE JOB CONDITIONS IS THE CONTRACTOR'S RESPONSIBILITY. EXTENSIVE STUDIES IN HANDLING VARIOUS TYPES OF MATERIALS WITH VARIOUS TYPES AND SIZES OF EQUIPMENT WILL AID THE CONTRACTOR TO SELECT THE PROPER EQUIPMENT TO PERFORM THE WORK IN THE MOST ECONOMICAL MANNER. MORE DETAILED INVESTIGATION OF THE EXCAVATION TO BE ENCOUNTERED WILL ALSO AID THE BIDDER TO DETERMINE THE MOST SUITABLE EQUIPMENT TO HANDLE THE MATERIAL. THIS WILL AVOID COSTLY CHANGES IN EQUIPMENT AND UNNECESSARY DELAYS DURING THE PROGRESS OF THE WORK. POWER SHOVELS AND DRAGLINES ARE NECESSARY TO EXCAVATE CERTAIN MATERIALS. POWER SHOVELS ARE NEEDED WHERE ROCK OR HEAVY BOULDERS ARE ENCOUNTERED; DRAGLINES ARE A NECESSITY WHERE MATERIAL MUST BE EXCAVATED FROM WATER OR VERY SOFT GROUND WHERE OTHER TYPES OF EQUIPMENT CANNOT BE OPERATED. IT IS DESIRABLE FOR THE CONTRACTOR TO SELECT A MACHINE AS LARGE AS CAN BE JUSTIFIED, DEPENDENT UPON THE SIZE OF THE PROJECT AND THE NATURE OF THE MATERIAL TO BE HANDLED, IN ORDER TO OBTAIN THE LOWEST HANDLING COST. THIS DECISION, HOWEVER, MUST BE INFLUENCED ALSO BY TRANSPORTATION RESTRICTIONS. DESIGN ENGINEERS HAVE PARTIALLY SOLVED THE PROBLEM BY MAKING MACHINES WHICH CAN BE DISMANTLED AND REASSEMBLED WITH LESS WORK, SUCH AS REMOVABLE CRAWLER FRAMES, REMOVABLE COUNTERWEIGHT, AND MEANS TO UTILIZE THE POWER OF THE MACHINE TO AID IN REMOVING AND REINSTALLING ATTACHMENTS, AS WELL AS IN LOADING AND UNLOADING. IT IS NECESSARY, THEREFORE, TO REVIEW THE LOAD LIMITATIONS IMPOSED ON TRANSPORTING MACHINES TO AND FROM THE JOB IF THE CONTRACTOR IS TO BE PERMITTED TO USE EQUIPMENT WHICH WILL PERFORM THE WORK MOST ECONOMICALLY. THE OUTPUT OF POWER SHOVELS AND DRAGLINES IS AFFECTED BY MANY FACTORS IN ADDITION TO THOSE PREVIOUSLY MENTIONED. DEPTH OF CUT, DEGREE OF SWING FOR LOADING, NUMBER AND SIZE OF HAULING UNITS, AND OPERATOR EFFICIENCY ARE SOME OF THE MOST IMPORTANT. SOME OF THESE ARE CLASSIFIED AS MANAGEMENT FACTORS AND REQUIRE CAREFUL STUDY TO OPERATE EFFICIENTLY. STUDIES HAVE BEEN MADE WHICH POINT OUT CONSIDERABLE LOST TIME DUE TO THESE FACTORS. FURTHER STUDIES OF THIS NATURE WILL BE BENEFICIAL TO CONTRACTORS AND MANUFACTURERS. /AUTHOR/

Jones, RP *Highway Res Abstracts Hwy Res Board* July 1956

3A 215509

CHOP OLD ASPHALT INTO CHEAP NEW BASE

A PROCESS FOR THE RECYCLING OF EXISTING ASPHALT PAVEMENT FOR BASE MATERIAL IS DESCRIBED. A TEN MILE STRETCH OF HIGHWAY IN NEVADA WAS RECLAIMED BY GRINDING THE 8-IN.-THICK ASPHALT MAT INTO 2-IN.-MINUS AGGREGATE PRODUCT, THEN BLENDING AND REMIXING IT WITH 3% PORTLAND CEMENT AND 8% WATER. THE RECLAIMED MATERIAL SERVED AS THE BASE FOR A NEW ASPHALT RIDING SURFACE WITH A SAVINGS OF 33-1/3% OVER ALL NEW AGGREGATE. DETAILS OF THE EQUIPMENT AND METHOD ARE GIVEN. /AUTHOR/

Construction Equipment Vol. 45 No. 3, Mar. 1972, p 37, 1 Phot

3A 215510

DEEP LIFT ASPHALTIC CONCRETE, WITH DISCUSSIONS AND CLOSURE

DEEP LIFT ASPHALTIC PAVEMENTS, BY ELIMINATING THE NEED FOR BASES OF CRUSHED ROCK OR UNTREATED

GRAVEL, ALLOW TRENCHING FOR UTILITIES AND SUBSEQUENT REINSTATEMENT TO BE UNDERTAKEN WITH LESS TRAFFIC DISRUPTION AND LESS DISTURBANCE TO THE ROAD ITSELF. RECOMMENDATIONS ON MIX CHARACTERISTICS AND DESIGN, PAVEMENT LAYING AND COMPACTION METHODS ARE MADE, BASED ON EXPERIENCE GAINED WITH DEEP LIFT ASPHALT PAVEMENTS IN NEW SOUTH WALES. THE METHOD WAS FOUND TO GIVE STRONG PAVEMENTS POSSESSING GOOD RIDING QUALITIES, WITHOUT THE PROBLEM OF REFLECTIVE CRACKING ASSOCIATED WITH CONCRETE PAVEMENTS.

Giffen, JC Divnich, G Bone, EJ DISCUSSER Bils, JA DISCUSSER Larcombe, LA DISCUSSER *Australian Road Research Board Proc* Vol. 5 1970, pp 231-47, 5 Fig, 5 Tab, 7 Ref

3A 215515

END-RESULT SPECS GET CAUTIOUS OK ON EXPERIMENTAL ASPHALT JOB

ACCEPTANCE OF ASPHALT PAVEMENT HAS BEEN STRICTLY ON THE BASIS OF END RESULTS ON A RECENT OVERLAY PROJECT IN ILLINOIS. THE EXPERIMENTAL SPECIFICATIONS AND JOB CONTROL PROCEDURES HAVE GIVEN THE CONTRACTORS VIRTUALLY A FREE HAND IN ESTABLISHING JOB MIXES, SCHEDULING HOTMIX PRODUCTION, AND IN DECIDING ON EQUIPMENT AND CONSTRUCTION METHODS. STATE INSPECTORS HAVE SAMPLED AND TESTED ONLY THE MATERIAL IN PLACE ON THE ROADWAY, OFFICIALLY IGNORING PRODUCTION PROCEDURES. ACCEPTANCE WAS BASED ON ASPHALT CONTENT AND AGGREGATE GRADATION IN THE MIX ON THE ROADWAY, DENSITY, PAVEMENT THICKNESS AND SURFACE SMOOTHNESS. IN ADDITION TO UPPER AND LOWER LIMITS, UNIFORMITY WAS A BIG FACTOR IN ACCEPTANCE. THE END-RESULT TESTING DID PERMIT SOME INCREASE IN PRODUCTION.

Roads and Streets Vol. 113 No. 12, Dec. 1970, pp 61-2, 3 Tab, 1 Phot

3A 215516

HRB QUESTIONNAIRE ON BRIDGE DECK FINISHING

DUE TO THE INCREASINGLY WIDESPREAD USE OF MECHANICAL BRIDGE DECK SCREEDING EQUIPMENT, A QUESTIONNAIRE WAS RECENTLY PREPARED AND DISTRIBUTED TO HIGHWAY RESEARCH BOARD MEMBERS TO PROVIDE A CURRENT RECORD OF THE EQUIPMENT IN USE. THE QUESTIONNAIRE WAS EXPANDED TO INCLUDE SOME INFORMATION PERTAINING TO CLOSELY ALLIED ITEMS SUCH AS CONSTRUCTION PROCEDURES AND MATERIALS. RESPONSES WERE RECEIVED FROM ALL THE STATES, CANADIAN PROVINCES, PUERTO RICO, AND THE DISTRICT OF COLUMBIA. THE RESULTS ARE CONSOLIDATED IN A TABLE. THE QUESTIONS DEAL WITH TYPE OF EQUIPMENT, HAND SCREEDING, SCREED RAILS, USE OF AIR INTRAINMENT AND METAL FORMS, CONTINUOUS PLACEMENT, USE OF RETARDER, AND FINISHING AND CURING PRACTICES.

Highway Res Circular, Hwy Res Board No. 133, May 1972, 5 p, 1 Tab

3A 215520

CONSTRUCTION METHOD SECTION

OBSERVATIONS FOR FULL-SCALE EXPERIMENTAL EMBANKMENTS OR OTHER ROAD EMBANKMENTS IN ACTUAL FIELDS AND LABORATORY TESTS, IN TERMS OF CREEP SETTLEMENT, ARE PERFORMED TO OBTAIN RELATION BETWEEN COMPACTION DEGREE AND SETTLEMENT STABILITY, TO ESTABLISH THE COMPACTION STANDARD FOR ROAD EMBANKMENTS AND THEIR QUALITY CONTROL. RESEARCH ON CONSTRUCTION METHODS FOR EARTH EMBANKMENTS INCLUDE: (1) THE RELATIONSHIP BETWEEN COMPACTION DEGREE AND SETTLEMENT AFTER COMPLETION; (2) SETTLEMENT PREVENTION METHODS FOR APPROACH EMBANKMENTS; (3) EARTH-WORKS QUALITY CONTROL ITEMS AND METHODS; AND (4) FILLING MATERIALS AND THEIR STABILITY. RESEARCH ON ECONOMICAL DESIGN FOR EARTH RETAINING WALLS UTILIZES LARGE SCALE MODELS FOR THE EXAMINA-

TION OF BASIC DESIGN DATA AND THE METHOD OF DESIGN AND CONSTRUCTION FOR SPECIAL RETAINING WALLS.

Public Works Res Inst, Cm /Japan/ Sept. 1971, pp 18-9, 1 Fig, 2 Photos

3A 215530

COMPUTER ANALYSIS FOR MODIFICATION OF BASE ENVIRONMENTAL CONDITIONS TO PERMIT COLD WEATHER PAVING

THE PURPOSE OF THIS STUDY WAS TO DEVELOP METHODS FOR PREDICTING THE EXPECTED TIME FOR AN ASPHALT CONCRETE MIX TO COOL TO SPECIFIED TEMPERATURES WHEN LAID ON PREHEATED BASE MATERIAL. THESE TIMES ARE COMPARED TO THOSE FOR SIMILAR UNHEATED BASE SITUATIONS. ALSO CONSIDERED WAS THE QUESTION OF FUEL COSTS ASSOCIATED WITH ANY BASE PREHEATING OPERATION. A FINITE DIFFERENCE SOLUTION WAS USED AS THE BASIS FOR A COMPUTER PROGRAM FOR CALCULATING TEMPERATURES AS A FUNCTION OF TIME, PLACE IN THE BASE, PLACE IN THE MIX, DURATION AND MAGNITUDE OF HEATING, TIME BETWEEN HEATER INPUT AND ASPHALT LAY-DOWN (CALLED STALL), AND THE VARYING ENVIRONMENTAL CONDITIONS. RESULTS OF THIS STUDY INDICATE THAT PREHEATING THE BASE MATERIAL HAS A PRONOUNCED EFFECT ON THE TIME FOR THE MIX TO COOL TO A SPECIFIED TEMPERATURE AND THAT THE FUEL COST OF PREHEATING APPEARS TO BE ECONOMICALLY FEASIBLE. IN ADDITION, WITH NO BASE PREHEAT, THE HEAT FLUX INTO THE BASE IS INITIALLY GREATER THAN THE HEAT FLUX TO THE ATMOSPHERE AND, THEREFORE, THE LOWER PORTION OF THE MAT IS COOLED MORE RAPIDLY. WITH PREHEATING, THE HEAT FLUX GOES INTO THE LOWER PORTION OF THE MAT INITIALLY, A REVERSAL IN THE DIRECTION OF HEAT FLUX AT THE BOTTOM SURFACE OF THE MAT. THIS IS PARTICULARLY SIGNIFICANT WHEN COUPLED WITH THE FACT THAT THE COMPACTIVE EFFORT IS LESS NEAR THE BOTTOM OF THE MAT THAN AT THE PLACE OF APPLICATION ON THE SURFACE OF THE MATERIAL BEING COMPACTED. /AUTHOR/

Frenzel, BG Dickson, PF Corlew, JS *Assoc Asphalt Paving Technol Proc* Vol. 40 1971, pp 487-508, 10 Fig, 1 Tab, 5 Ref

3A 215532

GRADE SEPARATION PROJECT AT OH-HARA INTERSECTION COMPLETED WITHOUT DISTURBING URBAN TRAFFIC
TRAFFIC CONGESTION AT URBAN AT-GRADE INTERSECTIONS HAS BEEN RECOGNIZED AS ONE OF THE MOST SERIOUS PROBLEMS IN ANY LARGE CITY. THE RECENTLY COMPLETED GRADE SEPARATION PROJECT AT OH-HARA INTERSECTION IN TOKYO WAS EXECUTED TO SOLVE SUCH A PROBLEM BECAUSE, WITH AN AVERAGE DAILY TRAFFIC COUNT OF 130,000, THE INTERSECTION HAD BECOME INFAMOUS DUE TO THE HEAVY AIR POLLUTION FROM AUTOMOBILE EXHAUST. DURING THE THREE YEARS OF CONSTRUCTION, TRAFFIC WAS NOT STOPPED. I.E., FROM RIGHT-OF-WAY ACQUISITION TO COMPLETION. DIFFICULTIES OF URBAN WORK PROJECT, PARTICULARLY OF TREATMENTS FOR TRAFFIC FLOW AND VARIOUS UNDERGROUND FACILITIES, ARE DISCUSSED. THE SYNCHRONIZED CONSTRUCTION OF JOINT-USE CONDUITS AND STRUCTURES OF TOKYO EXPRESSWAY IS EXPLAINED. THE TRAFFIC SITUATION AFTER COMPLETION IS ALSO REPORTED. /JRS/

Hasegawa, H Yagi, M *Japan Road Association Annual Reports* 1970, pp 67-75, 5 Fig, 4 Photos

3A 215536

INSTRUCTIONS FOR EARTHWORK CONSTRUCTION /IN PORTUGUESE/

STANDARD INSTRUCTIONS FOR THE EXECUTION OF BASIC HIGHWAY CONSTRUCTION, INCLUDING ENGINEERING STRUCTURES, DRAINAGE, AND SLOPE PROTECTION, ARE PRESENTED. /RRI/

Wilner, I

Parana State Highway Dept /Brazil/ 1965

ACKNOWLEDGMENT: Road Research Institute /Brazil/

3A 215548

EXPLOSIVE EXCAVATION RESEARCH

RESEARCH TO DEVELOP EXPLOSIVE EXCAVATION AS AN ACCEPTED COST-COMPETITIVE CONSTRUCTION TECHNIQUE IS BEING CONDUCTED BY THE U. S. ARMY ENGINEER WATERWAYS EXPERIMENT STATION EXPLOSIVE EXCAVATION RESEARCH OFFICE. TWO EXPLOSIVES, AMMONIUM NITRATE-FUEL OIL (ANFO) AND THE ALUMINIZED AMMONIUM NITRATE SLURRIES, APPEAR TO OFFER THE BEST CHARACTERISTICS AND COST ADVANTAGES. PROJECTS PRESENTLY IN PROGRESS OR UNDER STUDY INCLUDE A HIGHWAY CUT, SPILLWAY APPLICATIONS, HARBOR EXCAVATION, AND SEVERAL MILITARY APPLICATIONS. LARGE REDUCTIONS IN EMPLACEMENT AND EXPLOSIVES COSTS HAVE BEEN EXPERIENCED IN THE PAST TWO YEARS IN THE PROCESS OF DEVELOPING EXPLOSIVE EXCAVATION, AND FURTHER SIGNIFICANT REDUCTIONS APPEAR FEASIBLE. THESE REDUCTIONS, WHEN COMBINED WITH MORE EFFICIENT DESIGNS AND EXECUTION TECHNIQUES, SHOULD CONTINUE THE DOWNWARD COST TREND OF EXPLOSIVE EXCAVATION. /BJ/

Lafrenz, RL Redpath, BB
Blasting Journal June 1972

3A 215551

STRENGTH AND STIFFNESS OF LIGHTWEIGHT CONCRETE CORNERS

THIS PAPER PRESENTS RESULTS OF TESTS ON 54 REINFORCED LIGHTWEIGHT CONCRETE CORNERS SUBJECTED TO LOADS OPENING THE CORNER (I.E., PRODUCING TENSION ON THE INSIDE) ARE REPORTED. THE EFFECTS OF 28 TYPES OF REINFORCEMENT DETAILS ON ULTIMATE FLEXURAL STRENGTH, STIFFNESS, AND CRACKING WERE STUDIED, AND IT WAS FOUND THAT THE USE OF TWO SETS OF MUTUALLY PERPENDICULAR DIAGONAL REINFORCEMENTS SHOWED PROMISE. /AUTHOR/

Mayfield, B Kong, FK Beanison, A *Am Concrete Inst Journal & Proceedings* Vol. 69 No. 7, July 1972, pp 420-7

3A 215564

RECOMMENDED PRACTICE FOR HOT WEATHER CONCRETING

SUCH ENVIRONMENTAL FACTORS AS HIGH TEMPERATURE, LOW HUMIDITY, AND WIND CAN HAVE UNDESIRABLE EFFECTS ON CONCRETE PROPERTIES AND CONSTRUCTION OPERATIONS. POSSIBLE UNDESIRABLE EFFECTS ARE LISTED, AND RECOMMENDATIONS FOR MINIMIZING THEM ARE SUGGESTED. AMONG THESE RECOMMENDATIONS ARE SUCH MEASURES AS PRECOOLING INGREDIENTS, LIMITATION OF CONCRETE TEMPERATURE AS PLACED, LENGTH OF HAUL, FACILITIES FOR HANDLING CONCRETE AT THE SITE, AND SPECIAL PLACING AND CURING TECHNIQUES. /AUTHOR/

Am Concrete Inst Journal & Proceedings Vol. 69 No. 5, May 1972, p 151

3A 215565

REMOTE-CONTROLLED CAISSON, WITHOUT CREW INSIDE, INSTALLS PIER FOUNDATION

A REMOTE-CONTROLLED CAISSON MACHINE HAS INSTALLED A 70- FOOT-DEEP CONCRETE BRIDGE PIER FOUNDATION IN ITS FIRST FIELD TEST AT THE KISO-GAWA BRIDGE UNDER CONSTRUCTION NEAR NAGOYA, JAPAN. ONE MAN CAN OPERATE THE EXCAVATION UNIT WITH A TEMPLATE-GUIDED UNIT IN THE CONTROL ROOM. TV CAMERAS AT THE BOTTOM MONITOR EXCAVATION AND TRANSMIT A PICTURE TO A SCREEN IN THE CONTROL ROOM. THE JAPANESE GOVERNMENT COMMISSIONED THE UNMANNED CAISSON-SINKING SYSTEM, OPERATIONAL DETAILS OF WHICH ARE EXPLAINED IN THE ARTICLE, AFTER TWO ACCIDENTS IN 1969 CLAIMED THE LIVES OF 19 WORKERS.

Engineering News-record Vol. 188 No. 22, June 1972, p 17, 1 Fig, 1 Phot

3A 215581

A STUDY OF WASTE IN INDUSTRIALISED BUILDING SYSTEMS

PRODUCTIVITY IN CONSTRUCTION IS A SYSTEM-WIDE ATTRIBUTE RATHER THAN ONE LOCALIZED TO THE MANUFACTURING PLANT OR THE SITE. IF FAULTY MATERIALS, PROCESSES, OR PRODUCTS ARE USED AT THE PLANT, THEN THE HIGH MORTALITY IN ASSEMBLIES AT THE BUILDING SITE WILL REDUCE OVERALL PRODUCTIVITY. THE GENERALLY ALLOWED WASTE OF 7-9% IS WELL BELOW THE ACTUAL AVERAGE, WHICH IS OVER 15%. AN EIGHT-MONTH STUDY OF LARGE PRECAST CONCRETE COMPONENTS REVEALED THAT 70% OF DAMAGES OCCURED AT THE FACTORY AND THE REMAINING 30% EITHER IN TRANSIT OR AT THE SITE. THE MAIN PROBLEM IS THAT THE CONCEPT OF ACCEPTABILITY IS SO VAGUE AND RELATIVE THAT ITS INTERPRETATION IS LEFT SOLELY TO THE SKILL AND ABILITY OF THE INDIVIDUAL IN CHARGE. IN THE CASE OF BULKY COMPONENTS, SUCH AS CONCRETE SLABS, STANDARDIZATION OF QUALITY CONTROL IS RENDERED DIFFICULT. IN SYSTEM BUILDING IT IS VITALLY IMPORTANT TO LAY OUT THE PRODUCTION PROCESS IN SCHEMATIC FORM, IDENTIFY THE VARIOUS TYPES OF PRODUCTION FAULTS, RELATE THESE FAULTS TO THE STEPS IN THE PRODUCTION PROCESS, IDENTIFY THE QUALITY CONTROL CHECKS APPROPRIATE TO EACH STEP, ASSURE ADEQUATE SUPERVISION OF THE QUALITY CONTROL PROCESS (WHICH ENTAILS THOROUGH TRAINING AND GOOD TECHNOLOGICAL UNDERSTANDING), AND PROVIDE EQUIPMENT AND PROCEDURES SUITABLE FOR THE INDIVIDUAL QUALITY CONTROL OPERATIONS. EACH OF THESE REQUIREMENTS IS ILLUSTRATED, WITH PARTICULAR ATTENTION TO A SURVEY OF PRODUCTION FAULTS.

Dunung, PV *Concrete /UK/* Vol. 6 No. 9, Sept. 1972, pp 22-7, 7 Tab, 4 Phot

3A 215588

SYSTEMS BUILDING: FOUNDATIONS

A SURVEY OF EUROPEAN HIGH-RISE CONCRETE PREFABRICATION PLANTS DETERMINED THAT NO RESEARCH ON THE FOUNDATION SUBSYSTEM HAS BEEN UNDERTAKEN BECAUSE IT WAS CONSIDERED THAT THE FOUNDATION PROBLEMS WERE UNIQUE FOR EACH SITE. ON THE OTHER HAND, WORK HAS BEEN DONE TO REDUCE FOUNDATION SITES TO A LIMITED SET OF SUBSYSTEM TYPES BEST SUITED FOR VARIOUS FOUNDATION SOIL CONDITIONS ON A WORLDWIDE BASIS. ACCORDING TO THE CLOSED-SYSTEM APPROACH, A SINGLE FIRM SHOULD HANDLE THE DESIGN, CONSTRUCTION, AND POSTCONSTRUCTION MANAGEMENT. BY CONTRAST, THE OPEN SYSTEM WITH MODULAR COORDINATION PERMITS WIDE INTERCHANGEABILITY OF COMPONENTS OR SUBSYSTEMS BY VARIOUS MANUFACTURERS. LARGER AND LARGER COMPONENTS ARE BEING PREFABRICATED: IN THE SAN FRANCISCO BAY AREA, 900-FOOT CONTINUOUS CASTING BEDS FOR PRESTRESSED CONCRETE PILES WERE USED FOR THE SAN MATEO-HAYWARD BRIDGE. THE MOVE TO LARGER PREFABRICATION IN URBAN AREAS HAS BEEN PRIMARILY FOR WATER CROSSINGS, WHERE WATER TRANSPORT TO THE SITE PERMITS LARGE COMPONENTS. A BRIDGE BETWEEN SIBERIA AND ALASKA HAS BEEN PROPOSED FOR WHICH A BRIDGE PIER 300 FEET HIGH WOULD BE PREFABRICATED AT A SITE SUCH AS SEATTLE, TOWED TO THE BRIDGE SITE, PLACED UPRIGHT, AND SUNK INTO THE FOUNDATION SOILS. FROM A SYSTEMS STANDPOINT, COMPUTER SOFTWARE IS INCREASINGLY BEING USED TO DETERMINE THE MOST ECONOMIC COMBINATIONS OF DECK SPANS AND OTHER PRECAST COMPONENTS. GREATER ATTENTION SHOULD BE GIVEN TO MOBILE OR RELOCATABLE BRIDGES.

Wigginton, WB *Highway Research Board Special Reports* No. 132, 1972, pp 6-8, 4 Fig

3A 215589

SYSTEMS CONCEPTS FOR PRECAST AND PRESTRESSED CONCRETE BRIDGE CONSTRUCTION

RECENT ADVANCES IN THE FABRICATION, ENGINEERING, AND ERECTION OF PRECAST AND PRESTRESSED CONCRETE BEAMS AND STRUCTURES ARE REVIEWED, WITH SPECIAL ATTENTION TO THE ENGINEERING AND CONSTRUCTION OF THE DISNEY WORLD MONORAIL IN ORLANDO, FLORIDA. SOME 7 MILES OF 6-SPAN CONTINUOUS PRESTRESSED CONCRETE BOX GIRDER SECTIONS, SUPPORTED ON PRECAST CONCRETE COLUMNS, WERE CONSTRUCTED. THE 350 GIRDERS RANGED FROM 90 TO 110 FEET, AND HALF WERE ON VERTICAL AND HORIZONTAL CURVES TO RADII FROM 350 FEET UPWARD.

Anderson, AR *Highway Research Board Special Reports* No. 132, 1972, pp 9-21, 20 Fig, 1 Tab

3A 215590

CONSTRUCTION ECONOMY THROUGH SYSTEMS BUILDING ALTHOUGH THE SYSTEMS BUILDING CONCEPT IS 20 YEARS OLD, AND ALTHOUGH SYSTEMS COMPONENTS ARE BEING UTILIZED IN ACTUAL CONSTRUCTION, CURRENT APPLICATIONS OF THE CONCEPT BEAR ABOUT THE SAME RELATION TO OUR UNDERSTANDING OF IT AS DOES COL. LINDBERGH'S AIRPLANE TO SUPERSONIC JETS. THE PRESENT AND ANTICIPATED ECONOMIC CLIMATE DICTATES OPTIMIZATION IN THE ECONOMY OF CONSTRUCTION, BUT ENGINEERS ARE OFTEN REQUIRED TO INNOVATE BY USING TRADITIONAL TOOLS UNDER TIGHT DEADLINES. WHAT IS NEEDED ARE PROGRAMS THAT PERMIT ADVANCED ENGINEERING STUDIES AT THE VERY PRELIMINARY CONCEPTION OF A PROJECT IDEA TO ENSURE THAT DURING THE FINAL DESIGN PHASE ALL POSSIBLE COST-SAVING INNOVATIONS CAN BE INCLUDED. PRINCIPLES OF INNOVATION IN PROCEDURE, DESIGN, AND CONSTRUCTION ARE LISTED. OF THESE, THE MOST IMPORTANT ARE SIMPLICITY AND MODULARITY. THE FIGURES, KEYED TO TEXTUAL DESCRIPTIONS, PRESENT EXAMPLES OF INNOVATION IN A PROGRESSION FROM ELEMENTARY COMPONENTS TO VERY LARGE, COMPLEX STRUCTURES. FOUR OF THE FIGURES ARE DEVOTED TO THE GEOMETRIC DESIGN, SUPPORT, AND INSTALLATION OF A 25-FOOT-LONG BRIDGE MADE OF PAPER.

Zetlin, L *Highway Research Board Special Reports* No. 132, 1972, pp 22-30, 28 Fig

3A 215594

STEEL, CONCRETE, ALUMINUM, AND TIMBER IN SYSTEMS BRIDGES

TWO MAJOR REQUIREMENTS OF TOMORROW'S BRIDGES ARE ECONOMY AND AESTHETICS. EACH OF THE FOUR MATERIALS CONSIDERED HERE IS ECONOMICALLY COMPETITIVE IN SOME SITUATIONS AND NOT IN OTHERS, AND EACH HAS ITS OWN AESTHETIC USES AND LIMITATIONS. FUTURE CONCRETE USE INCLUDES ADJUSTABLE, NUMERICALLY CONTROLLED FORMS IN BOTH PRECAST AND SLIPFORM APPLICATION. STRENGTHS UP TO 10,000 PSI SHOULD BECOME COMMONPLACE, ESPECIALLY IN PRESENT APPLICATIONS. NEW CEMENTS AND IMPROVED METHODS OF ACCELERATING CURING WILL PRODUCE GREATER ECONOMY IN PRECAST OPERATIONS. USE OF SEL-STRESSING CEMENTS SEEMS MORE PROMISING THAN EVER BEFORE. LIGHTWEIGHT AGGREGATE PROMISES TO GAIN IN ACCEPTANCE. STEELS WILL UNDERGO STILL FURTHER INCREASES IN STRENGTH, AND NUMERICALLY CONTROLLED FABRICATION PROMISES TO IMPROVE NOT ONLY SPEED BUT ECONOMY AND PRECISION AS WELL. THIS WILL BE BENEFICIAL TO COMPLEX CONFIGURATIONS AS WELL AS TO REPETITIVE STANDARD UNITS. WHILE ALUMINUM'S GREAT ADVANTAGE IS ITS LIGHT WEIGHT AND FLEXIBILITY OF FABRICATION, IT SUFFERS FROM A RELATIVELY HIGH FIRST COST. ONCE THIS IS REDUCED, ALUMINUM WILL BECOME COMPETITIVE IN A BROADER RANGE OF APPLICATIONS. PROBABLY THE GREAT-

EST FUTURE DEVELOPMENT IN WOOD WILL BE IN EDUCATING ENGINEERS REGARDING THE CAPABILITY OF GLUED AND LAMINATED STRUCTURAL TIMBERS FOR BRIDGE CONSTRUCTION.

Scholer, CF Lally, A Pfeifer, DW Clark, JW Williamson, TG *Highway Research Board Special Reports* No. 132, 1972, pp 60-71

3A 215599

SLIPFORMER SETS 1000-YPH PACE

RUNWAYS TOTALING OVER 30,000 FEET IN LENGTH AT THE DALLAS/FORT WORTH REGIONAL AIRPORT ARE BEING LAID BY A SLIPFORM PAVER THAT PUTS DOWN A 50-FOOT SLAB WITH A DEPTH UP TO 17 INCHES. A SPREADER FLATTENS AND DISTRIBUTES PILES OF MUD DUMPED ON THE GRADE BY A FLEET OF 10-YARD HAULERS. GRADE CONTROLS ARE ELECTRIC OVER HYDRAULIC AND RESPOND TO STRINGLINE SENSORS. THE AUTOMATIC GUIDANCE SYSTEMS USES TOW STRINGLINES: ONE SIDE CONTROLS ALIGNMENT, WHILE THE OTHER SIDE SETS GRADE. THE SPREADER TOPS OFF A 12-INCH-THICK LIFT AT PRECISE GRADE FOR PLACEMENT OF 25 X 50-FOOT, 2300-LB REINFORCING MATS. THE MATS ARE SPOTTED WITH THE AID A TRUCK CRANE FITTED WITH SPECIAL RIDING FLOATS TO GET STABILITY FOR THE LONG REACH. OF SEVERAL APPROACHES TO ASSURE FULL KEYING OF THE REINFORCING INTO THE BOTTOM COURSE, THE MOST SUCCESSFUL WAS MAKING SEVERAL PASSES OVER EACH MAT WITH A VIBRATORY COMPACTOR.

Rehfield, J *Construction Equipment* Vol. 46 No. 4, Oct. 1972, pp 68-70, Photos

3A 215603

UNDERWATER TRANSPORTING OF CONCRETE WITH THE HYDRO-VALVE

A NEW METHOD DEVELOPED IN THE NETHERLANDS FOR PLACING CONCRETE UNDER WATER IS DESCRIBED. THE DEVICE ALLOWS PLACING CONCRETE OF HIGHER QUALITY THAN PREVIOUSLY POSSIBLE AND PROVIDES A MEANS OF PLACING REINFORCED CONCRETE UNDERWATER.

Schoewert, LC Hillen, HF *Am Concrete Inst Journal & Proceedings* Vol. 69 No. 9, Sept. 1972, pp 584-8, 5 Fig, 1 Tab

3A 215626

GUIDELINES FOR EROSION AND SEDIMENT CONTROL PLANNING AND IMPLEMENTATION

THESE GUIDELINES PRESENT A COMPREHENSIVE APPROACH TO THE PROBLEM OF EROSION AND SEDIMENT CONTROL FROM THE BEGINNING OF PROJECT PLANNING TO COMPLETION OF CONSTRUCTION. THEY PROVIDE A DESCRIPTION OF HOW A PRELIMINARY SITE EVALUATION DETERMINES WHAT POTENTIAL SEDIMENT AND EROSION CONTROL PROBLEMS EXIST AT A SITE BEING CONSIDERED FOR DEVELOPMENT, GUIDANCE FOR THE PLANNING OF AN EFFECTIVE SEDIMENT AND EROSION CONTROL PLAN, AND PROCEDURES FOR THE IMPLEMENTATION OF THAT PLAN DURING OPERATIONS. TECHNICAL INFORMATION ON 42 SEDIMENT AND EROSION CONTROL PRODUCTS, PRACTICES, AND TECHNIQUES IS CONTAINED IN FOUR APPENDICES. /HRIS/

Becker, BC Mills, TR
Hittman Associates 1972, 228 pp

3A 215629

RECLAMATION PROCESS CUTS STREET CONSTRUCTION COSTS BY 35%

RECLAMATION OF EXISTING PAVING MATERIALS IS PROVING TO BE A SATISFACTORY METHOD OF REBUILDING BITUMINOUS STREETS. THE OPERATION INVOLVES BREAKING UP THE OLD PAVEMENT, GATHERING THE MATERIAL IN WINDROWS, PULVERIZING AND MIXING THE BROKEN PIECES WITH A PORTABLE HAMMER MILL, THEN BLADING THE MIXTURE TO GRADE AND COMPACTING IT WITH A PNEUMATIC ROLLER. THE ONLY NEW MATERIAL ADDED IS THE WEARING

SURFACE OF PLANT-MIX ASPHALT. AT NO TIME DURING THE WORK CITED WERE RESIDENTS OF THE STREET UNABLE TO REACH THEIR HOMES BY CAR.

Phillips, DL *American City* Vol. 88 No. 3, Mar. 1973, pp 67-8

3A 215633

SAFETY BARRIERS SLIPFORMED IN TWO STEPS

IN THIS PROCESS, ONE MACHINE WITH A COMBINATION MULE, PLACED FOOTER AND GUTTER SIMULTANEOUSLY WHILE A SECOND FOLLOWED CLOSE BEHIND SHIPPING A CONCRETE SAFETY BARRIER. THE DIESEL POWERED SLIPFORMING SYSTEM EMPLOYS SIDE MOUNTED MULES AND BY BEING INSTALLED AS LEFT HAND UNITS, THE TWO MACHINES WERE ABLE TO MOVE WITH TRAFFIC IN THE INTEREST OF PRODUCTION SAFETY. ONLY ONE LANE OF ACCESS WAS REQUIRED TO BRING READY MIX TRUCKS UP TO THE FORWARD HOPPERS WHICH COMPRISE PART OF THE UNIT'S 1.5 CU YD ON-BOARD SUPPLY. AN ADVANTAGE IN SIDE MOUNTING MULES IS THAT THEY CAN GET CLOSE TO BRIDGE ABUTMENTS AND ADJACENT WALLS ALREADY POURED. THE CONFIGURATION OF THE FOOTER MULE ALLOWED PLACING THE REINFORCING MESH DIRECTLY INTO THE MULE AS IT PROGRESSED UNDER THE MACHINE'S AUTOMATED GUIDANCE ALONG THE STRING LINE. SEVEN TRUCKS SUPPLIED THE FOOTER CURBER UNIT WITH CONCRETE HAVING A 1.5 TO 2 IN. SLUMP. THE FOOTER AND CURBING WAS POURED AT RATES PEAKING NEAR 4000 FT. PER 8 HOUR SHIFT. ONLY ONE OPERATOR PER MACHINE WAS REQUIRED. THE WALL MEASURES 32 IN. IN HEIGHT, AND IS 20 IN. THICK AT ITS BASE, TAPERING TO 6 IN. AT ITS HEAD. A 1 IN. SLUMP WAS REQUIRED FOR THE CONCRETE USED AND THIS CALLED FOR CAREFUL CONTROL AT THE SOURCE OF SUPPLY. IN THIS PROCEDURE WHICH HAS BEEN TERMED A 'LIFE SAVER' IN BOTH THE TECHNICAL AND ECONOMIC SENSE, THE WALL WAS SLIPPED AT A RATE OF 3900 FT. PER 8 HOUR SHIFT.

Roads and Streets Vol. 116 No. 2, Feb. 1973, p 98, 2 Phot

3A 215635

PAVING TRAINS PUT BIKEWAY WORK IN HIGH GEAR

THE U.S. BIKING POPULATION IS ESTIMATED TO REACH 100 MILLION BY 1975. IN 1968 THE CONGRESS PASSED A NATIONAL TRAILS SYSTEM ACT THAT DEFINED A NEED FOR 150,000 ROUTE MILES IN URBAN AND SUBURBAN AREAS ALONE, AND IN 1971 THE BICYCLE TRANSPORTATION ACT PROVIDED PLANNING FUNDS. HR 692 IN THE PRESENT CONGRESS WOULD ALLOW SOME USE OF HIGHWAY TRUST FUND MONEY FOR BUILDING EXCLUSIVE BIKE LANES. OREGON ALREADY SETS ASIDE 1% OF HIGHWAY FUNDS FOR PUTTING EXCLUSIVE BIKEWAYS ALONG ALL NEW ROADS. THERE ARE THREE RECOGNIZED CLASSES OF BIKEWAYS. CLASS 1 WAYS ARE COMPLETELY SEPARATED FROM OTHER TRAFFIC, TO THE EXTENT OF PROVIDING OVERPASSES AT BUSY INTERSECTIONS. CLASS 2 WAYS CONSIST MAINLY OF WIDENED AND IMPROVED SHOULDER STRIPS, OFTEN SEPARATED FROM OTHER TRAFFIC BY A SLIPFORMED CURB OR BARRIER. CLASS 3 WAYS ARE PATHS BUILT OUT OF EXISTING ROADWAYS, USUALLY THROUGH STRIPING A SECTION AT THE EDGE AND MARKING IT FOR BIKE USE. ITTE AT THE UNIVERSITY OF CALIFORNIA HAS ALREADY MADE SOME STUDY OF CONSTRUCTION METHODS AND PRICES FOR THESE WAYS. WHILE A MINIMUM OF 30 CENTS PER LINEAR FOOT FOR 8-FOOT WAYS COVERS NORMAL 6-INCH-DEEP RIGHT-OF-WAY GRADING WHERE THERE ARE NO SPECIAL TERRAIN PROBLEMS, A GROUND-UP PROJECT COULD INVOLVE HEAVY CUTS AND FILLS. AT 40 CENTS PER LINEAR FOOT MINIMUM FOR A 4-INCH-THICK COURSE, BASE PREPARATION GOES MOSTLY TO AUTOMATED MACHINES, SUCH AS STRINGLINE-GUIDED FINEGRADERS AND TAILGATE SPREADERS ADJUSTED TO THE EXACT WIDTH OF THE BIKEWAY TO HANDLE STONE PLACEMENT IN A SINGLE PASS. COMPACT, SELF-PROPELLED VIBRATORY ROLLERS ARE IDEAL FOR GETTING THE APPROPRIATE BASE DENSITY. A 2-INCH AC SURFACE ON AN 8-FOOT WAY WILL RUN A MINIMUM OF 85 CENTS A LINEAR FOOT.

Construction Equipment Vol. 47 No. 4, Apr. 1973, pp 28-30, 4 Phot

3A 219664

A FASTER AND MORE ACCURATE BUILDING SURVEY WITH LASER EQUIPMENT
CONSTRUCTION LASERS WHICH ARE PROTECTED AGAINST IMPACT, DUST, FLUCTUATIONS OF TEMPERATURE FROM MINUS 30 TO PLUS 65 DEGREES C, ATMOSPHERIC MOISTURE AND PRESSURE UP TO 2.5 ATMOSPHERES HAVE BEEN AVAILABLE FOR TWO YEARS IN GERMANY. THEY ARE USED TO ADVANTAGE IN TUNNEL CONSTRUCTION, CANAL AND PIPE CONSTRUCTION, IN PIPE PUSHING AND FILL CONSTRUCTION, AND ALSO FOR THE AUTOMATIC CONTROL OF CONSTRUCTION EQUIPMENT. THE PARTICULAR ADVANTAGES OF THE METHOD ARE ITS ACCURACY AND SIMPLICITY. CONSTRUCTION LASERS ARE NOT DANGEROUS AT OUTPUTS AROUND 0.005 W. BECAUSE OF THE BRIGHTNESS OF THE BEAM A MULTIPLE OF THE BRIGHTNESS OF THE SUN THE HEIGHT OF THE BEAM IS KEPT IF POSSIBLE ABOVE HEAD LEVEL OR BELOW KNEE LEVEL. /TRRL/

Trantofsky, P

Tiefbau-berufsgenossenschaft /Germany/ Vol. 83 No. 5, 1971, pp 163-5

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 218677

THE COMPACTION OF THICK, SINGLE LAYER ROADBASES MADE OF BITUMINOUS MIXTURE AND STABILIZING CONCRETE

THE AUTHOR GIVES EXAMPLES OF THE ECONOMIC USE OF DOUBLE VIBRATING ROLLERS FOR THE COMPACTION OF SINGLE-LAYER ROADBASES. THE DISADVANTAGES OF AN 18 CM THICK BITUMINOUS LAYER PUT DOWN IN THREE SECTIONS ARE DISCUSSED: THE NECESSITY FOR THREE ROLLING PROCEDURES; UNSATISFACTORY ADHESION BETWEEN THE THREE LAYERS; AND INSUFFICIENT TRANSFER OF THE HORIZONTAL SHEAR FORCES. THE LAYING OF THE 18 CM THICK BITUMINOUS COURSE IN ONE OPERATION SAVES MONEY, AND BECAUSE OF THE ABILITY OF THE LAYER TO STORE HEAT, ROLLING CAN TAKE PLACE WHEN OUTDOOR TEMPERATURES ARE LOW. THE HOMOGENEOUS STRUCTURE OF THE LAYER ALSO ENSURES GREATER RESISTANCE TO TRAFFIC LOADING. CORES TAKEN FROM A GERMAN MOTORWAY CONSTRUCTION SITE SHOW THAT WITH THREE PASSES OF VIBRATING ROLLERS, MARSHALL COMPACTION OF 101 PERCENT CAN BE OBTAINED. SIMILAR EXPERIENCE HAS BEEN OBTAINED WITH STABILIZING CONCRETE IN SPAIN AND KENYA. THE CONSTRUCTIONAL FEATURES OF THE DOUBLE VIBRATING ROLLERS USE ARE DESCRIBED. /TRRL/

Kudren, *Bitumen, Terre, Asphalte, Peche /Ger/* Vol. 23 No. 1, 1972, pp 28-30, 6 Fig

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 218688

EQUIPPING THE PROJECT

THE PRE-BID STUDY AND CAREFUL PLANNING OF CONSTRUCTION METHODS TOGETHER WITH THE SELECTION OF THE MOST EFFICIENT EQUIPMENT CONFORMING TO THE PLANNING METHOD IS ESSENTIAL IN THE HEAVY CONSTRUCTION INDUSTRY. THE COST-SAVING OPPORTUNITIES OF NEW OR HIGHER PRODUCTIVITY UNITS VERSUS OLDER MODELS IS ILLUSTRATED BY A CONSIDERATION OF THE BENEFITS THAT CAN BE OBTAINED BY USING NEWER, HIGHER HORSEPOWER, LARGER CAPACITY UNITS. THE REDUCTION IN ESTIMATED PROJECT COSTS APPEARS NOT ONLY IN UNIT COSTS BUT ALSO IN OVERALL CAPITAL COSTS. COMPUTER STUDIES USING VEHICLE SIMULATION PROGRAMS HAVE GREATLY SIMPLIFIED THE SELECTION OF EQUIPMENT. THE ESTABLISHMENT OF A WELL-PLANNED COST AND BUDGET SYSTEM THAT PROVIDES CURRENT PRODUCTION AND COST INFORMATION IS ESSENTIAL FOR SUCCESSFUL AND PROFITABLE OPERATION. THE PROBLEMS PRESENTED BY HIGH EQUIPMENT

INVENTORIES, THE OBSOLESCENCE OF OLDER MODELS, AND THEIR EFFECT ON BONDING CAPACITY ARE RESTRICTIVE TO OTHERWISE TECHNICALLY HIGHLY QUALIFIED CONTRACTORS. LIBERAL USE OF MOBILIZATION ADVANCES WOULD ENCOURAGE THE UTILIZATION OF NEWER, MORE PRODUCTIVE EQUIPMENT AND WOULD RESULT IN LOWER BIDS FOR PUBLIC WORK PROJECTS THAT WOULD BENEFIT THE CONTRACTOR AND THE TAXPAVER. THE PROJECT ESTIMATE, THE WORK PROGRAM, NEW EQUIPMENT COST RECORDS, BONDING CAPACITY AND THE PUBLIC INTEREST ARE DISCUSSED.

Lee, OA *Highway Research Record, Hwy Res Board* No. 454, 1973, pp 1-6, 2 Tab

3A 215687

OPTIMIZATION OF HAUL FLEET SIZE AND DISTANCE BETWEEN PLANT MOVES ON HIGHWAY PAVING PROJECTS
EQUIPMENT CONFIGURATIONS AND PROCEDURES ON HIGHWAY PAVING PROJECTS WERE INVESTIGATED, AND A MEANS OF OPTIMIZING HAUL FLEET SIZE AND DISTANCE BETWEEN PLANT MOVES IS DISCUSSED. THE SIMULATION PROGRAM USED TO PREDICT PRODUCTION RATES IS DESCRIBED, AND A METHOD IS GIVEN FOR OBTAINING PRODUCTION IN TRUCKLOADS PER HOUR FROM THE PLOTS OF THE SIMULATION RESULTS WITHOUT THE NEED TO RUN THROUGH SEVERAL APPROXIMATIONS. SIX PAVING CONFIGURATION AND PROCEDURE MODELS ARE ANALYZED WITH REGARD TO COST PER CUBIC YARD OF CONCRETE IN PLACE FOR DIFFERENT TRUCK FLEET SIZES OR FOR RATES OF PAVING ADVANCE IN CONJUNCTION WITH DIFFERENT DISTANCES BETWEEN PLANT MOVES FOR EACH MODEL, LEAST-COST COMBINATION, AND LEAST-COST MODEL. THE STUDY REVEALED THAT SIMULATION IS ONE MEANS OF OBTAINING THE PRODUCTION RATES NEEDED FOR ANALYSIS OF PAVING SPREAD CONFIGURATIONS AND PROCEDURES. PLOTS ON LOG-LOG GRAPH PAPER WERE FOUND TO PROVIDE AN ECONOMICAL MEANS TO EXTRAPOLATE THE SIMULATED DATA. SIMULATION SHOWS THAT STEADY STATE IS ALWAYS REACHED IN A PAVING OPERATION AND USUALLY BETWEEN THE SECOND AND THIRD HOUR AFTER START OF PRODUCTION. MATHEMATICAL MODELING, IT WAS FOUND, ALLOWS A MEANS FOR ANALYZING DIFFERENT PAVING SPREAD CONFIGURATIONS AND PROCEDURES. A CONSIDERABLE DIFFERENCE WAS NOTED IN COST OF CONCRETE IN PLACE, DEPENDING ON THE PAVING SPREAD CONFIGURATION AND PROCEDURE USED. THE SENSITIVITY OF MODELS IN THE AREAS OF PRODUCTION AND NUMBER OF TRUCKS, MAKES THE PROCESS OF PICKING THE LEAST-COST COMBINATION WITHIN A MODEL, A DIFFICULT ONE. DETAILS ARE GIVEN OF THE REDUCTION OF DATA AND THE RESULTS OF THE ANALYTICAL STUDY.

Ghare, PM Bidwell, EL Cabrera, JG DISCUSSEER Maher, Mj DISCUSSEER *Highway Research Record, Hwy Res Board* No. 454, 1973, pp 16-31, 11 Fig, 7 Tab, 4 Ref

3A 215692

REVOLUTIONARY HOTMIX PLANT DRUMS OUT 500 TPH
THE INNOVATIVE HOTMIX PLANT CONSISTS OF A COMPACT UNIT IN WHICH THE DRUM DOUBLES AS BOTH DRYER AND MIXER. THE EQUIPMENT, INCORPORATES SOPHISTICATED ELECTRONIC MECHANISMS FOR METERING PRECISE AMOUNTS OF AGGREGATE AND ASPHALT AND A DRUM DESIGNED FOR CONTINUOUS MIX FLOW. THE DRUM MIXING PROCESS IS DETAILED. UNIFORMLY GRADED COLD FEED ENSURES HIGH OUTPUT RATES. TWO WHEEL LOADERS MOVE MATERIAL FROM THE SIZED STOCKPILES TO A THREE-COMPARTMENT COLD-FEED BIN, WHICH IS A PORTABLE UNIT MOUNTED TO A TANDEM-AXLE CHASSIS. THE BIN'S VARIABLE-SPEED FEEDERS ARE TIED IN ELECTRONICALLY TO METER THE EXACT AMOUNT OF EACH SIZE REQUIRED BY THE CURRENT OUTPUT RATE OF THE PLANT. THE AGGREGATE IS WEIGHED AUTOMATICALLY BY A BELT SCALE AS IT MOVES UP THE CONVEYOR TO THE DRUM. STONE AND SAND ENTER THE DRUM AT THE BURNER END AND MOVE

THROUGH A CONCURRENT PARALLEL-FLOW PATTERN. AN ASPHALT PUMP METERS IN THE BITUMEN. FURTHER PROCEDURAL DETAILS ARE GIVEN. MODIFIED SPECIFICATIONS FOR DRUM-MIXING PLANTS HAVE BEEN ADOPTED BY SEVERAL STATE HIGHWAY FORCES.

Day, R *Construction Equipment* Vol. 49 No. 1, Jan. 1974, pp 28-31, Photos

3A 218693

POST-TENSIONED STRUCTURAL SYSTEMS--DALLAS-FORT WORTH AIRPORT

THE FIRST PHASE OF THIS GIANT JET-AGE AIRPORT COMPLEX WAS DEDICATED ON SEPTEMBER 22, 1973. THE FOUR AIR TERMINAL BUILDINGS AND THEIR ADJACENT ELEVATED ROADWAYS AND PARKING FACILITIES MAKE EXTENSIVE USE OF PRECAST AND PRESTRESSED CONCRETE. ALL EXPOSED BUFF-COLORED CONCRETE WITH A SANDBLASTED TEXTURED FINISH. OVER 12,000 PIECES OF PRECAST CONCRETE WERE USED IN THE BUILDINGS AND 8,000 PIECES IN THE ELEVATED ROADWAYS. THE TERMINAL BUILDINGS ARE SEMICIRCULAR IN PLAN BUT ARE DEVELOPED FROM RECTANGULAR TWO-STORY MODULES CONSISTING OF PRECAST COLUMNS, PRESTRESSED BEAMS, DOUBLE-TEE FLOORS, AND PRECAST WALL PANELS USING WELDED CONNECTIONS. THE MEMBERS ARE GIVEN ADDITIONAL STABILITY BY POST-TENSIONING. THE ELEVATED ROADWAYS FOLLOW THE CURVE OF THE BUILDINGS AND MATCH THEIR ARCHITECTURAL DESIGN. CAST-IN-PLACE PRESTRESSED CONCRETE FRAMES AT 62-FT. CENTERS SUPPORT PRESTRESSED DOUBLE TEES, PRECAST FASCIA, AND CAST-IN-PLACE POST-TENSIONED ROADWAY TOPPING. PHASE I CONSTRUCTION EXCEEDS \$700 MILLION. THIS PAPER DESCRIBES THE CONSTRUCTION TECHNIQUES USED IN ERECTING THE AIR TRAFFIC CONTROL TOWER, TERMINAL FACILITIES, ENPLANING AND DEPLANING TRAFFIC STRUCTURES, AND PARKING FACILITIES.

Lamberson, EA *Prestressed Concrete Institute Journal* Vol. 18 No. 6, Nov. 1973, pp 72-91, 20 Fig

3A 215694

MEMBRANE ENCAPSULATED SOIL LAYERS

AS A RESULT OF THE DEVELOPMENT OF A DURABLE INEXPENSIVE MEMBRANE, MEMBRANE ENCAPSULATED SOIL LAYERS (MESL) CONSTRUCTION IS NOW ECONOMICALLY COMPETITIVE WITH CONVENTIONAL PAVEMENT CONSTRUCTION. TESTS HAVE SHOWN THAT SOIL LAYERS CAN BE EFFECTIVELY PROTECTED AGAINST INTRUSION OF MOISTURE WITH AVAILABLE MATERIALS AND EXISTING CONSTRUCTION TECHNIQUES. IT WAS CONCLUDED THAT THE EFFECTS OF RESIDUAL STRESSES INDUCED DURING CONSTRUCTION AND THE DENSIFICATION OF THE ENCAPSULATED MATERIAL DURING TRAFFIC RESULTED IN A STIFFER SYSTEM, WHICH WAS MORE EFFECTIVE IN DISTRIBUTING THE LOAD, THAN WAS PREDICTED BY MODELS USING SOIL PARAMETERS OBTAINED FROM THE AS-CONSTRUCTED CONDITIONS.

Sale, JP Parker, F Barker, WR *Am Soc Civil Engr J Soil Mech Div* Vol. 99 No. sm12, Dec. 1973, pp 1077-89

3A 215695

TIEBACK WALL CONSTRUCTION-RESULTS AND CONTROLS

THE TIEBACKS WERE USED IN CONJUNCTION WITH SOLDIER PILES AND LAGGING TO SUPPORT THE VERTICAL-WALLED EXCAVATION FOR THE OPERATIONS CONTROL CENTER BUILDING OF THE WASHINGTON METROPOLITAN AREA'S RAPID TRANSIT SYSTEM (METRO). UTILIZING WIRE-STRAND TENDONS, THE TIEBACKS WERE ANCHORED IN TERRACE DEPOSITS OF CLAY AND SAND. PRACTICAL TESTING PROCEDURES, WHICH WERE DEVELOPED ON THE JOB TO ENSURE SYSTEM SAFETY WHILE PERMITTING TIMELY EXECUTION OF THE WORK, ARE EXAMINED IN DETAIL. EMPHASIS IS PLACED ON THE IMPORTANCE OF ESTABLISHING A SYSTEM TO MONITOR THE PERFORMANCE OF TIED-BACK WALLS DURING AND AFTER EXCAVATION.

Ware, KR Mirsky, MM Louniz, WE *Am Soc Civil Engr J Soil Mech Div* Vol. 99 No. sm12, Dec. 1973, pp 1135-52

3A 215701

UNDERGROUND PIERCING TOOL

A SLENDER NEW UNDERGROUND PIERCING TOOL MAKES IT EASY AND EFFICIENT TO INSTALL LINES UNDER ROADWAYS. IT CAN BE PROPELLED THROUGH THE SUBSOIL FOR DISTANCES OF 100 FEET OR MORE WITH REASONABLE ACCURACY. THE SPIRALLY GROOVED NOSE CONE IMPROVES OPERATING PERFORMANCE IN DAMP AND WET SOILS. IT IS POWERED BY COMPRESSED AIR. THE ADVANTAGES OVER OTHER METHODS OF UNDERGROUND PIERCING CAN BE SUMMED UP AS COST SAVING. UNDER NORMAL CIRCUMSTANCES THE HOLE IS PIERCED MORE QUICKLY WITH LESS MANPOWER (LABOR COST), AND LESS EXPENSIVE RESTORATION (BACKFILLING, TAMPING, REPAVING) IS REQUIRED. /DCPL/

Florence, HV Frank, JA *Vol. 65 N No. 2, pp 800-2*

3A 215722

CONSTRUCTION OF A SIXTEEN INCH CONCRETE PAVEMENT THIS REPORT ON THE EXTENSION OF THE NUMBER 1 RUNWAY AT HEATHROW (LONDON) AIRPORT GIVES DETAILS OF THE METHOD AND EQUIPMENT USED IN THE CONSTRUCTION OF A 16-IN THICK CONCRETE PAVEMENT, AND SHOWS THAT WITH MODERN CONCRETE PLANT THE PRODUCTION OF SUCH A PAVEMENT TO A HIGH STANDARD IS A PRACTICAL PROPOSITION. THE PAVEMENT SLAB WAS SUPPORTED ON A 6-IN LAYER OF LEAN CONCRETE LAID ON AN 18-IN THICKNESS OF COMPACTED GRANULAR SUB-BASE.

Aerodome Works Devel Comm Proc /UK/ Nov. 1970, 13 pp, 9 Phot

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 215727

TUNNELS IN THE TONGARIRO POWER DEVELOPMENT

THE ARTICLE DESCRIBES THE DIFFICULTIES ENCOUNTERED IN THE DRIVING THROUGH VOLCANIC AND SEDIMENTARY ROCK OF THE 28 MILES OF TUNNEL FORMING PART OF THE TONGARIRO HYDRO-ELECTRIC POWER DEVELOPMENT IN THE NORTH ISLAND OF NEW ZEALAND.

Davie, J *Tunnels & Tunnelling /UK/* Vol. 3 No. 6, Nov. 1971, pp 420-4, 1 Fig, 7 Phot

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 215737

CONSTRUCTION OF THE LOISACH BRIDGE--WINTER CONSTRUCTION SITE IN A HALL TO GIVE PROTECTION FROM WEATHER CONDITIONS

DETAILS ARE GIVEN OF EQUIPMENT USED TO PROTECT THE 1314 M LONG BRIDGE WHILE IT WAS UNDER CONSTRUCTION. THE EQUIPMENT ENABLED CONSTRUCTION WORK TO BE CARRIED OUT ALL THE YEAR ROUND. /TRRL/

Europastrassen /Germany/ Vol. 4 No. 4, 71, pp 238-9, 2 Fig

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 215740

DESIGN OF TUNNEL LININGS TAKING ACCOUNT OF THE CONSTRUCTION PROCEDURE

THE DESIGN OF THE TUNNEL LINING IS USUALLY TREATED AS A PLANE PROBLEM, WITH NO ACCOUNT BEING TAKEN OF THE CONSTRUCTION PROCEDURE. THE DISADVANTAGE OF THIS IS THAT THE DEFORMATION OF THE ROCK WHICH TAKES PLACE BEFORE THE LINING IS INCORPORATED IS NOT CONSIDERED. THE AUTHOR SHOWS HOW THESE DEFORMATIONS, WHICH ARE ASSOCIATED WITH THE CONSTRUCTION OF THE TUNNEL, MAY BE INCLUDED IN STATIC DESIGN. IT IS PROVED THAT THE EFFECTIVE PRESSURE OF ROCK ON THE LINING IS TO A LARGE EXTENT DETERMINED BY THE CON-

STRUCTION METHOD AND THE STIFFNESS OF THE LINING, AND THAT A KNOWLEDGE OF THE MECHANICAL PROPERTIES OF THE ROCK IS NECESSARY BEFORE CALCULATIONS ARE CARRIED OUT. /TRRL/

Lombardi, G
Schweizerische Bauzeitung /Switz/ Vol. 89 No. 32, Aug. 1971, pp 793-801, 13 Fig

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 215745

PRINCIPLES AND PRACTICE OF BITUMINOUS SURFACING-VOLUME 1- SPRAYED WORK-FIRST EDITION
IN PART 1, ENTITLED 'PRINCIPLES AND DESIGN OF BITUMINOUS SURFACING', INFORMATION IS PRESENTED UNDER THE FOLLOWING CHAPTER HEADINGS (1) TYPES OF WORK, (2) MATERIALS, TYPES AND QUALITY, (3) PRIMING, (4) PRIMER-SEALS, (5) SEAL COATS, (6) THE ADHESION OF BINDER TO AGGREGATES, (7) SPECIAL TREATMENTS. PART 2, ENTITLED 'FIELD PROCEDURE FOR BITUMINOUS SURFACING', INCLUDES THE FOLLOWING CHAPTERS, (1) PREPARING FOR WORK, (2) PLANT AND EQUIPMENT, (3) PREPARING THE SURFACE, (4) PREPARING PRIMERS AND BINDERS, (5) SPRAYING OF PRIMERS AND BINDERS, (6) HANDLING AND INCORPORATING AGGREGATE, (7) TRAFFIC CONTROL, AND (8) WORK RECORDS. AMENDMENTS TO VOLUME 1 ARE INCLUDED.

Nat Assoc Austral State Road Auth 1965, 78 pp, Tabs

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 215762

HOLLAND EVALUATES HYDROVALVING CONCRETE
HYDROVALVING, A NEW DEVELOPMENT IN UNDERWATER CONCRETE PLACING, IS BRIEFLY DESCRIBED. THE METHOD USES A FLEXIBLE TUBE AND A POURING TUBE WITH A RIGID CYLINDRICAL SHIELD AT THE BOTTOM. THE WATER PRESSURE FORCES THE FLEXIBLE WALLS AGAINST EACH OTHER WHEN THE PIPE IS EMPTY. THE CONCRETE MOVES DOWNWARD SLOWLY UNDER ITS OWN WEIGHT. CORES WERE DRILLED FROM CONCRETE PLACED UNDER WATER BY VARIOUS METHODS AND SUBJECTED TO COMPRESSIVE STRENGTH TESTS. A COMPARATIVE STUDY IS MADE OF THE COSTS OF METHODS OF PLACING CONCRETE UNDERWATER. /TRRL/

Steijaert, PD
New Civil Engineer /UK/ Vol. 11 Oct. 1972, p 26, 2 Tab

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/IRRD 203 989, 2C33303989

3A 215764

CONSTRUCTION OF NEW SANYO TRUNK LINE AND ITS TUNNEL
DETAILS ARE GIVEN OF THE LAYOUT AND CONSTRUCTION OF THE HIGH-SPEED SANYO SHIN-KANSEN (NSL) RAILWAY WHICH, WHEN COMPLETED WILL COVER A DISTANCE OF 565 KM. THE PROPORTIONS OF TUNNEL TO THE TOTAL LENGTH OF THE LINE WILL BE 47 PER CENT. INCLUDED IN THE ROUTE IS THE SHIN-KAMMON UNDERSEA TUNNEL LINKING HONSHU WITH KYUSHU OVER A DISTANCE OF 18,560M. DETAILS OF TUNNEL CONSTRUCTION METHODS ARE GIVEN. /TRRL/

Shimada, T
Civil Engineering /Japan/ Vol. 9 1970, pp 82-92, 13 Fig, 5 Tab, 4 Phot

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 215766

THE COMPRESSED SLURRY SHIELD AS APPLIED TO A TUNNEL BORING OF LARGE DIAMETER
IN JAPAN THE COMPRESSED SLURRY SHIELD HAS FREQUENTLY BEEN USED FOR THE DRIVING OF TUNNELS (MAINLY SEWERAGE) OF LESS THAN 3M. DIAMETER. THIS

PAPER DESCRIBES THE APPLICATION OF THIS METHOD TO THE DRIVING OF THE HANEDA RAILWAY TUNNEL, WHICH IS 7.10 M. IN DIAMETER, 6K M. LONG, AND RUNS UNDER THE TAMAGAWA RIVER, THE MORIGASANE CANAL AND THE KEILUN CANAL. THE TUNNEL IS PART OF THE 100 KM. KEIYO LINE UNDER CONSTRUCTION FROM KAWASAKI CITY TO KISARAZEE IN THE CHIBE PREFECTURE. /TRRL/

Ohira, T
Japanese Railway Engineering Vol. 12 No. 3, 1971, pp 11-20, 5 Fig, 3 Phot

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 215770

WILL IT STOP AT TWO?
THE ARTICLE DISCUSSES IN GENERAL TERMS THE ARGUMENTS FOR AND AGAINST DIFFERING TYPES OF PROPOSED CHANNEL TUNNELS. THESE ARE: 1) BORED TUNNEL; 2) IMMERSED TUBE; 3) COMBINED TUNNEL/BRIDGE; 4) RAIL/ROAD COMBINATIONS; 5) MID-CHANNEL CITY DEVELOPMENT. TECHNIQUES FOR DESIGN AND CONSTRUCTION ARE EXAMINED. A NUMBER OF EXAMPLES ARE GIVEN SUCH AS THE CHESAPEAKE BAY BRIDGE, THE OOSTERSCHELDE BRIDGE, THE HONG KONG TUNNEL, ETC. POLLUTION PROBLEMS ASSOCIATED WITH THOSE HAVING VENTILATION, ESPECIALLY IN LONG TUNNELS AND THOSE HAVING HIGH GRADIENTS FOR RAIL TRAVEL, ARE MENTIONED TOGETHER WITH PROBLEMS ARISING FROM THE DIFFERENCES BETWEEN BRITISH AND CONTINENTAL RAIL LOAD GAUGES, TIDE FLOW AND NAVIGATION, AND SEDIMENT TRANSPORT, AND ITS SCOURING EFFECT. /TRRL/

Jeffs, E *Consulting Engineer* /UK/ Vol. 36 No. 10, Oct. 1972, pp 44-9, 2 Fig, 3 Phot

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 215774

A HISTORY OF TUNNELS
IN THIS BOOK, THE MAIN EXCAVATING METHODS USED THROUGH HISTORY ARE DESCRIBED, AND DETAILS ARE GIVEN OF VARIOUS TECHNOLOGICAL BREAKTHROUGHS, SUCH AS THE FIRST TUNNELLING SHIELD, THE COMPRESSED AIR DRILL, AND TODAY'S FULLY MECHANIZED TUNNELLING MACHINES. THE INFORMATION IS ORGANIZED UNDER THE FOLLOWING CHAPTER HEADINGS:-TUNNELLING: THE BASIC OPERATIONS; TUNNELS OF THE ANCIENT WORLD; THE BEGINNINGS OF MODERN TUNNELLING; THE BRUNELS: FATHER AND SON; EARLY RAILWAY TUNNELS; SOME BRUNEL RAILWAY TUNNELS; TUNNELS OF THE FRENCH AND THE AMERICANS; NEW DEVELOPMENTS AND THE ST. GOTTHARD TUNNEL; THE SEVERN TUNNEL: SUB-AQUEOUS TUNNELLING; TUNNELLING AT THE END OF THE NINETEENTH CENTURY; EARLY TWENTIETH-CENTURY TUNNELLING ACROSS THE WORLD; CHANGING AND UNCHANGING ASPECTS OF TUNNELLING; SOME MAJOR TWENTIETH-CENTURY TUNNELLING ACHIEVEMENTS; THE CHANNEL TUNNEL: PROPOSALS AND PLANS; THE PRESENT AND FUTURE OF TUNNELLING. /TRRL/

Beaver, P
Peter Davies Ltd /UK/ Textbook 1972, 166 pp, 22 Fig, 2 Tab, 24 Phot, 28 Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 215778

POLYESTER OVERLAYS FOR PORTLAND CEMENT CONCRETE SURFACES- AND DISCUSSION
THE USE OF THERMOSETTING POLYESTER RESINS IN PROTECTIVE COATINGS FOR PORTLAND CEMENT CONCRETE /PCC/ SURFACES IS DESCRIBED. SPECIFIC REFERENCE IS MADE TO THE USE OF POLYESTER-AGGREGATE SYSTEMS AS COATINGS ON PCC BRIDGE DECKS. TWO POLYESTER OVERLAY SYSTEMS ARE EXAMINED. ONE USES ORDINARY SEAL COAT APPLICATION METHODS IN WHICH POLYESTER RESIN IS SPRAYED DIRECTLY ONTO A CAREFULLY CLEANED PCC SURFACE.

STONE CHIPS ARE ADDED FOR SKID RESISTANCE. THE SECOND SYSTEM USES A POLYESTER-SAND MORTAR APPLIED AS A 1/4-IN. OVERLAY. THIS TYPE OF SYSTEM ALSO ACTS AS A LEVELING COURSE WHICH ALLOWS READJUSTMENT OF IRREGULAR WEARING SURFACES TO A DESIRED GRADE. SELECTIVE GRADATION OF THE AGGREGATE AND PROPER PROPORTIONING OF THE GRADED AGGREGATE WITH POLYESTER RESIN GIVE A DENSE IMPERMEABLE MORTAR OVERLAY. THE VARIATION OF COMPRESSIVE STRENGTH WITH AGGREGATE GRADING IS DEMONSTRATED. THE PROPERTIES OF SELECTED POLYESTER MORTARS ARE EXAMINED IN THE LABORATORY. THE MORTAR IS SHOWN TO REACH 80 PERCENT OF ITS ULTIMATE COMPRESSIVE STRENGTH IN LESS THAN 24 HR. THE COMPLETED MORTAR IS ALSO SHOWN TO BE RESISTANT TO HYDROCARBON SOLVENTS. METHODS USED FOR SURFACE PREPARATION AND FOR APPLYING THE POLYESTER OVERLAYS ARE EXAMINED. SPECIAL CONSTRUCTION EQUIPMENT IS DESCRIBED. BOTH OVERLAY SYSTEMS HAVE BEEN SHOWN TO BE EFFECTIVE IN SEVERAL LARGE-SCALE FIELD TESTS. /AUTHOR/

Santucci, LE *Highway Research Record, Hwy Res Board* 1963

3A 215784

FURTHER STUDIES OF EPOXY BONDING COMPOUNDS
SIMULATED COMPOSITE BEAM TESTS ARE BEING USED TO STUDY AN EPOXY FORMULATION, FORMULATION G, FOR HEAVY CONSTRUCTION AS A SHEAR CONNECTOR IN COMPOSITE BEAMS OF STEEL-TO-CONCRETE. INFORMATION ON THE PHYSICAL PROPERTIES OF A SINGLE EPOXY FORMULATION AS A PLASTIC AND AS AN ADHESIVE WITH DIFFERENT CONDITIONING TEMPERATURE AND CURING TIMES WAS DEVELOPED.

Miklofsky, HA Gonsior, MJ *Highway Research Record, Hwy Res Board* 1964

3A 215909

BRIDGE EXPANSION JOINT SEALANTS
STATE SPECIFICATIONS ARE CONTINUALLY UPDATED INCLUDING DATA IN EFFECT IN JULY 1969. DETAILS AND BEHAVIOR OF 21 DIFFERENT SEALANTS IN APPROXIMATELY 200 VARIOUSLY SHAPED BRIDGE JOINTS ARE ALSO PRESENTED. A MOVEMENT RATING SYSTEM IS DEVELOPED FOR PREFORMED ELASTOMERIC SEALS AND A NOMOGRAPH PRESENTED FOR DETERMINING THE PROPER GROOVE WIDTH TO MATCH THE SEALANT SIZE USED IN A PARTICULAR ENVIRONMENT. CONSTRUCTION DIFFICULTIES ARE DISCUSSED AND GENERAL BEHAVIOR OF THE VARIOUS SEALANTS ARE COMPARED. OVERALL IT WAS CONCLUDED THAT: (1) POURED-IN-PLACE SEALANTS SHOULD ONLY BE USED IN JOINTS EXPERIENCING LESS THAN 1/2 INCH MOVEMENT, (2) PREFORMED ELASTOMERIC SEALS ARE BEST, BUT ARE STILL NOT IDEAL, (3) SAW CUT JOINTS ARE BEST, AND (4) THE JOINT MUST BE PROPERLY DESIGNED AND CONSTRUCTED. /AUTHOR/

Gunderson, BJ
California Division Highways, Bureau of Public Roads /US/ July 1969

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4830534 69)PB185824, 1C34021865

3A 216003

CONSTRUCTION AND LONG-TERM BEHAVIOR OF 1/8-TH SCALE PRESTRESSED CONCRETE BRIDGE COMPONENTS
THE CONSTRUCTION AND OBSERVED LONG-TERM BEHAVIOR OF TWO SIMPLY SUPPORTED AND TWO THREE-SPAN CONTINUOUS COMPOSITE PRESTRESSED CONCRETE BEAMS ARE DESCRIBED. THE PRECAST, PRETENSIONED GIRDERS, 6 IN. DEEP BY 9 FT LONG, WERE 1/8-TH SCALE MODELS OF GIRDERS FROM A STRUCTURE BEING STUDIED IN THE FIELD. THE TWO THREE-SPAN STRUCTURES, REPRESENTING INTERIOR LINES OF BEAMS FROM THE PROTOTYPE STRUCTURE, WERE EACH MADE WITH THREE SIMPLY SUPPORTED GIRDERS WHICH

WERE MADE CONTINUOUS FOR LIVE LOAD EFFECTS BY MEANS OF REINFORCEMENT IN THE CAST-IN-PLACE DECK AND BY CONCRETE IN THE PIER DIAPHRAGM. THE EFFECTS OF CONTINUITY IN REDUCING THE LONG-TERM DEFORMATIONS OCCURRING AFTER THE DECK CONCRETE WAS CAST WERE STRIKINGLY SHOWN, AND IT WAS FOUND THAT A SIMPLE ELASTIC ANALYSIS COULD SATISFACTORILY PREDICT THE RELATIVE MAGNITUDES AND DIRECTIONS OF THE DEFORMATIONS OCCURRING AFTER THE DECK CONCRETE HAD HARDENED. CREEP AND SHRINKAGE DATA FOR THE CONCRETES USED IN THE STRUCTURES IS REPORTED. IT WAS FOUND THAT THE SMALL SIZE OF THE SPECIMENS LED TO LARGE CREEP AND SHRINKAGE STRAIN VALUES, AS WAS EXPECTED. HOWEVER, IT WAS ALSO FOUND THAT THE STRAIN PREDICTION METHODS BASED ON VOLUME-SURFACE RATIO EFFECTS COULD NOT BE INDISCRIMINATELY EXTENDED TO VERY THIN SPECIMENS AND MEMBERS.

Anderson, TC Houdeshell, DM Gamble, WL
Illinois University, Urbana No. N284, Oct. 1972, 106 pp

ACKNOWLEDGMENT: Federal Highway Administration, Illinois Dept of Transportation FHWA S0034, NTIS PB 219 405, 1C34023491

3A 216108

NEW BRAZING METHOD

BY USING THE LOW-PENETRATION CHARACTERISTICS OF INFRA-RED HEAT, NORTHROP-NORAIR /A DIVISION OF NORTHROP CORPORATION, HAWTHORNE, CALIFORNIA/ HAS EVOLVED AN IMPROVED PROCESS FOR BRAZING HONEY-COMB SANDWICH STRUCTURES. KNOWN AS NORTROBRAZING, THE NEW METHOD CONSISTS OF USING THE HEAT OUTPUT OF QUARTZ INFRA-RED /QIR/ LAMPS. THE HEAT VULNERABILITY OF QUARTZ LAMP TERMINALS HAS NOW BEEN REDUCED TO THE POINT WHERE THEY WILL REMAIN OPERABLE AS MANY AS 90 HOURS WITH A PART TEMPERATURE OF 3,000 DEGREES F BY MEANS OF SPECIAL CERAMIC TERMINAL INSULATORS AND SHIELDS. BESIDES HAVING LOW THERMAL CONDUCTIVITY, THE INSULATORS ARE CHANNELLED SO THAT GAS COOLANTS CAN BE CIRCULATED TO MINIMIZE THE EFFECTS OF REFLECTED HEAT ON TERMINALS. MADE AS PLUG-IN COMPONENTS, THEY ALSO FACILITATE THE TASK OF INSTALLING OR REMOVING QIR LAMPS.

Welding & Metal Fabrication Jan. 1966

3A 216170

PHILOSOPHY OF SERVICE LIFE IN CULVERT DESIGN

THE PHILOSOPHY OF SERVICE LIFE IN THE DESIGN OF CULVERTS HAS CHANGED OVER THE YEARS. WITH THE IMPROVEMENT AND ENLARGEMENT OF OUR HIGHWAY SYSTEM, CULVERT COSTS ARE SIGNIFICANT AND THE SERVICE LIFE OF THESE STRUCTURES DESERVE THE ATTENTION OF DESIGNERS. MANY ENGINEERS USE DURABILITY OF CULVERT MATERIALS AS THE ONLY MEASURE OF SERVICE LIFE, BUT OTHER FACTORS SUCH AS FLOOD DAMAGE AND CONSTRUCTION METHODS AFFECT THE LIFE OF A CULVERT. EVALUATION OF SERVICE LIFE IN THE DESIGN OF CULVERTS IS A COMPLEX SUBJECT INVOLVING LIFE OF THE HIGHWAY, HAZARDS AND DELAYS TO TRAFFIC, AND COSTS OF CONSTRUCTION, REPLACEMENT, AND MAINTENANCE. COST ANALYSES AND USE OF COMPARABLE ALTERNATES ON BID SCHEDULES ARE TWO METHODS PROPOSED TO OBTAIN AN ECONOMICAL CULVERT WITH A SERVICE LIFE CONSISTENT WITH THE HIGHWAY BEING CONSTRUCTED. FIELD OBSERVATIONS OF THE PERFORMANCE OF CULVERT MATERIALS AND METHODS OF CULVERT SELECTION AS USED BY SOME DESIGNERS ARE EXAMINED. (AUTHOR)

Herr, LA *Am Soc Civil Engr J Highway Div* Mar. 1966

3A 216264

EVALUATION OF A CONTINUOUS-LOGGING NUCLEAR MOISTURE-DENSITY MEASUREMENT SYSTEM (LANE-WELLS ROAD LOGGER)

EVALUATION OF A LANE-WELLS ROAD LOGGER AS A REPLACEMENT FOR CONVENTIONAL MOISTURE CONTENT AND DRY DENSITY MEASUREMENTS IN HIGHWAY CONSTRUCTION WAS BEGUN IN 1965 WITH ONE UNIT. THE EVALUATION CONSISTED OF CORRELATION STUDIES ON ACCURACY AND REPEATABILITY, AND GENERAL DEVELOPMENT OF MULTI-PROJECT OPERATING PROCEDURES TO FIT CONSTRUCTION PRACTICES IN SASKATCHEWAN. THE EVALUATION PROGRAM WAS EXPANDED IN 1966 TO THREE UNITS WITH EACH UNIT RESPONSIBLE FOR CONTRACT COMPACTION CONTROL OF SUBGRADE, GRANULAR SUB-BASE AND BASE COURSE, AND ASPHALTIC CONCRETE SURFACE COURSE ON SEVERAL PROJECTS. IN ADDITION, THE UNIT'S ABILITY TO PROVIDE TIGHT CONTROL TO ESTABLISH UNIFORMITY OF COMPACTION WAS ASSESSED AND FOUND SATISFACTORY. THE TWO-YEAR EVALUATION PROGRAM INDICATED THAT WHEN PROPERLY USED, THE ROAD LOGGER MEASUREMENTS ARE AS ACCURATE AS CONVENTIONAL TEST MEASUREMENTS. THE VOLUME OF DATA, THE MATTER IN WHICH IT IS PRESENTED, AND THE SPEED AT WHICH IT IS OBTAINED HAVE BROUGHT THE POSSIBILITY OF QUALITY CONTROL OF COMPACTION PROCESSES, INCLUDING SOILS SELECTION, TO THE POINT WHERE IT IS A PRACTICAL PROCEDURE. THE MAIN DISADVANTAGES OF THE ROAD LOGGER METHOD ARE THE INITIAL COST OF THE DATA AND THE ADDITIONAL TRAINING REQUIRED BY TECHNICIANS TO PROPERLY INTERPRET THE DATA. /AUTHOR/

Culley, RW

Saskatchewan Dept Hwys, Regina /Canada/ Mar. 1967

3A 216306

WELDING OF A514 PLATES SAVES WEIGHT, CUTS SIZE OF FABRICATED GIRDERS

A 96 FT LONG SUPPORTING RIGID FRAME FOR A THREE TRACK RAILROAD OVERPASS IN BEAUMONT, TEX., IS SAID TO REPRESENT THE FIRST APPLICATION BY A MAJOR RAILROAD OF ASTM A514 STEEL PLATE, A HIGH STRENGTH (100,000 PSI YIELD), QUENCHED AND TEMPERED CONSTRUCTIONAL ALLOY. PLATES OF ARMCO STEEL CORP'S SSS-1000 STEEL WERE CHOSEN BECAUSE THE ALLOY'S STRENGTH WOULD REDUCE THE BULK OF THE STRUCTURE AND STILL SUPPORT THE HEAVY ROADBED AND TRACKS. THE FRAME WAS FABRICATED IN THREE SECTIONS AT MOSHER STEEL CO., HOUSTON, BEFORE SHIPMENT TO THE ERECTION SITE. IT CONSISTS OF A 48 IN. WIDE BOX GIRDER WITH 3 1/2 IN. THICK FLANGES AND 1 IN. THICK WEBS. L-SHAPED END SECTIONS WEIGH 34 TONS EACH. THE 41 TON CENTER SPAN IS 46 FT LONG. SHOP WELDING PROCEDURES CALLED FOR MANUAL SHIELDED METAL ARC AND SEMI-AUTOMATIC GAS METAL ARC PROCESSES. BUTT WELDS IN THE HEAVY 3 1/2 IN. PLATE WERE MADE WITH E11018 ELECTRODES. FOR OTHER CONNECTIONS, MOSHER USED COVERED ELECTRODES OR CALCIUM DIOXIDE SHIELDED FLUX CORED WIRE (MCKAY SPEED ALLOY 115) WITH A 275 F PREHEAT. THE COMPANY STRESS RELIEVED THE FABRICATED SECTIONS AT 1050 F IN A CAR BOTTOM FURNACE. AT THE ERECTION SITE, TWO FULL PENETRATION WELDS JOINED THE MAIN BEAM TO THE END SUPPORTS. MANUAL SHIELDED METAL ARC WELDING WITH E11018 ELECTRODES WAS DONE IN A SMALL HOUSE. WHICH SHIELDED WELDERS AND THE JOINT AND HELPED MAINTAIN A PREHEAT OF 300 F. ENTRY PORTS IN THE WEB OF THE BOX BEAM PERMITTED INTERNAL PLACEMENT OF PREHEATERS. THE SSS-1000 FRAME SUPPORTS 15 BEAMS OF A441 STEEL WHICH FORM PART OF THE CAST-IN-PLACE COMPOSITE DECK SYSTEM. PLACED ON 37 IN. CENTERS, BEAMS WERE JOINED TO THE FRAME WITH FULL PENETRATION WELDS MADE WITH E7018 ELECTRODES. /ARTICLE/

Metal Progress Aug. 1966

3A 216429

DESIGN AND CONSTRUCTION OF SANITARY AND STORM SEWERS

CONTENTS: ORGANIZATION AND ADMINISTRATION OF SEWER PROJECTS SURVEYS AND INVESTIGATIONS QUANTITY OF SANITARY SEWAGE QUANTITY OF STORM WATER HYDRAULICS OF SEWERS DESIGN OF SEWER SYSTEMS APPURTENANCES AND SPECIAL STRUCTURES MATERIALS FOR SEWER CONSTRUCTION STRUCTURAL REQUIREMENTS CONSTRUCTION PLANS AND SPECIFICATIONS CONSTRUCTION METHODS SEWAGE AND STORM-WATER PUMPING STATIONS

Am Soc Civil Engr Manuals Eng Practice 1960

3A 216493

1000 FT COMPOSITE VIADUCT USING AUTOFAB WELDING

THE LONG ASHTON BY-PASS TO BE BUILT IN SOMERSET, CONTAINS, AMONG OTHER STRUCTURES, A 1000-FT VIADUCT SPANNING THE BRISTOL-EXETER RAILWAY LINE AND AN ADJACENT COUNTY ROAD. THIS STRUCTURE WILL BE ONE OF THE FIRST MAJOR BRIDGES IN THE UNITED KINGDOM TO BE BUILT USING HIGH TENSILE STEEL FABRICATED BY THE AUTOFAB AUTOMATIC WELDING SYSTEM RECENTLY INTRODUCED BY DORMAN LONG. /RRL/

Surveyor and Municipal Engineer /UK/ Nov. 1966

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 216509

JOINTS AND JOINT CONSTRUCTION IN CONCRETE AND REINFORCED CONCRETE CONSTRUCTION /GERMAN/

THIS IS THE FIRST COLLECTION OF APPROVED METHODS OF CONSTRUCTION IN THIS IMPORTANT FIELD. THIS FIRST PART OF THE BOOK DEALS WITH QUESTIONS OF CONSTRUCTION AND MATERIAL IN THE PRODUCTION OF STRUCTURAL JOINTS; THEIR NUMBER AND DESIGN, THE DIFFERENT KINDS OF JOINTS AND JOINT SEALERS. THE USE OF PVC COMPRESSIBLE SEALERS IS ALSO CONSIDERED. THE SECOND PART CONTAINS DETAILED DISCUSSIONS OF JOINTS AND JOINT CONSTRUCTION IN VARIOUS BUILDING PROJECTS, INCLUDING JOINTS IN BRIDGES AND CONCRETE ROADS. /FG/RRL/

Von, MENG W Schweigert, B Beton-herstellung-verwendung /Germany/ 1966

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 216516

CORROSION PROTECTION IN REINFORCED CONCRETE AND PRESTRESSED CONCRETE

PREVIOUS CORROSION INVESTIGATIONS ON STRUCTURES ARE REVIEWED AND THE FOLLOWING ARE DISCUSSED: PRINCIPLES OF CORROSION AND PROTECTION; DENSITY OF THE CONCRETE COVER WITH REGARD TO CORROSION; CARBONATION (WITH REFERENCE TO CONCRETE STRUCTURES UNDER WATER); RUSTING OF THE STEEL; REQUISITE THICKNESS OF COVER; EFFECT OF CRACKS UPON RUSTING OF THE STEEL; TYPICAL MISTAKES IN CONSTRUCTION (EXAMPLES OF BAD WORKMANSHIP, ETC. TENDING TO PROMOTE CORROSION OF REINFORCING STEEL); PARTICULAR FEATURES ASSOCIATED WITH PRESTRESSED CONCRETE; RULES FOR CORROSION PREVENTION. /LCPC/RRL/A/

Soretz, S

Zement Und Beton pp 1-11, July 1966

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 216587

QUALITY CONTROL IN CIVIL ENGINEERING

THE DIFFICULTY OF APPLYING CONVENTIONAL STATISTICAL QUALITY CONTROL METHODS TO CIVIL ENGINEERING WORKS ARE PRESENTED: THE PROBLEM OF ISOLATING COMPONENTS FOR EASY CONTROL, THE SPECIAL CHARACTER OF CIVIL ENGINEERING WORKS WHICH ARE NOT MASS PRO-

DUCTED, AND THE CONTINUOUS EVOLUTION OF CONSTRUCTION PROCEDURES. CONTROL IS NOT A ROUTINE PROCESS AS IN OTHER INDUSTRIES, ITS AIM IS TO ENSURE SAFETY AND REDUCE TOTAL COSTS INCLUDING INITIAL TOTAL COSTS, MAINTENANCE COSTS AND COSTS OF CORRECTING DEFECTS. CONTROL IS AN INDIRECT CONTRIBUTION OF IMPROVEMENTS IN CONSTRUCTION TECHNIQUES. EMPHASIS IS LAID ON THE IMPORTANCE OF CAREFULLY SELECTING THE PARTS OF THE WORK TO BE CONTROLLED, AND THE NEED FOR CONTROLLING MATERIALS CHARACTERISTICS, OPERATING CONDITIONS OF THE EQUIPMENT, SITE ORGANIZATION, PENALTIES TO BE IMPOSED AS A RESULT OF CONTROL, SAMPLING METHODS, AND STATISTICAL CONTROL CHARTS. / LCPC(A)/RRL/

Bonitzer, J *Bull Liaison Labs Routiers /France/* Sept. 1969

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 216827

INSTALLATION OF PREFORMED NEOPRENE COMPRESSION JOINT SEALS

THE EFFECTIVENESS AND IN-SERVICE PERFORMANCE OF A COMPRESSION JOINT SEAL IS DEPENDENT TO SOME DEGREE UPON PROPER INSTALLATION. TYPICAL COMPRESSION SEAL CONFIGURATIONS ARE, IN REALITY, ELASTOMERIC SEALING DEVICES, EACH WITH A RATED MOVEMENT CAPABILITY, DESIGNED TO FIT INTO A DEFINITE PREDETERMINED GEOMETRIC SHAPE OF JOINT, TO ACCOMMODATE PREDICTABLE CATEGORIES AND RANGES OF MOVEMENTS. SUGGESTED POSITIONING, CONSTRUCTIVE PRACTICE, AND GEOMETRY OF JOINT SHAPES FOR CONTRACTION, EXPANSION, LONGITUDINAL, BRIDGE APPROACH AND BRIDGE STRUCTURE JOINTS, ARE ILLUSTRATED AND DEFINED. USE OF LUBRICANT-ADHESIVES ARE DISCUSSED AND THE GROWTH STRETCH PHENOMENON DESCRIBED WITH SUGGESTED ELONGATION LIMITS BETWEEN 5-8 PER CENT, DEPENDING UPON SEAL WEB THICKNESS, JOINT WIDTHS, AND OTHER FACTORS AFFECTING THEIR ELONGATION. AN ANALYSIS OF CURRENT INSTALLATION MACHINES AND PRACTICES: AUTOMATIC, SEMI-AUTOMATIC AND MANUAL IS GIVEN, AND ILLUSTRATIONS OF TYPICAL MACHINES ARE SHOWN. A NEW EUROPEAN APPROACH TO SEAL GEOMETRY AND SEAL POSITIONING WHICH IS ILLUSTRATED GIVES PROMISE OF PROLONGING THE MAINTENANCE FREE LIFE OF JOINTED CONCRETE PAVEMENT.

Watson, SC *Am Assoc State Highway Officials Proc* Oct. 1967

3A 216831

HOLOGRAPHIC NONDESTRUCTIVE TESTING (HNDT)

TIRES, SANDWICH STRUCTURES, DISK BRAKES AND NUMEROUS OTHER ARTICLES USED IN TRANSPORTATION CAN NOW BE TESTED NONDESTRUCTIVELY WITH IMPROVED SPEED, ACCURACY AND RELIABILITY. KEY TO THIS VERSATILE NEW METHOD IS HOLOGRAPHIC INTERFEROMETRY, WHICH USES COHERENT LIGHT TO RECORD AND RECONSTRUCT THREE-DIMENSIONAL IMAGES. MINUTE SUBSURFACE ANOMALIES ARE CAUSED BY HEAT, PRESSURE, VACUUM, VIBRATION OR OTHER STRESSES (WELL BELOW THE ELASTIC LIMIT) TO PRODUCE CORRESPONDING MINUTE DEFORMATIONS OF THE TEST-OBJECT SURFACE, WHERE INTERFERENCE-FRINGE ANOMALIES ARE FORMED, AND DRAMATICALLY INDICATE THE POSITIONS, SHAPES AND SIZES OF THE HIDDEN FLAWS. /AUTHOR/

Grant, RM Brown, GM *Materials Evaluation* Apr. 1969

3A 216889

FURTHER STUDIES OF EPOXY BONDING COMPOUNDS

A STUDY IS REPORTED OF AN EPOXY FORMULATION CALLED FORMULATION G WHICH IS SUITABLE FOR APPLICATION IN THE FIELD OF HEAVY CONSTRUCTION. LONG TIME STUDIES WERE CONDUCTED INVOLVING THE AGING AND CREEP CHARACTERISTICS OF THE MATERIAL. SEVERAL EPOXY FOR-

MULATIONS WERE STUDIED. THE FACTORS OTHER THAN STRENGTH WHICH GOVERN THE CHOICE OF A SUITABLE FORMULATION ARE SPRAY-ABILITY, VISCOSITY, BRITTLINESS, ABILITY TO SET IN THE PRESENCE OF WATER, POT LIFE AND RESILIENCE. FORMULATION G SATISFIES ALL OF THESE CONSIDERATIONS FOR THE APPLICATIONS INVESTIGATED. A NON-STANDARD SHEAR TEST, NAMED THE SINGLE SHEAR ADHESION TEST, WAS DEVELOPED WHICH IS CONSIDERED RELIABLE FOR PREDICTING THE SHEAR STRENGTH OF A METAL-TO-CONCRETE ADHESIVE SYSTEM. POWER MIXING WAS FOUND TO BE SUPERIOR TO HAND MIXING FOR PREPARATION OF THE COMPONENTS AND FOR MIXING THE COMPONENTS. SANDBLASTING IS THE MOST SATISFACTORY METHOD FOR PREPARING A STEEL SURFACE, AND IS RECOMMENDED FOR COMPOSITE BEAM CONSTRUCTION IN THE FIELD. THE MAJOR STRENGTH OF THE EPOXY FORMULATION IS DEVELOPED WITHIN THE FIRST THREE DAYS. IN USING THE RECOMMENDED FORMULATION, THE CONCRETE SHOULD BE APPLIED WITHIN FOUR HOURS AFTER APPLICATION OF EPOXY TO THE STEEL. TEST RESULTS ARE REPORTED ON CREEP, FATIGUE ON GLUED JOINTS, IMPACT, STRENGTH GAIN UNDER VARIOUS PROGRAMMED TEMPERATURE CONDITIONS, EFFECT OF CHANGES IN FILLER CONTENTS, CATALYSTS, FLEXIBILIZERS, AND DEFORMATION CHARACTERISTICS OF MATERIALS. THE PERFORMANCE CHARACTERISTICS OF FORMULATION G AS A SHEAR CONNECTOR WERE FURTHER STUDIED BY ADDITIONAL COMPOSITE BEAM TESTS. FREEZE-THAW CYCLING OF STEEL TO MORTAR ADHESION SPECIMENS DID NOT AFFECT THE EPOXY, ONLY THE MORTAR. CONCRETE T-BEAMS, CONSISTING OF 8 SLAB GLUED TO A STEM WITH EPOXY, PROVED EQUAL IN STATIC TESTS ONLY TO MONOLITHIC T-BEAMS OF THE SAME DIMENSIONS. A SINGLE COMPOSITE STEEL-TO-CONCRETE BEAM, USING THE EPOXY AS A SHEAR CONNECTOR DEVELOPED 10/11 OF THE ULTIMATE FLEXURAL STRENGTH OF A LIKE BEAM IN WHICH STUD CONNECTORS WERE USED. THE EPOXY GLUED BEAM SHOWED BETTER INTERACTION AT HIGH LOADS. THE EPOXY FORMULATION PROVED SUPERIOR TO A MORTAR SLURRY IN A GROUTING APPLICATION AS DEMONSTRATED BY A SERIES OF PULL-OUT TESTS. THE EPOXY WAS MORE EASILY APPLIED, AND SHOWED MUCH GREATER BOND STRENGTH BETWEEN THE STEEL INSERTS AND CONCRETE CORES WHICH WERE TESTED. THE COST OF AN EPOXY FORMULATION FOR USE AS A SHEAR CONNECTING DEVICE IN COMPOSITE CONSTRUCTION IS NOT PROHIBITIVE.

Miklofsky, HA Gonsior, MJ Santini, JJ
Highway Research Board 1965

3A 216917

STATISTICAL QUALITY CONTROL OF HIGHWAY CONSTRUCTION MATERIALS

THE GREAT INCREASE IN HIGHWAY CONSTRUCTION WORK WHICH WAS EXPERIENCED DURING THE 1950'S AND EARLY 1960'S RESULTED IN RAPID ADVANCEMENT OF CONSTRUCTION METHODS. WITH EMPHASIS BEING PLACED UPON HIGH PRODUCTION. TESTING AND CONTROL PROCEDURES DID NOT KEEP PACE AND THIS RESULTED IN A SLIGHT REDUCTION IN OVERALL QUALITY. HOWEVER, THE HIGHWAY INDUSTRY WAS CHALLENGED AND, THROUGH READJUSTMENT OF CONTROL PROCEDURES, IMPROVEMENT IN QUALITY WAS MADE. TO DATE, SPECIFICATIONS HAVE BEEN OF THE ABSOLUTE TYPE WITH CONSIDERABLE RELIANCE BEING PLACED UPON THE EXPERIENCE OF THE ENGINEER AND HIS ABILITY TO SELECT REPRESENTATIVE SAMPLES. THIS SYSTEM HAS DRAWBACKS, PARTICULARLY UNDER THE STRESS OF AN INCREASING TEMPO OF CONSTRUCTION AND LACK OF TRAINED INSPECTORS. IN AN ATTEMPT TO IMPROVE SPECIFICATIONS, IT WAS SUGGESTED THAT THE HIGHWAY ENGINEER CONSIDER ADOPTING STATISTICAL QUALITY CONTROL (SQC) PROCEDURES. THE FIRST STEP IN THIS DIRECTION WAS TAKEN BY THE UNITED STATES BUREAU OF PUBLIC ROADS WHO HELD WORKSHOPS ON QUALITY CONTROL THROUGHOUT THE NATION IN THE FALL OF 1963. AT THESE WORK-

SHOPS THE BUREAU PROPOSED THAT THE STATE HIGHWAY DEPARTMENTS RESEARCH THE SUBJECT OF USING STATISTICAL CONTROL METHODS. IN THE SPRING OF 1964, THE CALIFORNIA DIVISION OF HIGHWAYS SUBMITTED A RESEARCH PROPOSAL INTENDED TO DETERMINE THE CONTROL LIMITS TO BE USED IN STATISTICAL SPECIFICATIONS FOR NINE CONSTRUCTION ITEMS. THE RESEARCH HAS BEEN COMPLETED ON THESE NINE ITEMS AND EIGHT INTERIM REPORTS CONTAINING THE FINDINGS RELATIVE TO THESE CONSTRUCTION ITEMS HAVE BEEN COMPLETED, AND ARE LISTED IN BIBLIOGRAPHY. /AUTHOR/

Sherman, GB Watkins, RO
California Division Highways May 1968

3A 217038

A CONCEPT OF PREENGINEERED, PREFABRICATED, PRESTRESSED MODULAR AND MULTIMODULAR SEALING SYSTEMS FOR MODERN BRIDGES AND STRUCTURES SINGLE-MODULE, MODULAR, AND MULTIMODULAR SEALING SYSTEMS APPEAR TO OFFER LONG-TERM, MAINTENANCE-FREE SOLUTIONS TO NEWLY DEVELOPING PROBLEMS AT BRIDGE JOINTS BROUGHT ABOUT BY NEW DESIGN SOPHISTICATION. THE NEED FOR ARMORED JOINTS AND THEIR DAMPING EFFECT TOGETHER WITH IMPROVED EMBEDMENT PRACTICES ARE DISCUSSED. UPWARD AND DOWNWARD VERTICAL FORCES, ROTATION, DEFLECTION, AND HORIZONTAL THRUST MOVEMENTS AND THEIR EFFECT ON SEAL SHAPES ARE ILLUSTRATED. THE TYPICAL BRIDGE-JOINT ENVIRONMENT CLEARLY DICTATES THE NEED FOR HEAVY-DUTY SEAL CONFIGURATIONS. WEBB, TOP, AND SIDE MINIMUMS, DEPTH-TO-WIDTH RATIOS, AND PRESSURE-GENERATION REQUIREMENTS ARE PRESENTED AND ANALYZED. SOME METHODS OF RELIABLE DECK TEMPERATURE DETERMINATION AND ADJUSTMENT FOR TEMPERATURE ARE GIVEN. CREEP-SHRINK CALCULATIONS AND TESTING OF MODULAR AND MULTIMODULAR SYSTEMS ARE ILLUSTRATED. /AUTHOR/

Watson, SC Highway Research Record, Hwy Res Board 1970

3A 217199

COARSE GRID SANDWICH CONSTRUCTION FOR WELDED STEEL STRUCTURES

BECAUSE OF THE MANY INNOVATIONS BEING MADE IN THE DEVELOPMENT OF MATERIALS AND IN FABRICATION AND CONNECTION TECHNIQUES, SANDWICH CONSTRUCTION FOR WELDED STEEL STRUCTURES MAY SOON BE FEASIBLE. METHODS OF ANALYSIS ARE DISCUSSED ALONG WITH A FABRICATION METHOD THAT MAY LEAD TO ECONOMICAL SOLUTIONS. THE COARSE GRID SANDWICH AS DEFINED HERE CONSISTS OF A RELATIVELY COARSE PATTERN OF STEEL BARS FRAMED AND SANDWICHED BETWEEN TWO SHEETS OF STEEL. THIS GENERAL TYPE OF SANDWICH IS PARTICULARLY WELL SUITED FOR WELDED STRUCTURES NOT ONLY BECAUSE OF THE LIKELIHOOD OF THE EXISTENCE OF HIGH SHEAR AND BENDING CONDITIONS BUT ALSO BECAUSE QUALITY OF CORE MATERIAL CAN BE CLOSELY CONTROLLED; SHEAR STRENGTH OF THE CORE CAN BE DESIGNED FOR ANY DESIRED VALUE; AND THE CORE CAN BE LOCALLY REINFORCED AND ITS ARRANGEMENT AND ORIENTATION ALTERED TO SUIT A GIVEN DESIGN. IN GENERAL, SANDWICH MATERIALS CAN BE USED EFFECTIVELY WHERE EITHER LOCAL OR GENERAL INSTABILITY DOES NOT ALLOW THE FULL UTILIZATION OF THE STRENGTH OF CONVENTIONAL MATERIALS. A FEW OF THE POSSIBLE APPLICATIONS IN CIVIL ENGINEERING STRUCTURES WOULD INCLUDE GIRDER WEBS, FLOORING SYSTEMS, BOX GIRDERS, BUILT UP COLUMNS, LOAD CARRYING WALLS, BRIDGE DECKS AND FOLDED PLATES. /AUTHOR/

Fisher, JM Stallmeyer, JE Welding Journal American Welding Soc Vol. 51 No. 3, Mar. 1972, pp 177-82

3A 217209

STRENGTH OF STUD SHEAR CONNECTORS

RESULTS ARE DESCRIBED OF TESTS ON 47 PUSH-OUT SPECIMENS DESIGNED TO STUDY THE STRENGTH OF STUD SHEAR CONNECTORS FOR COMPOSITE STEEL AND CONCRETE CONSTRUCTION. DIFFERENT STUD STEELS, TWO CONCRETE TYPES, AND VARIATIONS IN CONCRETE STRENGTH WERE EXAMINED; SPECIMENS WITH STUDS OF DIFFERENT DIMENSIONS AND HAVING SLABS WITH AND WITHOUT REINFORCEMENT WERE ALSO TESTED. THE SHEAR STRESS-SLIP CURVES FOR LOW LOADS WERE PREDICTABLE BY MODELLING THE CONNECTORS AS A FLEXIBLE ELASTIC DOWEL ON AN ELASTIC FOUNDATION. FOR HIGH LOADS AN EMPIRICAL EXPRESSION IS DEVELOPED DEFINING THE RELATIVE INFLUENCES OF THE VARIABLES EXAMINED.

Hawkins, NM Inst Engrs Civil Eng Trans /Australia/ Vol. ce 1 No. n1&2, pp 46-52

3A 217466

A STATISTICAL ANALYSIS OF CONCRETE AGGREGATE TEST RESULTS

THE REPORT DESCRIBES A STATISTICAL STUDY TO DETERMINE THE REPRODUCIBILITY OF CURRENT TEST METHODS AND FEASIBILITY OF USING STATISTICAL QUALITY CONTROL PROCEDURES FOR PORTLAND CEMENT CONCRETE AGGREGATE. THREE BRIDGE PROJECTS WERE STUDIED, TEST RESULTS ON RANDOMLY SELECTED SAMPLES WERE STATISTICALLY ANALYZED FOR VARIANCES. THE CONCLUSION WAS THAT SAND EQUIVALENT AND CLEANNESS TESTS WERE SATISFACTORY FOR FIELD CONTROL. LARGE VARIANCES OF MATERIAL AND SIEVING OPERATIONS INDICATE NEED FOR MODIFICATION OF SPECIFICATIONS. THE REPORT RECOMMENDED THE USE OF MOVING AVERAGE BASED ON THE FIVE MOST RECENT INDIVIDUAL TEST RESULTS. THE REPORT CONTAINS VALUABLE ANALYSIS OF VARIANCE DATA CHARACTERISTIC OF MATERIAL, SAMPLING AND TESTING PROCEDURE. /AUTHOR/

Sherman, GB Watkins, RO Folsom, JJ
California Division Highways Hpr, Feb. 1967

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4601123 67)

3A 217576

CRUSHED STONE: PRODUCTION AND GRADATION

IT IS PREDICTED THAT A MILLION TONS PER DAY OF CRUSHED LIMESTONE AND DOLOMITE FOR ROADSTONE AND CONCRETE WILL BE REQUIRED TO SATISFY THE PROJECTED DEMAND FOR EACH OF THE NEXT SEVERAL YEARS. THE EQUIPMENT REQUIRED TO HANDLE THIS TERRIFIC AMOUNT OF CRUSHED MATERIAL IS DISCUSSED. THE INVESTMENTS IN PRODUCTION EQUIPMENT AND PLANT SITES NECESSARY TO MEET THE CURRENT DEMAND FOR CRUSHED STONE CAN BE ESTIMATED TO BE IN THE BILLIONS OF DOLLARS. IT IS POSSIBLE BY VARYING THE SIEVE SIZES AND THE AMOUNTS OF MATERIALS PASSING A GIVEN SIEVE TO OBTAIN EITHER AN AGGREGATE CONTAINING ESSENTIALLY A SINGLE SIZE OR ONE HAVING A BALANCED COMBINATION OF DECREASING SIZES WHICH IS COMMONLY TERMED DENSE GRADED, THE MOST COMMON TYPE OF CRUSHED STONE PRODUCED FOR CONCRETE OR HIGHWAY WORK. THE SIMPLIFIED PRACTICE RECOMMENDATION (SPR) WAS INITIATED IN 1948 BY THE BUREAU OF PUBLIC ROADS: (1) TO DEVELOP A MINIMUM NUMBER OF STANDARD AGGREGATE GRADATIONS THAT CAN BE UNIFORMLY ADOPTED NATIONWIDE FOR GENERAL USAGE, WHILE AT THE SAME TIME, RECOGNIZING THE NEED FOR SOME VARIATION BY SPECIAL PROVISIONS TO FIT LOCALLY AVAILABLE MATERIALS, (2) TO ACHIEVE UNIFORMITY IN THE NUMBER AND SIZES OF SIEVES TO BE USED IN SPECIFYING THE AGGREGATE GRADATIONS, AND (3) TO DEVELOP AND ADOPT A SIMPLE AND UNIFORM SYSTEM FOR IDENTIFICATION OF THE STANDARD AGGREGATE GRADATIONS. WITH THE ADDITION OF SAND SIZES AND MINERAL FILLERS, THE SPR COULD ADEQUATELY DESCRIBE THE MA-

JORITY OF CRUSHED AGGREGATES USED IN CONCRETE AND HIGHWAY CONSTRUCTION. PLOTS ARE PRESENTED OF GRADATION CURVES FOR DENSE GRADED BASE AGGREGATES FOR SEVERAL STATES. A UNIFORM METHOD OF DESCRIBING AGGREGATES HAS NOT BEEN ADOPTED AND THIS IS THE STUMBLING BLOCK IN THE PATH TO UNIFORMITY FOR AGGREGATE GRADATIONS.

Copas, TL
National Limestone Institute 1967

3A 217737
BLAST-FURNACE SLAG FOR ROADBASES—PART 2
THIS SECOND PART PRESENTS CONSTRUCTION DATA. IN ORDER TO PROTECT THE ROADBASE, A SURFACE DRESSING STRENGTHENED WITH SAND WAS APPLIED. THE PENETRATION OF THE SLAG, WHICH HAD MEDIUM HARDENING PROPERTIES, WAS SATISFACTORY ALTHOUGH, BECAUSE OF THE IRREGULARITY OF THE TEXTURE, AN EXCESS OF BITUMEN REMAINED IN PLACES. DATA ARE PRESENTED ON LABORATORY TESTS, BEHAVIOR OF THE EXPERIMENTAL SECTION, AND ADVANTAGES OF GRANULATED SLAG. /LTE-LCPC-RRL/

Penna, AC
Carreteras /Argentina/ No. 47, July 1968, pp 12-5, 2 Fig, 5 Tab, 4 Phot, 3 Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 217867
STUDY OF THE FINE AGGREGATES MADE WITH CATIONIC EMULSIONS
OBSERVATIONS ARE MADE AT THE LABORATORY AND TRACK OF ASPHALT MIXTURES WITH SAND AND CATIONIC EMULSIONS USED IN ROAD PAVING. A REPORT IS TO BE MADE OF THE TECHNOLOGICAL CHARACTERISTICS OBTAINED AND THE CONSTRUCTION TECHNIQUE USED IN THE EXPERIMENTAL STRIP OF "BOM DESPACHO" LOCATED AT ITAPARICA ISLAND, BAHIA AS PART OF THE FERRY-BOAT SYSTEM SALVADOR-ITAPARICA-NAZARE. /RRI/

Tavares, P
Road Research Institute /Brazil/ 1970

ACKNOWLEDGMENT: Road Research Institute /Brazil/

3A 217909
ASPHALT SANDS MADE WITH CATIONIC EMULSIONS /IN PORTUGUESE/
A STUDY OF FINE AGGREGATES WITH EMULSIONS OF MEDIUM RUPTURING WAS MADE USING SEVERAL TYPES OF SANDS. CONCLUSIONS MADE BY DETERMINING PARTICLE SIZE DISTRIBUTION ARE PRESENTED ALONG WITH CONSTRUCTION METHODS. /RRI/

Tavares, NETO P
Fed Dist Hwy Dpt, Salvador /Braz/ 1970

ACKNOWLEDGMENT: Road Research Institute /Brazil/

3A 217942
MAKE NEW BASE FROM OLD CONCRETE
THE EQUIPMENT USED TO FORM THE NEW BASE CONSISTS OF TWO CAT-980 WHEEL LOADERS WHICH FEED BROKEN RUBBLE TO A UNIVERSAL 30 X 42 DOUBLE-JAW CRUSHER WHICH WITH ITS HOPPER, MAKES UP THE FIRST OF TWO PORTABLE UNITS. THE MINUS 8-IN. RESULT GOES FROM THERE TO THE SECOND PORTABLE, CONSISTING OF A DOUBLE-DECK 5 X 16 FT SCREEN MOUNTED AHEAD OF A 4-FT. CRUSHER. THE CLOSED CIRCUIT OPERATION FEEDS MATERIAL THROUGH THE SCREEN UNTIL IT PASSES THROUGH THE TOP DECK; THE OVERSIZE FROM THE SECOND SCREEN GOES TO ONE PILE, THE UNDERS TO ANOTHER. THE 75-FT. RADIAL STACKER HAS BELT SCALES SO THAT ACTUAL WEIGHT OF THE MATERIAL CAN BE OBTAINED WITHIN HALF OF A PERCENT MARGIN.

Construction Equipment Vol. 49 No. 1, Jan. 1974, p 84, 1 Phot

3A 217968
EXPERIMENTAL ROADWAY HEATING PROJECT ON A BRIDGE APPROACH /AND DISCUSSION/
ELECTRIC HEATING CABLES WERE INSTALLED WITH A BITUMINOUS CONCRETE RESURFACING ON THE 3 PERCENT GRADE OF A DRAWBRIDGE APPROACH TO AID IN SNOW REMOVAL AND ICE CONTROL. THE INSTALLATION OPERATION WAS DESIGNED TO PRODUCE MINIMUM DELAY SINCE THE DRAWBRIDGE APPROACH WAS PART OF A HEAVILY TRAVELED HIGHWAY. THE METHODS AND EQUIPMENT AND MATERIALS FOR CONSTRUCTION ARE GIVEN. INSTALLATION AND OPERATING COSTS AND DESIGN DATA ARE PRESENTED.

Henderson, DJ Highway Research Record, Hwy Res Board 1963

3A 218005
ROADSIDE MAINTENANCE AND ITS EFFECT ON HIGHWAY DESIGN AND CONSTRUCTION
PLOTS WERE ESTABLISHED ON MEDIAN AND CUT AND FILL SLOPE AREAS TO DETERMINE THE RELATIONSHIPS BETWEEN INCIDENCE OF EROSION, TURF DENSITY AND NITROGEN, PHOSPHOROUS AND POTASSIUM NUTRIENTS APPLIED IN VARYING AMOUNTS. MODERATE QUANTITIES OF NITROGEN AND PHOSPHOROUS WERE NECESSARY TO PREVENT THE DEVELOPMENT OF BARE AREAS ON SLOPES. WELL ORGANIZED COST/TIME STUDIES AND EXTENSIVE OBSERVATIONS SHOWED THAT A REDUCED-CONTROLLED MOWING PROGRAM COMBINED WITH APPROPRIATE EQUIPMENT CAN RESULT IN MOWING COST SAVINGS OF 25 TO 30 PERCENT. ON RIGHTS-OF-WAY AVERAGING 27 ACRES OF ROADSIDE AREA PER MILE. THIS REPRESENTS AN IMPORTANT SEGMENT OF THE MAINTENANCE BUDGET. THE EFFECTIVENESS OF RETARDANTS /GROWTH INHIBITORS/ IS CLOSELY RELATED TO TIME OF APPLICATION. USE OF VEGETATION CONTROL CHEMICALS MUST BE CAREFULLY UNDERTAKEN, AND PROPER EQUIPMENT IS ESSENTIAL PARTICULARLY IN AREAS ADJACENT TO ORNAMENTAL PLANTS AND SUSCEPTIBLE FARM CROPS. KARMEX AND SIMAZINE ARE EFFECTIVE SOIL STERILANTS. WHEN USED SINGLY, THE AMOUNTS NEEDED FOR VEGETATION CONTROL BENEATH GUARDRAILS ARE LARGE AND COSTS ARE HIGH. KARMEX PLUS WK SURFACTANT AND SIMAZINE WITH AMITROL-T ARE EFFECTIVE AND REASONABLY SAFE COMBINATIONS. TO SUCCESSFULLY ESTABLISH PLANTINGS OF WOODY SPECIES, IT IS ESSENTIAL THAT A PROPERLY PREPARED PLANTING BED BE PROVIDED, AND THAT THE FOLLOWING FACTORS BE CONSIDERED: /A/ PROPER SELECTION OF SPECIES /ECOLOGICAL PROPRIETY/. /B/ GOOD PLANTING TECHNIQUES. /C/ MAINTENANCE DURING ESTABLISHMENT PERIOD.

Coffman, B Edwards, W
Ohio State University Ecs-189, Jan. 1966

ACKNOWLEDGMENT:

3A 218026
RESEARCH STUDY OF MAINTENANCE OF HIGHWAYS IN OKLAHOMA, 1968
A MEANS HAS BEEN SOUGHT TO DEVELOP PROPER CONSIDERATION OF MAINTENANCE COST IN THE DESIGN AND CONSTRUCTION PROCESS, TO DEVELOP REQUIRED MAINTENANCE STANDARDS AND TO DEVELOP A RELIABLE METHOD OF ESTIMATING REQUIRED MAINTENANCE FUNDS ON A LONG-RANGE BASIS FROM HISTORICAL RECORDS. SAMPLING AND COST DATA COLLECTION TECHNIQUES ARE DESCRIBED. THIRTY FOUR FACTORS ARE IDENTIFIED THAT MIGHT AFFECT MAINTENANCE COSTS. RESULTS OF MULTIPLE REGRESSION ANALYSIS ARE PRESENTED ALONG WITH OTHER STATISTICAL TABULATIONS OF MAINTENANCE COSTS BY TYPE OF CONSTRUCTION. CONCLUSIONS BY THE AUTHOR EMBRACE THE FOLLOWING ITEMS OF SIGNIFICANCE: (1) YEARLY EXPENDITURES DO NOT ADEQUATELY REPRESENT MAINTENANCE PERFORMED, (2) ROUTINE AND SPECIAL

MAINTENANCE DO NOT APPEAR TO BE WELL DEFINED, (3) RANDOM MILE APPROACH OF OBSERVING MAINTENANCE AND ITS COSTS WAS INHIBITED BY LACK OF RECORDS OF ACTUAL COSTS OF MAINTAINING THE MILES IN THE SAMPLE, (4) VARIOUS DESIGNS AND ENVIRONMENTAL FACTORS SEEMED TO HAVE NO MATHEMATICAL RELATIONSHIP WITH MAINTENANCE COSTS AND (5) AN OBJECTIVE METHOD OF ESTIMATING FUTURE COSTS MUST WAIT FOR A DEFINITION OF THE LEVEL AT WHICH MAINTENANCE WILL BE PERFORMED. /BPR/

Hartroft, BC
Oklahoma Department of Highways, Bureau of Public Roads /US/ July 1968

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4731572 68)PB 179 250, 1C40021386

3A 218080
SYNTHETIC AGGREGATE SEAL COAST-CURRENT TEXAS HIGHWAY DEPARTMENT PRACTICES

PERSONAL VISITS, QUESTIONNAIRES, AND A REVIEW OF AVAILABLE LITERATURE WERE UTILIZED TO IDENTIFY CURRENT SYNTHETIC AGGREGATE SEAL COAT DESIGN AND CONSTRUCTION PRACTICES UTILIZED BY THE TEXAS HIGHWAY DEPARTMENT. PROBLEMS ASSOCIATED WITH THE PERFORMANCE OF SEAL COATS UTILIZING SYNTHETIC AGGREGATES FOR CONVERSTONE ARE DEFINED. POOR PERFORMANCE ASSOCIATED WITH WET AGGREGATES AND DEGRADATION OF AGGREGATES IS MAINLY RESPONSIBLE FOR POOR RESULTS OBSERVED IN THE FIELD. SUGGESTED SOLUTIONS TO THESE PROBLEMS ARE PRESENTED INCLUDING: CONTROL OF AGGREGATE QUANTITIES, ROLLING PRACTICES, DESIGN FOR TRAFFIC DENSITY, TRAFFIC CONTROL, AND CONSTRUCTION TIMING RELATIVE TO EXISTING ENVIRONMENTAL CONDITIONS. /FHWA/

Epps, JA Galloway, BM
Texas Transportation Institute, Texas State Department of Highways & Public Transp Res Rpt No. 83-1, May 1972, 68 pp

ACKNOWLEDGMENT: Federal Highway Administration FHWA M-0018, NTIS PB 218 550, 4C40023094

3A 218141
DEVELOPMENT OF UNIFORM PROCEDURES FOR ESTABLISHING CONSTRUCTION EQUIPMENT RENTAL RATES

A SURVEY OF STATE HIGHWAY DEPARTMENT PRACTICES DETERMINED THAT THE MAJOR CURRENT USE OF RENTAL RATES IS TO REIMBURSE CONTRACTORS FOR EQUIPMENT COSTS WHEN UNIT PRICES FOR CONSTRUCTION WORK DO NOT APPLY. THE RATES USED REPRESENT MODIFICATIONS OF THE ASSOCIATED EQUIPMENT DISTRIBUTORS RENTAL RATES OR ARE BASED ON THE ASSOCIATED GENERAL CONTRACTORS OF AMERICAS SCHEDULE OF EQUIPMENT OWNERSHIP COSTS. THE USE OF THESE BASES HAS CERTAIN DEFICIENCIES BECAUSE THEY ARE NATIONAL AVERAGES, THEY INCLUDE INAPPLICABLE COSTS, AND SUCH FORMULAE DO NOT RECOGNIZE THAT EQUIPMENT USED MAY BE FULLY DEPRECIATED. AN EXAMINATION OF THE BASES REPORTED BY THE STATES LED TO AN IDENTIFICATION OF THE APPROPRIATE EQUIPMENT COSTS AND OTHER FACTORS PERTINENT TO RATE DETERMINATION. A FORMULA TO EXPRESS EQUIPMENT COSTS AS AN HOURLY RATE WAS DEVELOPED. A CASE STUDY WAS MADE TO EXPERIENCE THE PROBLEMS OF APPLYING THE FORMULA AND TO DEMONSTRATE THE DEVELOPMENT OF RENTAL RATES. THE GUIDELINES WERE DEVELOPED ON THE PREMISE THAT THE RATES AT WHICH CONTRACTORS ARE REIMBURSED FOR EQUIPMENT USE SHOULD BE BASED ON ACTUAL COSTS, AND COST INFORMATION SHOULD BE SUSCEPTIBLE TO VERIFICATION BY THE HIGHWAY DEPARTMENT. THE COST SYSTEM OUTLINED CAN BE APPLIED TO THE ACCOUNTING FOR STATE-OR COUNTY-OWNED EQUIPMENT. RATES USED INTERNALLY FOR THE

ALLOCATION OF EQUIPMENT COSTS TO MAINTENANCE DISTRICTS OR OTHER COST CENTERS WOULD BE ON A SIMILAR FULLY-ALLOCATED COST BASIS.

Dudick, TS Ravenscroft, FI Highway Research Board Nchrp Reports 1966

3A 218200
CONCRETE BRIDGE DECKS' DETERIORATION AND REPAIR, PROTECTIVE COATINGS, AND ADMIXTURES
FURTHER OBSERVATIONS PERTAINING TO THE PERFORMANCE OF CONCRETE BRIDGE DECKS AND VARIOUS MEASURES EMPLOYED FOR PROTECTION AND REPAIR ARE REPORTED. CONSTRUCTION PRACTICES ARE DISCUSSED IN SUPPORT OF THE BELIEF THAT SCALING IS A MANIFESTATION OF FINISHING PRACTICES AND NOT NECESSARILY AN INHERENT PROPERTY OF CONCRETE. AN HISTORICAL ACCOUNT IS GIVEN OF DAMAGE SUSTAINED BY BOTH NEW AND OLD CONCRETE BRIDGE DECKS. REFERENCES' CONCRETE, BRIDGE DECKS-DETERIORATION, COATINGS AND REPAIRS, JAS. H. HAVENS AND W.B. DRAKE, FEBRUARY, 1963.

Hughes, RD Scott, JW
Kentucky Department Highways June 1966

3A 218310
SALVAGING OLD PAVEMENTS BY RESURFACING
THESE REFERENCES ON THE SALVAGING OF OLD PAVEMENTS BY RESURFACING INCLUDE PORTLAND CEMENT OVERLAYS FOR CONCRETE PAVEMENT, INCLUDING AIR-FIELDS, PERFORMANCE OF RESURFACE, CONSTRUCTION METHODS AND EQUIPMENT, AND ROAD WIDENING METHODS. THE USE OF EPOXY RESIN AND LATEX MORTARS FOR STRUCTURAL REPAIR OF CONCRETE PAVEMENTS IS DISCUSSED.

Highway Research Information Service Dec. 1968

3A 218344
SLAB JACKING
TO ELIMINATE UNEVENNESS IN THE PROFILE OF A ROAD SURFACE DUE TO SLAB SETTLEMENT, THE FOLLOWING MEASURES CAN BE CONSIDERED: (1) REMOVING SUBSIDING AND BROKEN SLABS, REPLACING THEM BY NEW ONES AND, IF NECESSARY, REINFORCING AND LEVELLING THE BASE AND SOIL BENEATH THE SLABS; (2) OVERSLABBING THE SUBSIDING SLABS; AND (3) JACKING UP THE SUBSIDING SLABS TO THE DESIRED LEVEL. VARIOUS METHODS OF CARRYING OUT THE ABOVE MEASURES ARE DESCRIBED: MECHANICAL LIFTING, COMPRESSED AIR INJECTION TO LOOSEN THE SLABS AND INTRODUCTION OF SAND UNDER PRESSURE TO HOLD THE SLAB AT THE CORRECT LEVEL, AND PRESSURE GROUTING WITH CEMENT MORTAR OR BITUMEN. /LCPC/RR/

European Cement Association /France/ July 1969

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 218418
PAVEMENT WIDENING AND RESURFACING IN IDAHO
MANY MILES OF ASPHALTIC AND PORTLAND-CEMENT CONCRETE PAVEMENTS WERE STRUCTURALLY INADEQUATE AND IN NEED OF IMMEDIATE RECONSTRUCTION IN IDAHO AT THE END OF WORLD WAR II. A PROGRAM OF WIDENING AND RESURFACING WAS INITIATED TO TAKE IMMEDIATE ACTION TO ACCOMMODATE TRAFFIC AND REDUCE MAINTENANCE COSTS. PROCEDURES USED FOR WIDENING AND RE-ENFORCING STRUCTURALLY INADEQUATE ASPHALTIC CONCRETE PAVEMENTS ARE ILLUSTRATED. PORTLAND-CEMENT CONCRETE PAVEMENTS THAT WERE STRUCTURALLY ADEQUATE WERE WIDENED AND RESURFACED AS SHOWN. ALL OF THE RESURFACING PROJECTS WERE GIVEN A SEAL COAT NOT SOONER THAN 10 DAYS AFTER LAYING THE PAVEMENT. CONSTRUCTION METHODS AND PERFORMANCE RESULTS ARE DISCUSSED. IT IS RECOMMENDED THAT THE

ADDED BASE AND STABILIZED BASE BE COMPACTED EQUAL IN DENSITY TO THE EXISTING BASE AND PAVEMENT TO REDUCE GROOVING AND REFLECTIONS OF THE OLD PAVEMENT EDGE. IT IS SUGGESTED THAT BY USING BITUMINOUS STABILIZED BASE A DISTANCE OF ONE FOOT OR MORE OUTSIDE THE FINISHED PAVEMENT WOULD HELP REDUCE PAVEMENT EDGE REFLECTION CRACKS BY INCREASING THE EDGE SUPPORT. PAVING THE SHOULDER FULL WIDTH TO THE SAME THICKNESS, AND WITH THE SAME MATERIAL AS THE PAVEMENT WOULD HELP. STABILIZING THE CRUSHED BASE WIDENING WITH PORTLAND CEMENT IS SUGGESTED TO ELIMINATE COMPACTION OF THE AGGREGATE BY TRAFFIC. STABILIZATION OF THE WIDENED BASE SHOULD BE FOR THE FULL DEPTH. PORTLAND-CEMENT CONCRETE PAVEMENTS SHOULD HAVE ALL ROCKING AND LOOSE SLABS MUD JACKED TO PREVENT MOVEMENT. IT WAS OBSERVED THAT A MINIMUM OF SIX INCHES OF CRUSHED GRAVEL BASE OVER THE OLD PAVEMENT IS REQUIRED IF REFLECTION CRACKS ARE TO BE ELIMINATED. A UNIFORMITY OF SECTION FULL WIDTH IS RECOMMENDED FOR GOOD RIDING QUALITY.

Erickson, LF Marsh, PA *Highway Research Board Bulletin* 1956

3A 218573

OPEN-GRADED PLANT-MIXED SEALS

THE OPEN-GRADED PLANT-MIX SEAL IS A CHIP-SEAL AGGREGATE CONTAINING SOME SAND-SIZED MATERIAL, WHICH IS PREMIXED IN A PLANT AND HAS RELATIVELY HIGH ASPHALT CONTENT. THIS TYPE OF SEAL PROVIDES A SMOOTH RIDING SURFACE. A DURABLE SEAL IS PRODUCED WHICH HAS GOOD SKID RESISTANCE QUALITIES. A NUMBER OF WESTERN STATES ARE CONSTRUCTING OPEN-GRADED, PLANT-MIXED SEALS AS A STANDARD ON ALL HIGH-QUALITY ASPHALT PAVEMENTS. GRADATION USED AND ASPHALT CONTENT ARE DISCUSSED. AGGREGATE PARTICLES ARE COATED WITH A FILM OF ASPHALT 3 TO 4 TIMES THICKER THAN THAT FOR A DENSE-GRADED MIX. THIS PROVIDES DURABILITY AND RESISTANCE TO MOISTURE IN SPITE OF THE HIGH VOID RATIO. IN CONTRAST TO THE EXTREMELY WIDE RANGE OF SKID RESISTANCE VALUES OF CHIP-SEAL SURFACES, A UNIFORMLY GOOD SKID-RESISTANCE SURFACE IS PRODUCED. THE LOSS OF SKID NUMBER WITH SPEED IS RELATIVELY SMALL BECAUSE OF THE VOIDS AT THE SURFACE. THE OPEN-GRADED PLANT-MIXED SEAL REDUCES ROUGHNESS, WHILE A CHIP-SEAL ADDS ROUGHNESS TO A SMOOTH PAVEMENT. WITH AN OPEN-GRADED PLANT-MIXED SEAL THERE IS PRACTICALLY NO LOSS OF MATERIAL AND NO FINE PARTICLES TO DAMAGE WINDSHIELDS. SURFACE WATER CAN ESCAPE THROUGH THE VOIDS INSTEAD OF FLOWING OVER THE SURFACE. PAINTED STRIPES ARE MORE VISIBLE AND DURABLE BECAUSE OF THE SURFACE VOIDS. NO CURING TIME IS REQUIRED SO THAT THE ROAD CAN BE OPEN TO TRAFFIC IMMEDIATELY FOLLOWING ROLLING. COST IS LARGELY DEPENDENT ON AGGREGATE AVAILABILITY. CONSTRUCTION PROCEDURES ARE DESCRIBED AND IT IS POINTED OUT THAT THE SEAL CANNOT BE EXPECTED TO CORRECT LARGE UNDERLYING STRUCTURAL DEFICIENCIES OF A POOR PAVEMENT. ONE OBJECTION TO THE USE OF THE SEAL IS ITS SUSCEPTIBILITY TO OIL DRIPPINGS AT AN EARLY AGE.

Hewett, JW *Highway Research Record, Hwy Res Board* 1969

3A 218617

TOP DRESSING OR DRY MAINTENANCE ROADS

A RESUME OF PUBLICATIONS, CORRESPONDENCE, CONFERENCES AND FIELD INSPECTIONS, CONCERNING TRAFFIC BOUND SURFACES OF STONE, SLAG, OR GRAVEL SUITABLE FOR THE USE OF 500 TO 600 VEHICLES PER DAY IS PRESENTED. THE USUAL CONSTRUCTION PRACTICE IS TO BUILD A CRUST FIVE OR SIX INCHES THICK BY TRAFFIC COMPACTION IN COMPARATIVELY THIN LAYERS. IT IS MAINTAINED IN SMOOTH RIDING CONDITIONS BY FREQUENT BLADING OR DRAGGING.

Conner, CN *Highway Research Board Proceedings* 1928

3A 218638

TREATMENT OF LOW COST ROADS

A DISCUSSION OF BASIC CONSIDERATIONS IN THE CONSTRUCTION OF CRUSHED STONE OR GRAVEL ROADS IS FOLLOWED BY MORE DETAILED EXAMINATION OF TWO EXPERIMENTAL TREATMENTS STUDIED BY SOUTH CAROLINA OVER A THREE-YEAR SPAN: THE DOUBLE SURFACE TREATMENT (BUILDING A BITUMINOUS CARPET OVER AND IN BOND WITH THE TOP-SOIL ROAD SURFACE) AND MIXING TREATMENTS (SCARIFYING AND PULVERIZING THE ROAD SURFACE TO A SUFFICIENT DEPTH, THE ADDING THE BITUMINOUS MATERIAL IN SEVERAL APPLICATIONS WITH SLIGHT DISKING BETWEEN APPLICATIONS).

Pauls, JT *Highway Research Board Proceedings* 1928

3A 218629

"PUDDLE MACADAM", USING SOFT SANDSTONES

WEST VIRGINIA HAS BEEN EXPERIMENTING WITH A NEW-ROAD CONSTRUCTION METHOD IN WHICH THE PAVEMENT IS CONSTRUCTED AS FOR WATER-BOUND MACADAM UP TO THE POINT WHERE WATER IS ADDED, WHEREUPON THE SURFACE SWEEPED FREE OF SURPLUS DUST AND SCREENINGS AND COLD TAR IS APPLIED. THE SPECIFICATION FOR THE TAR IS GIVEN. THE ADVANTAGES OF THE METHOD ARE CONSIDERED TO BE THAT IT PERMITS THE USE OF SOFTER GRADES OF STONE, ECONOMICAL USE OF THE COMPLETE CRUSHER RUN, MINIMAL DELAYS TO TRAFFIC, AND EXCEPTIONAL SURFACE SMOOTHNESS.

Gray, BE *Highway Research Board Proceedings* 1928

3A 218732

UNDERWATER BUSINESS-CRAWLER GRABS OCTOPUS

THE SCRIPPS INSTITUTION OF OCEANOGRAPHY HAS DEVELOPED A TRACKED, REMOTE-CONTROLLED VEHICLE CAPABLE OF OCEAN BOTTOM OPERATIONS AT DEPTHS UP TO 6,000 FEET. CONTEMPLATED USES ARE UNDERWATER CONSTRUCTION, RETRIEVAL OF SCIENTIFIC INSTRUMENTS, DEEP-SEA SEARCH AND RESCUE, AND GEOLOGICAL INVESTIGATIONS. THE FRAME ATTACHES A LONG, JOINTED MANIPULATOR ARM AND OPERATED FROM THE SURFACE BY MEANS OF SONAR AND TELEVISION CAMERAS ON THE VEHICLE.

Constructor Dec. 1970

3A 218981

CONSTRUCTION EQUIPMENT SECTION

RESEARCH ON DEVELOPMENT OF CONSTRUCTION EQUIPMENT INCLUDES: (1) A BIG HOLE DRILLING MACHINE FOR THE FOUNDATION CONSTRUCTION OF LARGE STRUCTURES IN THE SEA; (2) FUNDAMENTAL STUDIES TO DEVELOP AN OPERATORLESS BULLDOZER CONTROLLED AUTOMATICALLY BY PRE-SET PROGRAMS; (3) A DEFLECT-GRAPH TO MAKE POSSIBLE THE MEASUREMENT DEFLECTION OF ROAD SURFACE CONTINUOUSLY AND AUTOMATICALLY; AND (4) A SAND JETTING MACHINE FOR IMMersed TUNNELS AND AN EXCAVATION SYSTEM ON THE SEA BOTTOM. RESEARCH ON THE ESTABLISHMENT OF WORKING PERFORMANCE AND MECHANICAL CHARACTERS OF CONSTRUCTION EQUIPMENT CONTAINS: (1) FIELD EXPERIMENTS TO DEVELOP COMPACTED SNOW REMOVAL EQUIPMENT (2) FUNDAMENTAL INVESTIGATIONS ON COMPACTABILITY AND FINISHABILITY OF THE CONCRETE PAVERS; (3) STUDY OF COMPUTERIZED ESTIMATION ON THE PERFORMANCE EFFICIENCY OF EARTH MOVING EQUIPMENT; (4) STUDIES ON ROCK CUTTING APPLIED TO MECHANICAL BORINGS, USING DRILLING TEST STAND AND A TWO DIMENSIONAL CUTTING APPARATUS; (5) KEEP-AWAY-METHODS FORM NOISE AND VIBRATIONS DUE TO THE CONSTRUCTION WORKS; AND (6) OPTIMUM CONDITIONS IN MAN-MACHINE SYSTEMS OF CONSTRUCTION EQUIPMENT.

Public Works Res Inst, Cm /Japan/ Sept. 1971, pp 16-7, 1 Fig. 3 Phot

3A 219040

HEATER-REMIXER METHOD OF BITUMINOUS SURFACING
THE SPECIFICATIONS FOR THE SURFACING OF 4.7 MILES OF ROADWAY WITH AN AVERAGE WIDTH OF 80 FEET, REQUIRED THE USE OF A SELF-PROPELLED HEATER-REMIXER FIRED BY BUTANE AND CAPABLE OF COVERING 3000 SQUARE YARDS PER HOUR, WHILE HEATING THE EXISTING BITUMINOUS SURFACE TO THE EXTENT THAT IT COULD BE SCARIFIED AND REMIXED TO A DEPTH OF NOT LESS THAN 0.75 OF AN INCH. CONSTRUCTION PROCEDURE IS DETAILED. THE BITUMINOUS SURFACING WAS APPLIED IN SEVEN ADJACENT PASSES AND REQUIRED 12 WORKING DAYS. THE CONTRACTORS' EFFORTS MEET PROCEDURAL REQUIREMENTS ARE DESCRIBED. THE APPLICATION OF THE ASPHALT REJUVENATING AGENT AND THE SPECIFICATIONS THAT IT IS REQUIRED TO MEET ARE OUTLINED. THE APPLICATION OF THE 0.75-INCH PLANT-MIX BITUMINOUS SEAL IS DESCRIBED. PHOTOGRAPHS OF THE OPERATION ARE PRESENTED AND COMMENTS ARE MADE ON THE COST AND SOME PROCEDURAL PROBLEMS THAT HAVE BEEN ENCOUNTERED.

Kasper, WL *Highway Focus* Vol. 4 No. 3, Apr. 1972, pp 42-7, 6 Phot

3A 219088

THIN CONCRETE OVERLAY FOR RESIDENTIAL STREETS
TO TEST THE FEASIBILITY OF USING THIN CONCRETE OVERLAY IN A RESIDENTIAL LOCATION, A TEST SITE WAS CHOSEN ADJACENT TO AN ASPHALT OVERLAY WHICH COULD SERVE AS A CONTROL SECTION FOR EVALUATION. BRASS COATED AND PLAIN STEEL FIBERS WERE USED AND THE ADDING PROCEDURE IS DESCRIBED. TRANSIT MIX TRUCKS DUMPED WET CONCRETE ON THE PAVEMENT AHEAD OF THE FINISHER, THE PAVEMENT HAVING BEEN PREVIOUSLY WET DOWN. PROCEDURAL DETAILS ARE OUTLINED AND PERFORMANCE OVER A 6-MONTH PERIOD IS DISCUSSED. RELIABLE COST DATA ARE NOT AVAILABLE. A SERIES OF QUESTIONS ON THE CONSTITUTION OF THE MIX, PROBLEMS ENCOUNTERED, AND DEVELOPMENT OF STRENGTHS ARE ANSWERED.

Better Roads Vol. 43 No. 4, Apr. 1973, pp 24-6, 4 Phot

3A 219110

WRITE A LEASE THAT WORKS FOR YOU
ALL THE AVAILABLE CHOICES OPEN TO RENTERS AND/OR LEASERS OF CONSTRUCTION EQUIPMENT ARE DISCUSSED IN TERMS OF TYPICAL SITUATIONS THAT MIGHT ARISE. FOR INSTANCE, IF MAINTENANCE IS TO BE HANDLED SEPARATELY THIS SHOULD BE SPELLED OUT UNDER A "WET" LEASE CLAUSE. SHOULD THE EQUIPMENT BECOME OBSOLETE BEFORE THE LEASE EXPIRES A CANCELLATION CLAUSE, WHICH SHOULD BE CAREFULLY NEGOTIATED PRIOR TO SIGNING THE LEASE, OUGHT TO BE INCLUDED. SHOULD THE DESIRE TO BUY THE EQUIPMENT BE EXPRESSED, THIS TOO SHOULD BE REQUESTED IN A FULL-PAYOUT CONTRACT WITH AN OPTION TO BUY. LIKEWISE SHOULD USED EQUIPMENT BE DESIRED THEN (1) SECOND-HAND EQUIPMENT SHOULD BE SPECIFIED, (2) LEASED EQUIPMENT CAN BE TRADED AT THE EXPIRATION OF EACH LEASE FOR COMPARABLE NEW EQUIPMENT, (3) A VERY HIGH PURCHASE OPTION CAN BE AGREED UPON, AND (4) THE EQUIPMENT CAN BE LEASED FROM THE DISTRIBUTOR ON A NON-FULL-PAYOUT BASIS. SHOULD CASH BE QUICKLY NEEDED, SELL SOME EQUIPMENT TO A LEASING FIRM AND THEN LEASE THE SAME EQUIPMENT FROM THE SAME FIRM ON A FULLY-PAYOUT BASIS ON THE REMAINING VALUE OF THE EQUIPMENT. SHOULD THE WORK BE SEASONAL THEN, IF POSSIBLE, ARRANGE WITH THE LEASING FIRM FOR THE MONTHLY PAYMENTS NOT TO BE MADE DURING THE MONTHS WHEN NO WORK IS DONE. SHOULD OUTRIGHT OWNERSHIP BE DESIRED, ALTHOUGH THE FINANCIAL SITUATION MIGHT BE SUCH THAT IT IS NOT POSSIBLE, THEN LEASE THE EQUIPMENT WITH AN EARLY TERMINATION OPTION. SHOULD A TAX ADVANTAGE BE REQUIRED, DO NOT BECOME AN OWNER, INSTEAD INSERT A RENEWAL CLAUSE INTO THE LEASE.

Construction Equipment Vol. 47 No. 7, June 1973, pp 60-4, 5 Photo

3A 219274

THE ECONOMICS OF HEAVY CONSTRUCTION EQUIPMENT STANDARDIZATION
THE PROBLEM OF STANDARDIZATION OF HEAVY CONSTRUCTION EQUIPMENT IS ANALYZED FROM THE VIEWPOINT OF A MEDIUM-SIZED HEAVY CONSTRUCTION COMPANY AND AS VIEWED BY CERTAIN GOVERNMENT ORGANIZATIONS. IT IS HOPED THAT THIS ANALYSIS WILL ACCOMPLISH TWO OBJECTIVES' /1/ DEVELOP THE SIGNIFICANT FACTORS AND VARIABLES WHICH AFFECT FAMILY STANDARDIZATION OF HEAVY CONSTRUCTION EQUIPMENT, AND /2/ OUTLINE A METHOD OF ANALYSIS WHICH CONTRACTORS CAN USE TO IMPROVE THEIR EQUIPMENT POLICY. IT IS CONCLUDED THAT STANDARDIZATION OF EQUIPMENT WILL RESULT IN INCREASED PROFITS. THEREFORE, A FORMAL PROCEDURE SHOULD BE SET UP IN EACH CONSTRUCTION COMPANY TO ANALYZE THE BENEFITS AND SPECIFY THE METHOD OF IMPLEMENTATION OF A FAMILY STANDARDIZATION POLICY ON EACH PROJECT.

Koster, FD
Stanford University Sept. 1964

AD647842\$3.00, 1P41085004

3A 219275

EARTHMOVING TRENDS TO WATCH IN YOUR BUSINESS
A REVIEW IS PRESENTED OF EARTHMOVING TRENDS ON SCRAPER FLEET MAKE-UP, MACHINE SIZE PREFERENCES, SELF-LOADING SCRAPERS, ALL-WHEEL-DRIVE /TWIN-ENGINE/ SCRAPERS, TANDEM BOWL RIGS, CRAWLER-DRAWN PANS, RIPPING, EARTH COMPACTORS, AND A FEW WORDS ABOUT THE ROLE OF THE COMPUTER IN THE EVOLUTION OF EARTHMOVING INTO SOME SEMBLANCE OF A BUSINESS-LIKE BUSINESS. A MACHINE THAT MERITS INCREASED CONSIDERATION IN THE LARGER EARTHMOVING FLEETS IS THE TWO-ENGINE UNIT WITH POWER ON TWO AXLES. THE TWIN SCRAPER HAS ESTABLISHED ITSELF AS A LOW-COST PRODUCER ON A WIDE RANGE OF JOBS. TWO-ENGINE SCRAPERS ARE ALSO BEING CONSIDERED FOR THEIR VALUE IN HELPING TO REDUCE UNBALANCED PUSH-LOADING, AS WITH THE PADDLE SCRAPERS. A NEW IDEA THAT WILL CAUSE SOME REFIGURING IS THAT OF LINKED, PADDLE-TYPE SCRAPERS. THIS RESULTED FROM THE NEED FOR REDUCING PUSH-LOADING COSTS AND PLANNING THE OVERALL FLEET TO MAKE PUSHER SERVICE MORE EFFICIENT. GREATER USE OF THE LARGE RUBBER-TIRE TRACTOR SHOVEL, FRONT-END LOADER, WHEEL-LOADER IS RECOMMENDED. LARGER, SELF-PROPELLED COMPACTORS THAT REALLY DELIVER THE YARDAGE AND KEEP UP WITH BIGGER SCRAPERS ON THE FILL ARE IN CONSTANT USE NOW. THE USE OF THE ELECTRIC COMPUTER TO CLOSE IN ON THE COMPLEXITIES OF EARTH-MOVING EQUIPMENT PRODUCTIVITY AND COST ANALYSIS IS THE MOST RECENT DEVELOPMENT. IT IS EMPHASIZED THAT IT IS IMPORTANT TO HAVE THE BEST EQUIPMENT FOR THE JOBS AT HAND FOR THE MARKET OUTLOOK OF COST REDUCTION.

Roads and Streets Feb. 1967

3A 219279

TO RENT????? OR NOT TO RENT??
THE COSTS AND PROFITS INVOLVED IN AN EQUIPMENT RENTAL BUSINESS ARE ANALYZED AND DISCUSSED. MAINTENANCE AND TRAINING FOR OPERATION INVOLVE A LARGE NUMBER OF PERSONNEL AS WELL AS A LARGE OFFICE STAFF FOR DETAILED RECORD KEEPING ON EACH MACHINE. THE AUTHOR IS CONVINCED THAT MORE TOTAL NET PROFIT CAN BE OBTAINED FROM THE SAME PIECE OF EQUIPMENT ON A RENTAL BASIS THAN ON A STRAIGHT SALE.

Arnold, RG *Construction Equipment Distribution* Jan. 1967

3A 219209

WHEN DO WE GET TO SEE THE PROFIT?

RENTAL-PURCHASE EQUIPMENT AGREEMENTS ARE DISCUSSED AND A RENTAL-PURCHASE ANALYSIS FORMULA PRESENTED. FINANCING METHODS FOR DISTRIBUTORS ARE ANALYZED. HIDDEN COSTS IN RENTAL-PURCHASE AGREEMENTS ARE DISCUSSED.

Bankowski, WT *Construction Equipment Distribution* Jan. 1967

3A 219281

A STUDY TO DETERMINE THE FEASIBILITY OF DEFINING EARTHMOVING VEHICLE SYSTEMS BY ANALYTICAL TECHNIQUES

THE FEASIBILITY OF DEFINING EARTHMOVING VEHICLE SYSTEMS BY ANALYTICAL TECHNIQUES HAS BEEN DEMONSTRATED. THE BASIC METHODOLOGY AND SKELETAL COMPUTER PROGRAM HAVE BEEN DEVELOPED TO DETERMINE THE COST/EFFECTIVENESS ADVANTAGES OF SPECIAL EQUIPMENT SYSTEMS SUCH AS THOSE CONSISTING OF MULTIPURPOSE, MULTIFUNCTION VEHICLES. THE COMPUTER PROGRAM DEVELOPED HAS VERIFIED THE ANALYTICAL APPROACH BY STRUCTURING A HYPOTHETICAL VEHICLE SYSTEM WHOSE COST FOR PERFORMING A SPECIFIC AIRFIELD CONSTRUCTION WAS SUBSTANTIALLY LESS THAN THE COST INCURRED BY EACH OF THREE SPECIFIED ENGINEER COMBAT BATTALIONS. /AUTHOR/

Jaquish, PE Erickson, GB Jobaris, JE
Army Material Command /US/, Engineering Res & Dev Labs, Army /US/ Apr. 1967

AD650764, 1P41086234

3A 219289

NEW BELT CONVEYOR UNDER TEST

GOVERNMENT ENGINEERS ARE TESTING A PILOT MODEL OF A NEW TYPE OF CONVEYOR BELT WHICH WIGGLES RATHER THAN MOVES--AND MAY OPEN THE WAY TO A COMPLETELY MODULAR SYSTEM. THE MATERIAL TO BE CONVEYED MOVES ALONG A FLEXIBLE BELT, WITHOUT ANY FORWARD MOVEMENT OF THE BELT ITSELF. THIS IS ACCOMPLISHED BY SUPPORT YOKES THAT MOVE UP AND DOWN IN SEQUENCE. THIS GIVES AN UNDULATORY MOTION TO THE BELT, WHICH, IN TURN, IMPARTS A FORWARD MOTION TO MATERIAL ON IT. REPORTEDLY, SUCH A SYSTEM, BUILT IN MODULES, COULD BE QUICKLY AND EASILY LENGTHENED WITHOUT SHUT-DOWN OR DISASSEMBLY. ARCS AND Y'S COULD BE FORMED, AND THE BELT COULD BE DESIGNED TO NEGOTIATE CORNERS AND EITHER MERGE OR SEPARATE STREAMS OF MOVING MATERIALS. /ARTICLE/

Bureau of Mines /US/

ACKNOWLEDGMENT: Washington Science Trends, Dc

3A 219296

1967 RIPPING AND BLASTING RESULTS IN SOUTHWESTERN U.S.A.

IMPROVEMENTS IN TRACTORS AND RIPPERS AND IN BLAST-HOLE DRILLS AND EXPLOSIVES HAVE INCREASED PRODUCTION AND DECREASED UNIT COST IN THE FRAGMENTATION OF EARTH-ROCK STRUCTURES. THESE METHODS ARE SUMMARIZED AND RESULTS CURRENTLY IN PRACTICE PRESENTED. PRACTICES ARE CORRELATED WITH THE SEISMIC SHOCK WAVE VELOCITIES OF THE STRUCTURES. SEISMOGRAPH STUDIES WERE MADE OF 300 JOB SITES AND 200 OF THE STUDIES CORRELATED WITH THE CONTRACTORS' AND THE MINERS' EXCAVATING METHODS AND PRODUCTION. THE ROCKS OF SOUTHWESTERN USA ARE GENERALLY WARPED, FOLDED, DIPPED, AND FAULTED BY EARTHQUAKES AND ARE OF IGNEOUS, SEDIMENTARY, AND METAMORPHIC TYPES, THE SEISMOGRAPH IS AN ACCEPTED MEANS OF MEASURING THE COST OF EXCAVATION OF ROCKS BY DERIVING: (1) RIPPING COSTS AND BLASTING COSTS WHICH ARE PRO-

PORTIONAL TO THE DEGREE OF CONSOLIDATION OF THE MATERIAL, (2) CONSOLIDATION WHICH IS PROPORTIONAL TO THE SEISMIC SHOCK WAVE VELOCITY OF THE MATERIAL, AND (3) THE COST OF PREPARING THE MATERIAL FOR MOVEMENT WHICH IS PROPORTIONAL TO THE SHOCK WAVE VELOCITY OF THE EARTH-ROCK STRUCTURE. TRACTORS ARE INCREASING IN HORSEPOWER AND WEIGHT, AND THE PARALLELGRAM TYPE RIPPER IS MORE EFFICIENT THAN THE SWING TYPE RIPPER. THESE FACTORS HAVE INCREASED THE PRODUCTION OF MEDIUM AND HEAVY-DUTY TRACTOR RIPPERS. THE PERFORMANCE AND OPERATION OF THESE RIPPERS ARE REVIEWED. AVERAGING PRODUCTION AND UNIT COST EQUATIONS FOR BOTH MEDIUM AND HEAVY-DUTY TRACTOR RIPPERS, PRODUCTION VARIES INVERSELY APPROXIMATELY AS THE 3.15 POWER OF THE SHOCK WAVE VELOCITY. THE UNIT COST VARIES APPROXIMATELY AS THE 3.18 POWER. PERCUSSION DRILLS AND BLASTING ARE ALSO DISCUSSED. THE SELECTION OF RIPPING OR BLASTING METHODS DEPENDS ON THE CONSOLIDATION FOUND IN THE EARTH-ROCK STRUCTURE. SECONDARY CONSIDERATIONS ARE METHOD OF HAULAGE, THICKNESS OF BEDDING OR STRATIFICATION OF THE ROCK

Church, HK *Roads and Streets* Sept. 1967

3A 219308

RESEARCH WORK CARRIED BY THE INSTITUTE FOR CONSTRUCTION MACHINERY AND OPERATIONS /IN GERMAN/

THE FOLLOWING REPORTS ARE INCLUDED IN THIS PUBLICATION: (1) ANNUAL SURVEY OF CONSTRUCTION MACHINERY-NEW DEVELOPMENTS IN CONCRETE MIXERS AND MIXING PLANT, AND IMPRESSIONS FROM AMERICAN CONCRETE ROAD CONSTRUCTION BY W. JURECKA; (2) DYNAMIC SOIL COMPACTION BY H. FRENKING, R. FRICKARTZ, AND R. SONNENBERG; (3) THE INFLUENCE OF WETTING AGENTS ON THE COMPACTION OF SOILS BY H. WOLF; (4) THE INFLUENCE OF THE SHAPE OF THE SHOE OF TRACKED VEHICLES ON THEIR POWER BY K. OGAKI; (5) THE DRAINAGE OF FRESH CONCRETE BY ELECTRO-OSMOSIS BY W.U. KOHLER; (6) THE SELECTION OF APPARATUS FOR INTENSIVE PREPARATION OF CEMENT MORTAR BY J. PICK; (7) MEASUREMENT OF MOISTURE IN CONCRETE AGGREGATES BY W. SLOWAK; (8) HEATING AND DRYING PROCESSES IN MIXING PLANTS FOR BITUMINOUS MIXTURES BY F.J. SCHLOSSER; AND, (8) THE DEVELOPMENT OF NETWORK PLANNING TECHNOLOGY IN CONSTRUCTION OPERATIONS BY R. SEELING /TRRL/

Technische Hochschule, Aachen /Germany/ 1967

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 219309

COMPLETELY MECHANIZED TUNNEL DRILLING MACHINES /IN GERMAN/

A DESCRIPTION OF A FULLY-MECHANIZED DRILLING MACHINE FOR THE CONSTRUCTION OF TUNNELS AND SUBTERRANEAN CANALS, MAINLY BUILT FOR WORK IN HARD ROCK IS GIVEN. THE MACHINE CAN BE USED FOR TUNNEL DIAMETERS BETWEEN 1.90 AND 2.20 M. ECONOMICS OF THE MACHINE ARE DISCUSSED. /FG/RRL/

Tiefbau /Germany/ 1967

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 219327

DIESEL EXHAUST CONTAMINATION OF TUNNEL AIR

THE BUREAU OF MINES STUDIED AIR CONTAMINATION CAUSED BY DIESEL EXHAUST IN A 10,000-FT VENTILATED TUNNEL. SEQUENTIAL AIR SAMPLES WERE TAKEN AT THE ENDS AND MIDDLE OF THE TUNNEL DURING AN OPERATING CYCLE. OBSERVED AND CALCULATED RESULTS FOR CARBON DIOXIDE, CARBON MONOXIDE, AND NITROGEN OXIDES WERE ESSENTIALLY IN AGREEMENT. NITROGEN DIOXIDE

WAS PRESENT ONLY IN TRACE AMOUNTS. IT WAS FOUND THAT CONTAMINATION WAS RELATED TO THE VOLUME OF VENTILATING AIR, THE NUMBER OF HAULAGE TRIPS, TRAIN SPEED, AND ENGINE LOAD. /AUTHOR/

Holtz, JC Dalzell, RW
Bureau of Mines /US/

TN23.A45 NO. 7074, IP41201922

3A 219343

FLORIDA STATE ROAD DEPARTMENT TOTAL COST PURCHASING

THE TOTAL COST PURCHASING CONCEPT WAS INVESTIGATED IN FLORIDA TO REFINE ITS PURCHASING PROCEDURES IN REGARD TO HEAVY EQUIPMENT, ACQUISITION AND OPERATION, WITH PARTICULAR REFERENCE TO THE REPAIR SERVICES AND ACQUISITION OF PARTS. THIS PURCHASING PROCEDURE WAS HELD LEGAL BY THE STATE ATTORNEY GENERAL PROVIDING THAT THE BIDS WERE PUBLIC AND COMPETITION WAS NOT ELIMINATED ON EACH INDIVIDUAL ITEM ADVERTISED. A CHANGE OF FORM WAS MADE IN THE BID BLANK AND LENGTHY SPECIFICATIONS WERE WRITTEN COVERING THE GUARANTEED MAXIMUM TOTAL COST OF REPAIRS TO BE INCORPORATED IN THE BID. COPIES ARE PRESENTED OF BID PROPOSALS AND OTHER PERTINENT INFORMATION INCLUDING A SAMPLE OF THE BID TABULATIONS.

Mickler, R *Am Assoc State Highway Officials Proc* 10 pp, Dec. 1968

3A 219353

HIGHWAY CONSTRUCTION EQUIPMENT NOISE HAZARDS
PROLONGED EXPOSURE OF PERSONNEL TO THE INTENSE NOISE PRODUCED BY DIESEL-POWERED HIGHWAY CONSTRUCTION EQUIPMENT CAN CAUSE PARTIAL DEAFNESS. BOTH LEVEL AND FREQUENCY OF A NOISE MUST BE CONSIDERED IN DETERMINING THE PROBABLE EFFECT ON HEARING. THE SUSCEPTIBILITY OF INDIVIDUALS TO NOISE-INDUCED HEARING LOSS VARIES WIDELY. THE NOISE-INDUCED HEARING LOSS ACCUMULATES GRADUALLY AND IS PERMANENT AND CANNOT BE CORRECTED BY ANY KNOWN MEDICAL TREATMENT OR BY USING A HEARING AID. IT IS A COMPENSABLE OCCUPATIONAL DISEASE IN MANY JURISDICTIONS, AND SOME STATES HAVE ADOPTED REGULATIONS INTENDED TO CONTROL OCCUPATIONAL EXPOSURES THAT CAN CAUSE IT. THE BEST METHOD OF PREVENTION IS TO ELIMINATE HARMFUL NOISE EXPOSURES BY ENGINEERING METHODS OR OPERATING PROCEDURES. WHERE THESE MEASURES FAIL, PERSONAL PROTECTIVE EQUIPMENT CAN BE USED.

Botsford, JH *Highway Research Record, Hwy Res Board* 1969

3A 219354

SOUND REDUCTION OF EARTH-MOVING MACHINERY
THE FOLLOWING NOISE SOURCES OF EARTH MOVING MACHINERY ARE DESCRIBED: (1) EXHAUST NOISE, (2) COOLING FANS, (3) NOISE RADIATED BY ENGINE, (4) COMBUSTION AIR INTAKE NOISE, (5) ACCESSORY NOISE, AND (6) OPERATOR LOCATION NOISE. EXPERIENCE HAS SHOWN THAT EXHAUST AND COOLING FAN NOISE HAVE BEEN THE MAJOR PROBLEMS AS AN OBSERVER HEARS A VEHICLE. RADIATION DIRECTLY FROM DIESEL ENGINES CAUSES A DISTINCT SOUND THAT IS ANNOYING TO SOME PRIMARILY BECAUSE OF ITS CHARACTER. THE USE OF TURBO-CHARGERS MAY RESULT IN SOME OBJECTIONABLE NOISE, PERHAPS BECAUSE NO MUFFLERS ARE USED, AND SOMETIMES BECAUSE THE TURBO-CHARGER OPERATION RESULTS IN EXCESSIVE WHINE. FUTURE TRENDS CALL FOR QUIETER EQUIPMENT OF ALL SORTS.

Groening, JA *Highway Research Record, Hwy Res Board* 1969

3A 219357

INFORMATION NEEDS FOR CONTROLLING EQUIPMENT COSTS

SOME OF THE VARIATIONS IN EQUIPMENT COSTS ARE PRESENTED AND DISCUSSED. EQUIPMENT MANAGEMENT IS AN INTEGRAL AND INSEPARABLE PART OF CONSTRUCTION MANAGEMENT. THE SOLUTIONS TO THE EQUIPMENT PROBLEMS LIE IN THE EQUIPMENT MANAGER'S ACCESS TO FACTS AND TO HIS ABILITY TO USE THEM. THE FUNCTIONS AND INFORMATION NEEDS OF EQUIPMENT MANAGEMENT MAY BE CLASSIFIED AS: (1) SCHEDULING, SELECTION AND REPLACEMENT, (2) PURCHASING AND FINANCING, AND (3) MAINTENANCE. EACH OF THESE FUNCTIONS WHICH MUST CONTRIBUTE TO ATTAINMENT OF THE COMPANY'S GOALS FOR EQUIPMENT MANAGEMENT ARE DESCRIBED AND DISCUSSED. INFORMATION SYSTEMS USING ELECTRONIC DATA PROCESSING EQUIPMENT FOR EACH OF THESE FACTORS ARE ANALYZED. THE INFORMATION SYSTEM MUST PROVIDE THE COMMUNICATIONS NECESSARY TO ATTAIN THE MANAGEMENT GOALS OF ACHIEVING THE OPTIMUM LEVELS OF MOST SUITABLE EQUIPMENT.

Cox, EA *Highway Research Record, Hwy Res Board* 1969

3A 219358

AVERAGE PRODUCTION RATES FOR MAJOR EQUIPMENT

A CONCISE SUMMARY IS PRESENTED OF AVERAGE PRODUCTION RATES FOR KEY ROAD CONSTRUCTION EQUIPMENT UNITS. THESE RATES WERE DEVELOPED BY ANALYZING DATA FROM FIELD RESEARCH STUDIES CONDUCTED BY THE U. S. BUREAU OF PUBLIC ROADS. THE EQUIPMENT STUDIED WAS OPERATED UNDER A VARIETY OF JOB CONDITIONS AND MANAGEMENT PRACTICES DURING CONSTRUCTION OF SEVERAL HUNDRED HIGHWAY PROJECTS LOCATED THROUGHOUT THE UNITED STATES. EACH TYPE OF KEY EQUIPMENT STUDIED EXPERIENCED LOST TIME DUE TO A VARIETY OF DELAY CAUSES. THE MAGNITUDE OF THESE TIME LOSSES IS REFLECTED IN THE PRODUCTION RATES REPORTED UNDER THREE DIFFERENT TIME CLASSIFICATIONS AS FOLLOWS: (1) PRODUCTIVE TIME RATES, COMPUTED WITH THE TIME FOR ALL DELAYS EXCLUDED, (2) NET AVAILABLE WORKING TIME RATES, COMPUTED BY EXCLUDING ONLY THE TIME FOR INDIVIDUAL DELAYS THAT LASTED 15 MINUTES OR MORE, AND (3) SCHEDULED SHIFT TIME RATES, COMPUTED BY EXCLUDING ONLY THE TIME FOR INDIVIDUAL WEATHER-CAUSED DELAYS THAT LASTED 15 MINUTES OR MORE.

Highway Research Record, Hwy Res Board 1969

3A 219361

CONSTRUCTION AND MAINTENANCE EQUIPMENT
THIRTY-NINE INFORMATIONAL REPORTS ON PERFORMANCE, TIME UTILIZATION, AND COSTS PERTAINING TO EQUIPMENT EMPLOYED ON HIGHWAY CONSTRUCTION AND MAINTENANCE WORK ARE COMPILED IN THIS PUBLICATION. THE REPORTS ARE GROUPED BY MAJOR CATEGORIES OF WORK: (1) PORTLAND CEMENT CONCRETE PAVING, (2) BITUMINOUS PAVING, (3) POWER SHOVEL GRADING, (4) SCRAPER GRADING CRAWLER TRACTOR DRAWN UNITS, (6) OTHER EQUIPMENT, AND (7) HIGHWAY MAINTENANCE OPERATIONS.

Highway Research Board Special Reports 1962

3A 219366

OFF-THE-ROAD TIRES. PART II-MAINTENANCE AND REPAIR PRACTICES

FACTORS AFFECTING TIRE LIFE ARE ENUMERATED AND PROCEDURES FOR THE EXTENSION OF TIRE LIFE THROUGH MAINTENANCE, RETREADING, AND REPAIR ARE DISCUSSED. PART I OF THIS SERIES DEALS WITH THE SELECTION CRITERIA FOR VARIOUS DUTIES, GIVING A DESCRIPTION OF THE NUMEROUS TYPES OF TREADS AVAILABLE, ETC. THE FIVE MAJOR FACTORS AFFECTING TIRE LIFE ARE DISCUSSED: (1) DRIVER EDUCATION, (2) VEHICLE MAINTENANCE, (3) ROAD MAINTENANCE, (4) TRUCK OPERATIONAL PROCEDURES, AND

(5) TIRE MAINTENANCE. A SUCCESSFUL TIRE OPERATION REQUIRES TIRE RECORDS. RECOMMENDATIONS ARE GIVEN FOR THE PROPER STORAGE OF TIRES.

Clarke, WH
National Crushed Stone Association

ACKNOWLEDGMENT: Canadian Pit and Quarry

3A 219367

OFF-THE-ROAD TIRES. PART I

INFORMATION IS PRESENTED ON THE SELECTION, USE, MAINTENANCE AND REPAIR OF OFF-THE-ROAD TIRES--ONE OF THE HIGH COST ITEMS IN MANY OPERATIONS AND CONSTRUCTION PROJECTS. THE SELECTION OF EQUIPMENT AND TIRES IS DISCUSSED IN RELATION TO LOAD, SPEED, DISTANCE, SAFETY, TYPE OF OPERATION, SURFACE CONDITIONS AND ECONOMY. ALSO INCLUDED IS INFORMATION ON TREAD DESIGNS, TIRE CONSTRUCTION, AND TREAD COMPOUNDS. IN THE SECOND PART OF THE SERIES FACTORS AFFECTING TIRE LIFE ARE ENUMERATED AND PROCEDURES FOR THE EXTENSION OF TIRE LIFE THROUGH MAINTENANCE, RETREADING, AND REPAIR ARE COVERED. /AUTHOR/

Clarke, WH
National Crushed Stone Association

ACKNOWLEDGMENT: Canadian Pit and Quarry

3A 219369

AUTOMATIC GRADER OPENS WAY TO FAST SIDEWALK CONSTRUCTION

A NEW TRACK-MOUNTED FINE-GRADING MACHINE ADVANCES 5 FEET PER MINUTE AS IT LEVELS THE EARTH TO FINAL ELEVATION FOR A CONTRACTOR INSTALLING SIDEWALKS IN MINNESOTA. GUIDED BY A SENSOR, THE MACHINE AUTOMATICALLY ESTABLISHES A PRECISE GRADE, CUTTING THE EARTH TO A SELECTED DEPTH AND FEEDING IT INTO A CONVEYOR FOR DISCHARGE AT THE REAR. THE FINE-GRADER INCREASES PRODUCTION 15 TO 30% AND ELIMINATES OTHER RIGS, THREE LABORERS, AND VIRTUALLY ALL HAND WORK.

Construction Methods & Equipment Dec. 1969

3A 219384

PART 2: REPLACE FOR MORE PROFIT

REPLACEMENT OF CONSTRUCTION EQUIPMENT CAN BE DECIDED UPON BY ONE OF THE FOLLOWING THREE METHODS: REPLACEMENT BY INTUITION, REPLACEMENT FOR MINIMIZING COSTS, OR REPLACEMENT FOR MAXIMIZING PROFITS. A SUMMARY IS PRESENTED OF THE DECISIONS REACHED BY THE THREE METHODS IN SOLVING AN EXAMPLE PROBLEM. A DISCOUNTED CASH FLOW MATHEMATICAL MODEL WAS DEVELOPED WHICH IS DESCRIBED. IN MAKING DECISIONS ABOUT EQUIPMENT POLICY, THE FOLLOWING FACTORS ARE CONSIDERED: (1) TIME VALUE OF MONEY, (2) TECHNOLOGICAL ADVANCES IN EQUIPMENT (OBSELESCENCE), (3) EFFECT OF TAXES (DEPRECIATION TECHNIQUES, ETC.), (4) INFLUENCE OF INFLATION, INVESTMENT CREDIT, GAIN ON SALE, (5) INCREASED COST OF BORROWING MONEY, (6) CONTINUING REPLACEMENTS IN THE FUTURE, (7) INCREASED COST OF FUTURE MACHINES, AND (8) EFFECT OF PERIODIC OVERHAUL COSTS AND REDUCED AVAILABILITY. THE OPTIMIZATION OF PROFITS IS THE KEY TO THE SOLUTION OF MOST PROBLEMS BY USING A COMPUTER MODEL. ANOTHER MATHEMATICAL MODEL IS PRESENTED IN WHICH REVENUES AND COSTS ARE CONSIDERED FOR ALL MACHINES. THE REVENUES AND COSTS ARE CLASSIFIED AS: (1) REVENUES FROM THE SERVICES OF THE MACHINES, (2) MAINTENANCE AND OPERATING COSTS, INCLUDING ANNUAL FIXED COSTS, PENALTIES AND OVERHEAD, (3) CAPITAL COSTS, INCLUDING INTEREST ON INVESTMENTS, DEPRECIATION CHARGES, AND INTEREST ON BORROWED FUNDS, (4) DISCRETE COSTS SUCH AS ENGINE,

TRACK, AND FINAL DRIVER OVERHAULS, AND (5) INCOME AND CORPORATION TAXES, CONSIDERING DEPRECIATION METHOD, RECAPTURE OF INCOME ON SALE AND INVESTMENT CREDIT. THESE MATHEMATICAL MODELS HELP IN PROPER ANALYSIS OF EQUIPMENT WHICH IS BASIC IN THE DEVELOPMENT OF SOUND REPLACEMENT POLICY. REPLACEMENT POLICY.

Douglas, J *Construction Methods & Equipment* Apr. 1970

3A 219389

CHANGES IN THE EQUIPMENT INDUSTRY

THE USE OF CMI EQUIPMENT IS DESCRIBED IN MARKING GRADE, TRIMMING GRADE, SPREADING MATERIALS, STABILIZATION, CONCRETE AND ASPHALT PAVING. AUTOMATED GRADING EQUIPMENT (AUTOGRADE) CAN PLACE EACH DAY ALL OF THE ROCK, SOIL CEMENT, ASPHALT OR CONCRETE THAT CAN BE HAULED. THE MACHINE CAN GRADE 1/2 TO 2 MILES OF SUBGRADE PER DAY OR CAN FINE TRIM AS MUCH AS 6 TO 7 MILES PER DAY OF MATERIAL THAT IT HAD PREVIOUSLY SPREAD. THE SAME MACHINE WITH SLIGHT MODIFICATIONS CAN DO LIME, CEMENT, AND ASPHALT STABILIZATION. IT CAN DO AERATION AND MIXING OF SUBGRADE SOILS OR OF BASES. THE SAME MACHINE WITH A HEATED COMPACTING SCREED CAN DO BASE AND SUBBASE WORK AND CAN PLACE ASPHALT IN FULL WIDTH COURSES. WITH THE SLIPFORM MODIFICATION IT CAN DO FULL WIDTH PAVING, CAN PAVE WITH OR WITHOUT FORMS, CAN DO WIDENING AND HAS BEEN USED BY SEVERAL CONTRACTORS FOR SLIPFORMING RAMPS. AUTOMATED EQUIPMENT IS CAPABLE OF ACCURATE GRADE MAKING. THE CMI EQUIPMENT OPERATES USING SIX-SENSORS, ONE FOR THE FRONT TRACK STEERING, ONE FOR THE REAR TRACKS, ALLOWING THE NEGOTIATION OF SHORT RADIUS CURVATURES, FOUR SENSORS, ONE AT EACH CORNER, MAINTAIN GRADE TAKEN FROM STRINGLINE OR SKIS. THE SENSORS ARE ALIKE AND ARE DIRECT CURRENT TWO-CONTACT ROTARY SWITCHES WHICH ACTIVATE SOLENOID VALVES EQUIPPED WITH HYDRAULIC LOCKS TO PREVENT LEAKAGE. THE SOLENOID VALVES IN TURN CORRECT FOR GRADE OR ALIGNMENT BY ADJUSTING TWO WAY HYDRAULIC CYLINDERS. FLOW TO THE CYLINDER IS CONTROLLED BY METERING VALVES TO INCREASE OR DECREASE THE REACTION RATE. AUTOMATED EQUIPMENT MAY BE USED TO SPREAD UNIFORM COURSES OF MATERIALS SUCH AS PUGMILLED AGGREGATE OR SOIL CEMENT METERED AHEAD OF THE MACHINE BY WINDROW BOXES. IN THE WEST, HIGH SPEED PROJECTION OF BASE IS PERFORMED BY DUMPING AHEAD WITH BELLY-DUMP UNITS, SPREADING WITH AN AUTOGRADE, ALLOWING EXCESS MATERIAL TO FLOW OUT THE REAR MOLDBOARD CENTER WINDROWS WHERE IT IS RECLAIMED AND HAULED AHEAD. THE RECLAIMING OF THIS MATERIAL MAY BE DONE BY A BELT WHICH IS A NORMAL PRACTICE IN MISSOURI. MATERIALS MAY BE METERED INTO THE MACHINE BY THE USE OF A JERSEY TYPE OF THESE ATTACHMENTS AS POSSIBLE, ESPECIALLY THE HYDRAULIC PLACING HOT MIX ASPHALT BASES, BINDER, AND SURFACE COURSES. AUTOMATIC FOUR-CORNER GRADE CONTROL AND FRONT AND REAR STEERING ARE USED EFFECTIVELY IN SLIPFORM PAVING FOR SPREADING, PAVING AND FINISHING. MESH DEPRESSORS CAN BE AUTOMATED AND CROWN CHANGES THROUGH TRANSITION SECTIONS CAN BE DONE AUTOMATICALLY.

Minor, WH *Ohio Highway Engineering Conf Proc* pp 143-149, Apr. 1969

3A 219395

MARKET RESEARCH OF THE BRAZILIAN HIGHWAY EQUIPMENT

A SURVEY WAS MADE OF THE NATIONAL MANUFACTURING OF HIGHWAY EQUIPMENT. /RRI/

Botelho, CM
Road Research Institute /Brazil/ 1967

ACKNOWLEDGMENT: Road Research Institute /Brazil/

3A 219396

CONTRIBUTION TO THE STUDIES AND CODIFICATION OF LUBRICANTS, FUELS, AND HYDRAULIC FLUIDS FOR HIGHWAY EQUIPMENT

THE NEED IS EMPHASIZED OF ESTABLISHING A CENTRAL AGENCY OF LUBRICATION IN THE HIGHWAY AGENCIES, WHICH WOULD UNDERTAKE THE STUDY AND SOLUTIONS OF THE PROBLEMS CONCERNED WITH LUBRICANTS. DETAILED REFERENCES TO ITS ORGANIZATION ARE GIVEN. TWO MANUALS ARE SUBMITTED. ONE IS CONCERNED WITH THE ORIGIN, TREATMENT, COMPOSITION, ETC. OF LUBRICANTS. THE OTHER IS CONCERNED WITH INSTRUCTIONS FOR ACQUISITION, STORAGE, HANDLING, REVEIVING, ETC. FINALLY, THE AUTHOR PROPOSES THE ADOPTION OF A CODE FOR THE STANDARDIZATION OF LUBRICANTS, DEVELOPED BY THE CENTRAL AGENCY OF LUBRICATION. THE CODE SHOULD BE USED FOR TABLES OF GENERAL RECOMMENDATIONS AND IN SPECIFICATIONS FOR EACH TYPE OF VEHICLE IN LUBRICATION SYSTEMS. /RRI/

Buerger, PE

National Highway Department /Brazil/ 1962

ACKNOWLEDGMENT: Road Research Institute /Brazil/

3A 219397

ELEVATING SCRAPERS PROVE VALUE IN HIGH-PRODUCTION JOBS

ELEVATING SCRAPERS HAVE AN HOURLY PRODUCTION CAPACITY LESS THAN COMPARABLY RATED CONVENTIONAL SCRAPERS, BUT THEY HAVE THE EFFICIENT CHARACTERISTIC OF BEING SELF-LOADING WHICH MAKES THEM MORE ECONOMICAL IN MANY EARTH MOVING SITUATIONS. SELF-LOADING SCRAPERS ARE WORKING IN HIGHWAY CONSTRUCTION, DAM AND WATER CONTROL PROJECTS, AIRPORT CONSTRUCTION, AS WELL AS IN RESIDENTIAL AND COMMERCIAL BUILDING SITE DEVELOPMENTS. ABOUT 4 TO 5 INCH DEPTH OF PENETRATRION IS PERFORMED BY THE CUTTING EDGE; THIS BOILS THE MATERIAL UP IN FRONT OF THE ELEVATOR FLIGHTS, AND MOVING FLIGHTS SWEEP IT INTO THE SCRAPER BOWL. THIS LOADING SWEEPING ACTION REQUIRES FAR LESS HORSE POWER THAN PUSHING A CONVENTIONAL SCRAPER, BECAUSE THE MATERIAL ENTERING THE BOWL IS ALWAYS BEING PLACED ON TOP OF THE INCREASING LOAD. FIELD WEIGHT STUDIES OF THE CATERPILLER 32-CUBIC-YARD-CAP- ACITY ELEVATING SCRAPER DEMONSTRATE ITS ABILITY TO LOAD A WIDE RANGE OF MATERIALS. ELEVATOR SPEEDS SHOULD BE CORRELATED WITH THE LOADING CHARACTERISTICS OF THE MATERIAL. ALL LOADING SHOULD BE DONE IN FIRST-GEAR TORQUE-CONVERTER DRIVE FOR MAXIMUM RIM-PULL WITH MINIMUM WHEEL SLIPPAGE. TO ASSIST IN LOADING AND CONTAINING SAND, OTHER GRANULAR MATERIALS WITH LOWER MOISTURE BAFFLES ARE AVAILABLE WHICH CAN BE FITTED BEHIND THE ELEVATOR. THESE REDUCE LOSS OF MATERIAL OVER THE FRONT OF THE CUTTING EDGE. UTILITY APPLICATIONS FOR THE ELEVATING SCRAPER ARE FINISH GRADING, HAUL ROAD MAINTENANCE, SLOPE WORK, CLEAN-UP WORK, INTERCHANGE LANDSCAPING, REPLACING STRIPPED TOPSOIL, STRIPPING AND LOADING ASPHALT PAVEMENT AND MANY OTHER JOBS.

Roads and Streets Apr. 1969

3A 219398

A STUDY OF THE HIGHWAY CONSTRUCTION EQUIPMENT INDUSTRY IN CONNECTION WITH THE CONTINUING HIGHWAY PROGRAM

THE AASHO-ARBA JOINT COOPERATIVE COMMITTEE PREPARED A REPORT TO IDENTIFY PROBLEM AREAS WHICH MIGHT NEED SPECIAL ATTENTION IN CONNECTION WITH THE FUTURE HIGHWAY PROGRAM. THE DATA PRESENTED WAS DRAWN ESSENTIALLY FROM HIGHWAY CONSTRUCTION EQUIPMENT INDUSTRY SOURCES WITH THE COOPERATION OF HIGHWAY OFFICIALS. THE REPORT RELATES SPECIFI-

CALLY TO THE HIGHWAY CONSTRUCTION EQUIPMENT INDUSTRY REQUIREMENTS ANTICIPATED FOR THE YEARS BETWEEN 1975 AND 1985; THE STUDIES WILL ALSO BE USEFUL AS AN OVERVIEW OF PRODUCTION AND CAPACITY TRENDS, /AUTHOR/

American Road Builders Association July 1970

3A 219403

EQUIPMENT FOR STABILIZED BASE CONSTRUCTION
EQUIPMENT AND TECHNIQUES ARE DESCRIBED FOR SOIL COMPACTION AND SOIL STABILIZATION OF THE ADDITIVE AND MECHANICAL TYPES. THE IMPORTANCE IS EMPHASIZED OF SEGREGATION DURING MATERIAL HANDLING AND DURING THE BLENDING AND MIXING OPERATION. THE FOLLOWING EQUIPMENT IS DESCRIBED AND PICTURED: MIXING AND BLENDING EQUIPMENT WITH ITS OWN FLUID HANDLING SYSTEM; A METERED FLUID DISTRIBUTOR WITH SPRAY BAR; MEANS OF RAPID DRYING OF OVER-WET MATERIALS BY AERATION; HIGH SPEED, OPEN SEGMENTED WHEEL, SHEEPS-FOOT ROLLER; A HIGH SPEED ROLLER EQUIPPED WITH PAD TYPE WHEEL; A PNEUMATIC ROLLER USED IN HIGHWAY CONSTRUCTION; A TANDEM STEEL WHEEL ROLLER USED PRIMARILY FOR SURFACE ROLLING OF ASPHALTIC CONCRETE; AND HEAVY CLAY PULVERIZED BY A PULVI-MIXER.

Trainer, MJ *Ohio Highway Engineering Conf Proc* Apr. 1967

3A 219404

AUTOMATIC CONTROLS ON CONSTRUCTION EQUIPMENT: STATE OF THE ART

THE USE OF ELECTRONIC DEVICES FOR AUTOMATIC CONTROL OF CONSTRUCTION EQUIPMENT HAS INCREASED STEADILY SINCE THE INCEPTION IN 1958. SEVENTY PERCENT OF THE STATE HIGHWAY DEPARTMENTS IN THE UNITED STATES HAVE REQUIRED AUTOMATIC CONTROL AT SOME TIME OR ANOTHER, AND 65 PERCENT REGULARLY SPECIFY AUTOMATICALLY CONTROLLED EQUIPMENT. HIGHWAY DEPARTMENTS IN CANADA HAVE BEEN LEADERS IN THE USE OF THIS AUTOMATIC EQUIPMENT, AND UNITED STATES AND EUROPEAN PLANT MANUFACTURERS ARE EXPERIENCING AN INCREASING DEMAND FOR ELECTRONIC GUIDANCE SYSTEMS ON ROAD CONSTRUCTION MACHINERY. A DESCRIPTION OF TYPICAL ELECTRONIC CONTROL DEVICES NOW ON THE MARKET IS INCLUDED IN THIS EVALUATION. EXAMPLES ARE GIVEN OF THE SMOOTHNESS THAT MAY BE EXPECTED WITH ELECTRONICALLY CONTROLLED PAVERS WHEN CONDITIONS ARE FAVORED BY GOOD WORKMANSHIP AND GOOD EQUIPMENT. ALTHOUGH AUTOMATIC CONTROLS REDUCE THE DEPENDENCE ON OPERATING PERSONNEL, THERE IS INJECTED THE ADDED PROBLEM OF SETTING AND MAINTAINING THE CONTROLS. PERSONNEL PROPERLY TRAINED IN AUTOMATIC CONTROLS MUST BE AVAILABLE ON THE JOB. /AUTHOR/

Bower, LC Gerhardt, BB *Highway Research Record, Hwy Res Board* 1970

3A 219454

DEVELOPMENT OF EQUIPMENT FOR HIGHWAY CONSTRUCTION

ALTHOUGH THIS JOINT HRB/ARBA COMMITTEE WAS ORGANIZED SOME YEARS AGO, ITS WORK WAS SEVERELY CURTAILED BY THE WAR, AND THE 26TH ANNUAL MEETING WAS ITS FIRST OPPORTUNITY SINCE THEN TO MAKE A MAJOR ASSESSMENT OF THE HIGHWAY EQUIPMENT FIELD. A TWO-DAY CONFERENCE WAS ATTENDED BY 115 REPRESENTATIVES FROM 15 STATES; ITS PURPOSE WAS LARGELY TO ACQUAINT MANUFACTURERS WITH THE NEEDS OF ENGINEERS AND CONTRACTORS. THE MAJOR TOPICS OF DISCUSSION ARE NOTED BRIEFLY.

Clemmer, HF *Highway Res Abstracts Hwy Res Board* Mar. 1947

3A 219462

HOW TO SPECIFY A LOADER: SIZING IT TO PRODUCTION REQUIREMENTS

THE WHEEL LOADER MARKET IS HIGHLY COMPETITIVE, WITH OVER 30 MANUFACTURERS PRODUCING MORE THAN 100 DIFFERENT MODELS, OF WHICH ABOUT 75% ARE SPECIFICALLY DESIGNED AND MANUFACTURED FOR THE CONTRACTOR END USE MARKET. A SYSTEMATIC ANALYSIS MUST BE MADE IN ORDER TO CHOOSE THE LOADER OR MIX OF LOADERS APPROPRIATE FOR A GIVEN JOB OR TYPE OF ACTIVITY. THE ELEMENTS OF SUCH AN ANALYSIS ARE JOB CONDITIONS, CALCULATION OF LOADER PRODUCTION, BUCKET CAPACITY, AND CORRECTION FACTORS FOR EFFICIENCY. MEANS OF QUANTIFYING THESE ELEMENTS AND RELATING THEM IN AN ARITHMETIC EQUATION ARE GIVEN.

Thomson, P *Public Works* Vol. 103 No. 3, Mar. 1972, pp 64-6, 3 Tab

3A 219466

STOP EQUIPMENT NOISE

TWO CHARTS SHOW CONSTRUCTION EQUIPMENT NOISE LEVEL DB(A) AT 50 FEET AND THE ESTIMATED LEVELS OBTAINABLE BY SELECTING QUIETER PROCEDURES OR MACHINES AND IMPLEMENTING NOISE CONTROL FEATURES REQUIRING NO MAJOR REDESIGN OR EXTREME COST. THE FOUR BASIC WAYS TO CONTROL NOISE POLLUTION ARE: STOP IT AT THE SOURCE, BLOCK IT, MOVE IT AWAY, AND USE SOMETHING QUIETER. EXAMPLES OF RECENT DEVELOPMENTS ALONG THESE LINES ARE REPORTED.

Construction Equipment Vol. 46 No. 1, July 1972, pp 32-5

3A 219491

CONTRACTORS-MEASURE THAT NOISE

THE OCCUPATIONAL SAFETY AND HEALTH ACT (OSHA) ESTABLISHES SOUND LEVELS THAT MUST NOT BE EXCEEDED FOR A GIVEN AMOUNT OF TIME PER DAY UNLESS THE CONTRACTOR PROVIDES MEANS OF PROTECTING THE WORKERS FROM THE NOISE. THE PRESENT ARTICLE AFFORDS CONTRACTORS SOME BASIC INFORMATION ABOUT THE MEASUREMENT OF NOISE; THE CONSTRUCTION, OPERATION, AND CARE OF NOISE LEVEL METERS; MEANS OF REDUCING EQUIPMENT NOISE AT THE SOURCE; AND MATERIALS THAT CAN BE USED TO BLOCK OR ABSORB SOUND.

Constructor Vol. 54 No. 7, July 1972, pp 18-22, 1 Tab

3A 219494

CATERPILLAR PERFORMANCE HANDBOOK EDITION 3

MACHINE PERFORMANCE MUST ULTIMATELY BE MEASURED IN UNIT COST OF MATERIAL MOVED, A MEASURE THAT INCLUDES BOTH PRODUCTIVITY AND COSTS. FACTORS BEARING DIRECTLY ON PRODUCTIVITY INCLUDE SUCH THINGS AS WEIGHT TO HORSEPOWER RATIO, CAPACITY, TYPE OF TRANSMISSION, SPEED, AND OPERATING COSTS, WHICH THIS PERFORMANCE HANDBOOK CONSIDERS IN DETAIL. THERE ARE OTHER LESS DIRECT PERFORMANCE FACTORS FOR WHICH NO TABLES, CHARTS OR GRAPHS ARE POSSIBLE. SERVICEABILITY, SAFETY, PARTS AVAILABILITY, AND OPERATOR CONVENIENCE ARE EXAMPLES. MANY SECTIONS OF THE HANDBOOK INCLUDE TABLES OR CURVES SHOWING CYCLE TIMES OR HOURLY PRODUCTION FIGURES FOR CATERPILLAR MACHINES UNDER CERTAIN CONDITIONS. STATEMENTS OF CONDITIONS ALWAYS ACCOMPANY OR PRECEDED THE CURVES OR TABLES. BEFORE USING ANY PERFORMANCE INFORMATION IN THIS HANDBOOK, A COMPLETE UNDERSTANDING OF THE QUALIFYING CONDITIONS IS ESSENTIAL. THE DATA IS BASED ON FIELD TESTING, COMPUTER ANALYSES, LABORATORY RESEARCH AND EXPERIENCE; AND EVERY EFFORT HAS BEEN MADE TO ASSURE THEIR CORRECTNESS. HOWEVER, ALL SUCH DATA IS BASED UPON THE ACHIEVEMENT OF 100% EFFICIENCY IN OPERATION-A STATUS WHICH CANNOT BE ACHIEVED CONTINUOUSLY EVEN UNDER IDEAL CONDITIONS. THUS, IN USING SUCH PERFORMANCE AND PRODUCTION DATA, IT IS NECESSARY TO CORRECT THE

RESULTS INDICATED IN THE HANDBOOK TABLES BY APPROPRIATE FACTORS TO ALLOW FOR THE ANTICIPATED ACTUAL JOB EFFICIENCY, OPERATOR EFFICIENCY, MATERIAL CHARACTERISTICS, HAUL ROAD CONDITIONS, ALTITUDE, AND OTHER FACTORS WHICH MAY REDUCE PERFORMANCE OR PRODUCTION ON A PARTICULAR JOB. /AUTHOR/

Caterpillar Tractor Company Jan. 1973

3A 219501

MAINE DOT USES DIESEL POWER

ALTHOUGH PAVING THE WAY FOR EVENTUAL DIESELIZATION OF THE FLEET OF HIGHWAY MAINTENANCE AND CONSTRUCTION EQUIPMENT WAS STARTED IN 1935, THE MOST SIGNIFICANT TRANSITION FROM GASOLINE TO DIESEL POWER INVOLVED THE DEPARTMENT'S LARGE FLEET OF DUMP TRUCKS EACH OF WHICH IS EQUIPPED FOR WINTER SERVICE INCLUDING SNOW REMOVAL AND ICE CONTROL. TWO HUNDRED AND FIFTY UNITS POWERED BY DOMESTIC ENGINES AND SMALLER CLASS VEHICLES HAVE BEEN USED. SIX YEARS OF TEST, EVALUATION AND COMPARISON HAVE PROVED THAT THE DIESEL IS COMPLETELY ADAPTABLE FOR PATROL DUTY AT A SUBSTANTIAL DECREASE IN FINAL OPERATING COST. FINAL COMPARATIVE ANALYSIS REVEALED A TOTAL ENGINE OPERATING AND REPAIR COST AVERAGE PER ENGINE HOUR OF \$0.5677 FOR THE DIESEL, COMPARED WITH \$1.0411 FOR THE GASOLINE UNITS. INCREASINGLY RIGID ECOLOGY STANDARDS PROMPT UTILIZING DIESEL POWER UNTIL A SUPERIOR, CHEAPER SOURCE OF POWER IS READILY AVAILABLE. ALTHOUGH IMPROVEMENTS IN PERFORMANCE, DEPENDABILITY AND LONGER ENGINE LIFE ARE IMPORTANT, SAVINGS IN FUEL COST IS SEEN TO BE THE PRIMARY JUSTIFICATION FOR DIESELIZATION.

Vigue, RF *Public Works* Vol. 103 No. 11, Nov. 1972, pp 66-9, 2 Tab, 5 Phot

3A 219502

EQUIPMENT PLUS INFLATION EQUALS LOSS

A COMPUTER AND A MATHEMATICAL MODEL CAN CLARIFY THE ECONOMICS OF EQUIPMENT OWNERSHIP, AIDING CONTRACTORS IN DETERMINING THE EFFECTS INFLATIONARY CHANGES SHOULD HAVE ON THEIR EQUIPMENT POLICIES. IN DEVELOPING THIS MATHEMATICAL MODEL, A GROUP OF EQUATIONS IS WRITTEN TO SIMULATE THE COSTS OF OWNING, MAINTAINING, AND OPERATING CONSTRUCTION MONEY, OBSOLESCENCE, DEPRECIATION TECHNIQUES, INFLUENCE OF INFLATION, COST OF BORROWING MONEY, CONTINUING FUTURE REPLACEMENTS AND INCREASED COST OF FUTURE MACHINES. /AUTHOR/

Douglas, J *Constructor* Vol. 55 No. 4, Apr. 1973, pp 22-5

3A 219503

EFFECT OF CONSTRUCTION EQUIPMENT VIBRATIONS ON NEARBY BUILDINGS

VARIOUS CRITERIA THAT HAVE BEEN USED TO EVALUATE DAMAGE CAUSED TO STRUCTURES BY VIBRATION ARE OUTLINED. THREE TYPES OF GROUND WAVES THAT ARE GENERATED ARE: LONGITUDINAL OR COMPRESSION WAVES IN WHICH LOW FREQUENCIES PREDOMINATE; VERTICAL WAVES IN WHICH HIGH FREQUENCIES PREDOMINATE; AND TRANSVERSE OR SHEAR WAVES THAT BEGIN WITH HIGH FREQUENCIES AND TAPER OFF TO LOW FREQUENCIES. A DAMAGE CRITERION IS DEFINED AS THE MAGNITUDE OF ONE OR MORE QUANTITIES ASSOCIATED WITH THE VIBRATION IMPINGING ON THE STRUCTURE, AND IF EXCEEDED, WILL RESULT IN SOME DEGREE OF FAILURE WITHIN THE STRUCTURE. DATA FROM TESTS CARRIED OUT BY THE BUREAU OF MINES ARE OF 3 CLASSES, NAMELY, MAJOR DAMAGE; MINOR DAMAGE; AND NO DAMAGE. AN EMPIRICAL FORMULA HAS BEEN DEVELOPED THAT GIVES THE AMOUNT OF GROUND ENERGY PRODUCED BY A CHARGE OF DYNAMITE IN TERMS OF A MEASURE OF VIBRATION LEVEL CALLED ENERGY RATIO (ER). ER MAY BE USED FOR THE DETERMINATION OF

THE UPPER LIMITS FOR VIBRATION OF MANY TYPES OF CONSTRUCTION ACTIVITY. A STUDY CONDUCTED TO FIND A SIMPLE VIBRATION MEASUREMENT THAT WOULD PROVIDE A DEPENDABLE INDICATION OF DAMAGE RISK IS DESCRIBED. THE STUDY CONCLUDED THAT THERE WAS A WELL-DEFINED THRESHOLD LEVEL OF VIBRATION ABOVE WHICH DAMAGE COULD OCCUR. PEAK PARTICLE VELOCITY GAVE THE BEST INDICATION OF THAT THRESHOLD WHICH OCCURS BETWEEN 4 AND 5 IN./SEC. TESTS ARE DESCRIBED WHICH WERE CONDUCTED TO ESTABLISH THE VELOCITY LEVEL OF VIBRATION FROM DIFFERENT TYPES OF CONSTRUCTION EQUIPMENT AND TO DETERMINE HOW THE VIBRATION VARIES WITH DISTANCE. BLASTING OPERATIONS MUST BE MONITORED BY INSTRUMENTATION, TO ENSURE THAT SAFE VELOCITY LEVELS ARE NOT EXCEEDED. INVESTIGATORS USED A PORTABLE VELOCITY SEISMOGRAPH IN WHICH THREE-AXES VELOCITY SIGNALS ARE RECORDED ON MAGNETIC TAPE AND DISTANT FIELD READOUT IS ACHIEVED BY REDUCING THE TAPE SPEED 10:1 AND DISPLAYING THE SIGNALS ON A PEN-CHART RECORDER BUILT INTO THE INSTRUMENT. DIAGRAMS ILLUSTRATING GROUND WAVES RESULTING FROM VIBRATIONS AND RECORDED SIMULTANEOUSLY BY SEISMOGRAPH. VERTICAL VIBRATIONS, AND LONGITUDINAL VIBRATIONS ARE PRESENTED.

Brown, LM *Highway Research Board Special Reports* No. 138, 1973, pp 117-31, 33 Fig, 6 Ref

3A 219504

CONSTRUCTION EQUIPMENT: ENVIRONMENTAL TOOLS FOR PROGRESS OR DESTRUCTION

MANUFACTURERS, WHILE CONTINUING TO DESIGN AND BUILD PRODUCTIVE, LONG-LASTING, HEAVY DUTY MACHINES, CAN EXPAND THEIR CONCERN AND EFFORTS TO MAKE THEM CONTRIBUTE LESS NOISE AND AIR POLLUTION. EFFORT MUST BE DIRECTED TOWARD ACHIEVEMENT TO MACHINE SAFETY. EXAMPLES ARE GIVEN OF THE WIDE VARIATION IN ENVIRONMENTALLY ORIENTED REGULATIONS WRITTEN BY GOVERNMENT AGENCIES. THE CONSTRUCTION INDUSTRY MANUFACTURERS ASSOCIATION (CIMA) WAS ORGANIZED TO RECOGNIZE AND PROMOTE THE DEVELOPMENT OF UNIFORM PERFORMANCE STANDARDS THAT WILL SERVE THE OBJECTIVES OF GOVERNMENT REGULATIONS. THE ISSUANCE OF THE OCCUPATIONAL SAFETY HEALTH ACT (OSHA) AND THE ESTABLISHMENT OF U S ENVIRONMENTAL PROTECTION AGENCY (EPA) ARE SIGNIFICANT EVENTS WHICH AFFECTED THE MANUFACTURING SEGMENT OF THE CONSTRUCTION INDUSTRY. THE CIMA IS SPONSERING A PRODUCT REQUIREMENT INDEX FOR OSHA AND A PRODUCT CLASSIFICATION SYSTEM. THE EFFORTS OF THE CIMA IN THE STANDARDIZATION OF SAFETY DEVICE REQUIREMENTS ARE DESCRIBED. THE PROPOSED STRUCTURES (ROPS) IS DISCUSSED AND THE TYPE OF MACHINES THAT WILL BE AFFECTED ARE MENTIONED. ALTHOUGH MANUFACTURERS SAW NO MAJOR OBSTACLES PROVIDED SUFFICIENT LEAD TIME WAS ALLOWED TO COMPLY WITH THE REQUIREMENTS, OBJECTIONS WERE RAISED TO RETROFITTING MACHINES ALREADY IN THE FIELD. TECHNICAL AND SAFETY FACTS POINT TO THE INADVISABILITY OF ARBITRARILY WELDING A STRUCTURE WITHOUT CONSIDERATION BEING GIVEN TO THE INTEGRITY OF THE MACHINE TO SUPPORT THE STRUCTURE. THE RESULTS OF AN INVESTIGATION OF THE FREQUENCY OF ROLL-OVER ACCIDENTS IS PRESENTED. SAFETY RULINGS DIRECTED AT THE OPERATOR OF THE CONSTRUCTION EQUIPMENT ARE LACKING. WHILE OPERATOR EDUCATION IS PRIMARILY RESPONSIBILITY OF THE EMPLOYER, THE CIMA OFFERS TECHNICAL ASSISTANCE IN THIS AREA. CURRENTLY AVAILABLE SAFETY MANUALS ARE REVIEWED. SAFETY STANDARDS FOR CRANES ARE DISCUSSED. IN A CONSIDERATION OF THE ECONOMICS OF NOISE ABATEMENT, IT IS NOTED THAT CONSULTANTS WARN THAT THE COST IS NOT IN EXACT PROPORTION TO THE NUMBER OF DECIBELS REDUCED. TO COMPLY WITH EPA AIR POLLUTION CONTROL REGULATIONS, DUST-SUPPRESSION DEVICES MUST

BE USED ON DRILLING OPERATIONS. STRINGENT PARTICULATE EMISSION STANDARDS WILL REQUIRE EXPENSIVE CONTROL DEVICES. THE OBSERVATION IS MADE THAT MANY OF THE REGULATIONS ARE UNECONOMIC AND IMPRACTICAL, AND WILL HAVE TO BE SOLVED THROUGH NEGOTIATION AND COMPROMISE BETWEEN GOVERNMENTAL AGENCIES AND INDUSTRY.

Messinger, RD *Highway Research Board Special Reports* No. 138, 1973, pp 132-41, 1 Tab, 7 Ref

3A 219506

WHAT OSHA (OCCUPATIONAL SAFETY AND HEALTH ACT) MEANS..... STOP NOISE AT ITS SOURCE

RESEARCH IS BEING CONDUCTED TO LOWER THE NOISE LEVEL ON THE OUTSIDE AS WELL AS ON THE INSIDE OF EARTHMOVING EQUIPMENT. VARIOUS MEANS OF ACCOMPLISHING THIS TASK ARE DISCUSSED, AND A REPORT IS GIVEN ON THE PROGRESS MADE THUS FAR.

Roads and Streets Vol. 115 No. 5, May 1972, p 60, 1 Phot

3A 219507

THE LONGEST ROAD TUNNEL

THIS ARTICLE BRIEFLY DESCRIBES METHODS AND MACHINERY IN USE IN THE DRILLING OF THE ST. GOTHARD TRANS-ALPINE ROAD TUNNEL FROM GOSCHENEN IN SWITZERLAND TO AIROLE IN ITALY. THE 16.3 KM TUNNEL, DUE TO OPEN BETWEEN 1978 AND 1979 WILL BE THE LONGEST IN EUROPE. /TRRL/

Engineering /UK/ Vol. 211 No. 9, 1971, pp 1004-8, 4 Fig, 5 Phot

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/IRRD 201 671, 3C41232333

3A 219510

SILENT CONCRETE AND ROCK BREAKER

A NEW TYPE OF PAVEMENT BREAKER, SIMILAR TO THE COMMON AIR-OPERATED JACKHAMMER, HAS BEEN SHOWN TO BE RAPID AND SILENT. THE SPLITTER USES A SMALL COMPRESSOR POWER PACK WHICH CAN BE OPERATED WITH AIR, ELECTRICITY, OR GAS DRIVES. THE UNIT WORKS BEST AT NORMAL 100 PSI AIR PRESSURE BUT CAN OPERATE EFFECTIVELY AT AIR PRESSURES DOWN TO 60 PSI. CONTROL OF SPLITTING LINES IS SO ACCURATE THAT PATTERNS CAN BE CUT FROM CONCRETE SLABS WITHOUT DAMAGE TO THE SURROUNDING SLAB MATERIAL.

Military Engineer Vol. 66 No. 429, Jan. 1974, p 56

3A 219511

EUROPEAN STANDARD ON CRAWLER TRACTORS AND THEIR EQUIPMENT

THIS STANDARD SPECIFIES THE GERMAN, ENGLISH, SPANISH, FRENCH, ITALIAN AND SWEDISH TERMINOLOGY FOR CRAWLER TRACTORS AND THEIR SUPPLEMENTARY EQUIPMENT AND GIVES STANDARD CONDITIONS UNDER WHICH TESTS SPECIFIED BY THE MANUFACTURER SHOULD BE CARRIED OUT. /TRRL/

Comm for European Constr Equipment /UK/ Standard 1965, 29 pp, 16 Fig

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/IRRD 203 017, 3C41235485

3A 219512

EUROPEAN STANDARD ON CRUSHING MACHINERY

THIS STANDARD DEALS ONLY WITH DEFINITIONS AND METHODS OF MEASUREMENT IN REGARD TO CRUSHING MACHINERY USED FOR PRODUCING AGGREGATES FOR CONSTRUCTION WORK. THE DOCUMENT SPECIFIES TERMINOLOGY TO BE ADOPTED FOR CRUSHING MACHINERY (WITH SKETCHES), THE DEFINITION OF ESSENTIAL FEATURES OF THE MACHINERY AND THE CONDITIONS UNDER WHICH THE

TEST, SPECIFIED BY THE MANUFACTURER, ARE TO BE CARRIED OUT. /TRRL/

Comm for European Constr Equipment /UK/ Standard 1969, 61 pp, 77 Fig

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/IRRD 203 016, 3C41235486

3A 219515

ANALYSIS OF THE WORK OF MACHINES FOR EARTHWORKS IN A MODERN MACHINE-SOIL SYSTEM
IN PLANNING THE ORGANIZATION OF WORK THE OPERATION OF MACHINES IS ASSESSED GENERALLY ACCORDING TO SOIL CLASS, AN OVERSIMPLIFICATION SINCE IT FAILS TO TAKE INTO ACCOUNT THE CHANGES ON THE SOIL SURFACE DUE TO MOISTURE, CHANGING COMPACTNESS, OR FROST ACTION. CALCULATIONS HAVE BEEN MADE TO DETERMINE THE VARIABILITY OF THE DRIVING FORCE AND LOOSENING AND PUSHING RESISTANCE FOR SANDY LOAM AS A FUNCTION OF VARIABLE MOISTURE CONTENT. AT VARIOUS PARAMETERS DRIVING FORCE DEPENDS ON THE MAGNITUDE OF SLIP AND MOISTURE, WITH THE MAXIMUM FORCE APPEARING AT MOISTURE W EQUALS 10 PERCENT. AS MOISTURE INCREASES THE DRIVING FORCE DECREASES; FOR EXAMPLE, AT W EQUALS 20 PERCENT IT AMOUNTS TO BARELY 60 PERCENT OF THE FORMER VALUE. THE EXAMPLE PRESENTED HERE SHOWS THAT THE ANALYSIS OF THE WORK OF MACHINES FOR EARTHWORKS IN A MACHINE-SOIL SYSTEM IS MORE EFFECTIVE THAN ASSESSMENT ACCORDING TO "SOIL CLASS".

Wialicki, A
Building Review /Poland/ Vol. 42 No. 11-2, 1970, pp 152-7

3A 219518

MAKE YOUR EQUIPMENT DOLLAR SMARTER
CONSTRUCTION EQUIPMENT MAGAZINE AND MANAGEMENT CONCEPTS INTERNATIONAL SPONSORED A SERIES OF SEMINARS WHICH DELT WITH TAX ACCOUNTING, ACQUISITION ANALYSIS, LEASING, FINANCING, RENTAL, AND GENERAL ECONOMICS. EXCEPTS ARE PRESENTED. DR. ROBERT AUERBACH, PROFESSOR OF ECONOMICS AT THE UNIVERSITY OF ILLINOIS, PRESENTS AN EXPLANATION OF THE ORIGINS OF THE CURRENT INFLATION WHICH HE ATTRIBUTES TO FISCAL AND MONETARY POLICY MISMANAGEMENT ON THE FEDERAL LEVEL. WALLACE BUHLER, VICE PRESIDENT OF CORBETTA EQUIPMENT, DISCUSSES THE RELATIVE MERITS OF RENTAL, LEASING, FINANCING, AND PAYING STRAIGHT CASH. AN EXAMPLE IS GIVEN.

Construction Equipment Vol. 49 No. 7, June 1974, pp 17-24, 1 Tab

3A 219519

LONG TERM CREDIT FOR SHORT TERM NEEDS: BAD NEWS
DR. JAMES R. RATLIFF, PROFESSOR OF ACCOUNTING AT NEW YORK UNIVERSITY, OBSERVES THAT ACCOUNTING AS RELATED TO CONSTRUCTION IS A VERY SUBJECTIVE THING; HE RECOMMENDS KEEPING THREE SETS OF BOOKS FOR TAX SAVINGS ON DEPRECIATION (ONE EACH FOR GOVERNMENT, SHARE HOLDERS, AND MANAGEMENT). ALSO DISCUSSED ARE: (1) LEASING; (2) PRESENT VALUE; (3) INVESTMENT TAX CREDIT; (4) COST OF CAPITAL. WARD M. HARRELL, PRESIDENT OF PLANIN MACHINERY COMPANY, DISCUSSES RENTING HEAVY EQUIPMENT FROM THE POINT OF VIEW OF THE COMPANY LEASING OUT EQUIPMENT. RONALD H. ZECH, LEASING OFFICER WITH FIRST CHICAGO LEASING CORP., DISCUSSES TAX BENEFITS OF A CONDITIONAL SALE; SHORT-AND LONG TERM FINANCING; RAISING CAPITAL. ROBERT V. RIEKER, MANAGER OF MARKETING RELATIONS AT GENERAL ELECTRIC CREDIT CORP., DISCUSSES LOANS FOR EQUIPMENT. PAUL O'BRIEN, FACULTY MEMBER OF THE SCHOOL OF BUSINESS OF THE UNIVERSITY OF ILLINOIS (CHICAGO) STATES THAT THERE ARE TWO WAYS TO EVALUATE THE CHOICE OF EQUIPMENT IN TERMS OF GAIN OR LOSS:

PAYBACK AND BAILOUT ANALYSES. AN EXAMPLE IS GIVEN TO DEMONSTRATE THE UTILITY OF EACH APPROACH.

Construction Equipment Vol. 49 No. 7, June 1974, pp 19-20, 1 Tab

3A 219520

STRAIGHT ANSWERS TO RENTAL & LEASING QUESTIONS
CONSTRUCTION EQUIPMENT MAGAZINE AND MANAGEMENT CONCEPTS INTERNATIONAL SPONSORED A SERIES OF SEMINARS DEALING WITH VARIOUS ECONOMIC QUESTIONS. AN EXAMPLE IS PRESENTED OF THE WRAP UP SESSIONS, A QUESTION AND ANSWER PERIOD; THIS SPECIFIC ONE DEALS WITH INTERNAL REVENUE SERVICE PROCEDURES REGARDING LEASING.

Construction Equipment Vol. 49 No. 7, June 1974, p 24

3A 219521

RENTAL, LEASING GAIN STRONGLY
FINANCING ACTIVITY IS OFF, POTENTIAL BUYERS OF EQUIPMENT ARE LOOKING AT OUTRIGHT ACQUISITION TWICE, AND RENTAL, ESPECIALLY WITH OPTION TO PURCHASE, IS INCREASING EVEN FASTER THAN IT HAS IN THE PAST FEW YEARS. THESE ARE THE CONCLUSIONS OF CE'S FOURTH ANNUAL SURVEY OF RENTAL, LEASING AND FINANCING TRENDS AMONG ITS READERS. WHILE THE DOMINANT PATTERN AMONG CE SURVEY RESPONDENTS CONTINUED TO BE OUTRIGHT PURCHASE FOR CASH, OR FINANCING, IT IS SLIPPING. THE POSSIBLE REASON IS HIGH INTEREST RATES AND UNCERTAINTY OF MONEY. THE PERCENTAGE OF RESPONDENTS RENTING OR LEASING FROM 1 TO 50 PERCENT OF THEIR SPREAD GREW CONSIDERABLY OVER LAST YEAR, WITH A CORRESPONDING DROP IN OUTRIGHT PURCHASE AND FINANCE (THE GROUP CLAIMING NO FINANCING HELP GREW ALMOST 50 PERCENT OVER LAST YEAR). ANOTHER INDICATION ONLY A LITTLE OVER HALF THE READERS FOUND IT NOW EASIER TO FINANCE THAN A YEAR AGO. WHILE LAST YEAR THREE-QUARTERS OF THEM FOUND IT EASIER. EQUIPMENT ACQUISITION PLANS FOR THE NEXT TWO YEARS INDICATE NO INCREASE IN DIRECT PURCHASE OR FINANCING, BUT A MAJOR JUMP IN RENTAL AND SOME IN LEASING. AND EVIDENTLY RENTAL IS NOW THE ROUTE TO BUYING; THE PERCENTAGE OF USERS ON RENTAL-PURCHASE OPTIONS JUMPED, WHILE THE FREQUENCY OF PURCHASING RENTAL MACHINES AMONG RENTERS ROSE SIGNIFICANTLY. (PICKUP RATES OR 10 TO 50 PERCENT GAINED, WHILE OTHER FREQUENCIES LOST). THERE SEEMS TO BE A TREND AMONG RENTERS TO SWITCH TO LEASING. WHILE THE PROPORTION OF THESE RENTING THE MOST POPULAR TYPES OF EQUIPMENT STAYED RELATIVELY THE SAME, THOSE LEASING THE SAME EQUIPMENT GAINED CONSIDERABLY. LAST YEAR, FOR EXAMPLE, 43 PERCENT OF THE RESPONDENTS RENTED BACKHOES, THIS YEAR 40; BUT THE PERCENT LEASING WENT FROM 15 TO 21. FOR AIR COMPRESSORS, 36 PERCENT RENTED; DOWN FROM 44, BUT 15 PERCENT LEASED, UP FROM NOTHING A YEAR AGO. LEASING OF CRAWLER TRACTORS AND WHEEL LOADERS HAS ALMOST DOUBLED.

Construction Equipment Vol. 49 No. 7, June 1974, pp 30-1, 8 Fig

3A 225859

ELECTRICAL ROAD HEATING
INFORMATION OBTAINED FROM AUTHORITIES OPERATING ROAD HEATING INSTALLATIONS IS USED TO ASSESS THEIR COST AND PERFORMANCE. CONSTRUCTION METHODS ARE DESCRIBED AND POWER REQUIREMENTS ARE GIVEN. THE USE OF UNINSULATED STEEL MESH AS A CONDUCTOR AT NOT MORE THAN 50 VOLTS HAS BEEN FOUND TO BE GENERALLY MORE RELIABLE THAN INSULATED CABLE AT A HIGHER VOLTAGE. THE AVERAGE CAPITAL COST OF ROAD HEATING INSTALLATIONS TO DATE HAS BEEN L4.64 PER SQUARE METRE AND THE AVERAGE OPERATING COST L0.15 PER SQUARE METRE PER ANNUM. THE METHOD COSTS 15-30 TIMES THE COST OF CHEMICAL TREATMENT. /HSL/

Williamson, PJ Hogbin, LE
Road Research Laboratory /UK/ 1969

ACKNOWLEDGMENT: Highway Safety Literature NHSB HSL-007 702 FLD, 2/4, NTIS-PB-190 319, 3C53214127

3A 225908

EXPERIMENTAL INSTALLATION OF RUMBLE STRIPS IN INDIANA

RUMBLE STRIPS WERE INSTALLED AT HIGH FREQUENCY ACCIDENT LOCATIONS. DIFFERENT SPACINGS WERE USED FOR THE FIVE EXPERIMENTAL INSTALLATIONS ACCORDING TO THE VARIOUS DESIGN STANDARDS; THE THICKNESS VARIED FROM 1/4 INCH TO 1/8 INCHES. THE INSTALLATIONS WERE INSTALLED IN THE SAME GENERAL MANNER WITH THE SAME TYPE OF MATERIAL AND EQUIPMENT. EACH INSTALLATION COST BETWEEN \$350. TO \$500. THE APPENDIX INCLUDES INFORMATION ON MATERIALS REQUIRED, CONSTRUCTION PROCEDURES, AND INSTALLATION PROCEDURES.

Saville, KM *Purdue University Road School Proc* 1969

3A 226516

UNSHEATHED STEEL CAR PARK OVER RAILWAY AIRSPACE A DESCRIPTION IS GIVEN OF THE METHODS EMPLOYED TO SOLVE THE PROBLEM OF ERECTING A 300-CAR PARKING GARAGE OVER A WEDGE-SHAPED PORTION OF RIGHT-OF-WAY OVER RAILROAD TRACKS THAT WERE LARGELY INACCESSIBLE FOR HEAVY BUILDING EQUIPMENT. THE STRUCTURE, WHICH UTILIZED PLATE WEB GIRDERS, WAS COMPLETED IN ABOUT THREE MONTHS, APART FROM FINISHES. THE MAIN REQUIREMENT FOR ERECTION WAS CENTRAL LOCATION OF A LARGE-CAPACITY CRANE.

Bambach, JD *Acier Stahl Steel, Brussels /Belgium/* June 1972, pp 285-7, 6 Fig

3A 226869

TACK-UP FOR HORSHAM CAR PARK

DETAILS ARE GIVEN OF THE CONSTRUCTION OF A MULTI STORY PARKING GARAGE BUILT IN HORSHAM, WHICH PROVIDES ACCOMODATION FOR 420 VEHICLES ON FIVE PARKING LEVELS. IT WAS CONSTRUCTED BY MEANS OF THE LIFT SLAB SYSTEM WHEREBY THE ENTIRE REINFORCED CONCRETE FLOOR AND ROOF SLAB WERE CAST IN-SITU AT GROUND LEVEL AND JACKED UP IN TURN. /TRRL/

Contract Journal /UK/ Vol. 248 No. 4848, Aug. 1972, 29 pp, 1 Fig, 1 Phot

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/IRRD 202 830, 2C53235513

3A 228717

DISPLACEMENT DETECTORS AND MEASUREMENTS

THIS PAPER IS RESTRICTED TO THE RELATIVE DISPLACEMENT DETECTORS BASED ON VARIATIONS OF ELECTRIC RESISTANCES /POTENTIOMETERS/ OR INDUCTANCES, AS WELL AS TO THE ABSOLUTE DISPLACEMENT DETECTORS /WITHOUT REFERENCE BASIS/ SUCH AS ACCELEROMETERS BASED ON THE VARIATIONS OF AN INDUCTANCE, PIEZO-ELECTRIC ACCELEROMETERS AND GEOPHONES. AFTER A BRIEF DESCRIPTION OF THE BASIC PRINCIPLE AND A FEW CONSTRUCTION METHODS OF SUCH DETECTORS, THE MAIN ADVANTAGES AND DISADVANTAGES OF EACH TYPE OF THESE INSTRUMENTS ARE INDICATED. THE ELECTRONIC SYSTEM NORMALLY ASSOCIATED FOR MEASUREMENTS OF FAST AND SLOW OCCURRING DISPLACEMENTS ARE ALSO DESCRIBED, AND THE PRINCIPLE OF THEIR OPERATION IS EXPLAINED. WITHOUT REFERENCE TO CONSTRUCTION DETAILS. FOLLOWING THE DESCRIPTION OF EACH CATEGORY OF DETECTORS, A NUMBER OF EXAMPLES OF MEASUREMENT ARE MENTIONED. /LCPC/A/RRL

Donnat, J *Bull Liaison Labs Routiers /France/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 228942

CONSTRUCTION CLAIMS AND THE ENGINEERING GEOLOGIST

THE PROBLEMS OF CONSTRUCTION CLAIMS, ALTHOUGH WITH US FOR MANY YEARS, HAVE INCREASED IN THE LAST DECADE. CLAIMS AGAINST OWNERS AND CONTRACTORS HAVE INCREASED IN NUMBER AND SIZE, JUST AS THE NUMBER, SIZE AND COMPLEXITY OF ENGINEERING PROJECTS HAVE INCREASED. THE AREAS MOST FERTILE AS A BASIS FOR CONTRACTORS CLAIMS ARE SUBSURFACE CONDITIONS, WHERE PRECONSTRUCTION UNKNOWNNS ARE MOST NUMEROUS. THE ENGINEERING GEOLOGIST IS URGED TO MAKE EVERY EFFORT TO UNDERSTAND THE NATURE OF CLAIMS, THEIR BASIS AND JUSTIFICATION. IN ADDITION, THE ENGINEERING GEOLOGIST MUST KEEP CURRENT, NOT ONLY ON GEOLOGIC INVESTIGATION METHODS AND INTERPRETATION, BUT ON CONSTRUCTION METHODS. FOUR GUIDE-POSTS AN ENGINEERING GEOLOGIST MUST DEVELOP ARE THESE' 1/ WILLINGNESS TO FURNISH THE CONTRACTOR WITH HIS THINKING AND KNOWLEDGE ON A PROJECT AS WELL AS THE FACTUAL DATA AVAILABLE' 2/ WILLINGNESS TO ACCEPT RESPONSIBILITY, NOT ONLY FOR INVESTIGATIONAL FACTS, BUT FOR PERSONAL INTERPRETATIONS AND THINKING' 3/ DESIRE TO KNOW CONSTRUCTION METHODS AND EQUIPMENT' AND 4/ SYSTEM TO TRANSMIT INFORMATION FROM THE FIELD INVESTIGATION STAGE TO THE SPECIFICATION WITHOUT LOSING IMPORTANT FACTS OR ADDING MISLEADING OR ERRONEOUS ITEMS. /GA/

Waggoner, EB *Engineering Geology /Netherlands/*

ACKNOWLEDGMENT: Geoscience Abstracts Jul66

3A 229290

RECOMMENDATIONS FOR THE DESCRIPTION AND EVALUATION OF SOIL CONDITIONS (IN GERMAN)

THESE RECOMMENDATIONS OF THE PUBLICATION "SOIL SURVEYS IN ROAD CONSTRUCTION" EXPLAIN SOIL SURVEYS, OF THE "SPECIFICATIONS FOR DESIGN IN ROAD CONSTRUCTION". THE NOTE DEALS WITH THE GENERAL DESCRIPTION OF SOIL CONDITIONS, THE CONSTRUCTION OF INDIVIDUAL SOIL LAYERS AND EVALUATION OF AND SUGGESTIONS FOR CONSTRUCTION METHODS. THE APPENDIX REFERS TO PERTINENT SPECIFICATIONS, STANDARDS AND RECOMMENDATIONS. /RRL/

Road Research Society /Germany/

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 229630

ENGINEERING GEOLOGY IN KANSAS HIGHWAY CONSTRUCTION

A BRIEF HISTORY IS PRESENTED OF THE GEOLOGICAL NEEDS AND THE GEOLOGICAL SECTION OF THE KANSAS HIGHWAY DEPARTMENT ON HIGHWAY DESIGN AND CONSTRUCTION. WHEN HIGHWAY DESIGN WAS CHANGED FROM THAT OF TERRAIN GRADES TO THE LONG RADIUS CURVES AND RULING GRADES, IT RESULTED IN MARKED DEEPENING OF ROAD CUTS AND INCREASED HEIGHT OF THE FILL SECTIONS. THESE IMPROVED DESIGN AND CONSTRUCTION PRACTICES INCREASED THE NEED FOR ENGINEERING GEOLOGISTS WHO HAVE THE RESPONSIBILITY OF IDENTIFYING THE VARIOUS GEOLOGIC MATERIALS WHICH WILL SUPPORT THE OVERALL ROAD STRUCTURE, DETERMINE WHAT GEOLOGIC PROBLEMS EXIST, AND PRESCRIBE A SOLUTION FOR THESE PROBLEMS. PHOTO-INTERPRETATION AND RECONNAISSANCE FIELD INVESTIGATION BY THE GEOLOGIST PROVES HELPFUL IN THE ADVANCED PLANNING OF THE HIGHWAY ROUTE. LARGE SAVINGS HAVE RESULTED BY AVOIDING ADVERSE GEOLOGICAL CONDITIONS THROUGH THE PROPER CHOICE OF HIGHWAY ALIGNMENT. WITH THE ALIGNMENT ESTABLISHED, GEOLOGICAL FIELD DATA OBTAINED INCLUDE MEASURED STRATIGRAPHIC SECTION, DESCRIPTION OF STRATA, ELEVATION OF STRATA, TEST HOLE DATA AND OTHER INFORMA-

TION. GEOLOGIC DATA ARE GRAPHICALLY PORTRAYED AND EARTHWORK IS CLASSIFIED AS EITHER ROCK OR COMMON EXCAVATION ON THE BASIS OF GEOLOGIC CHARACTERISTICS. A TENTATIVE GRADE LINE IS PLOTTED SHOWING ITS RELATIONSHIP TO THE STRATA PORTRAYED ON THE CROSS SECTION AND PROFILE IN THE CUT AND FILL SECTION. WORK OF THE GEOLOGIST IS REVIEWED IN RELATION TO THE BALANCE FACTOR, OVERBREAKAGE, SUBGRADING, THE HIGHWAY BACKSLOPE, GROUNDWATER PROBLEMS AND UNDERDRAINS, LANDSLIDES, AND SETTLEMENT. BRIDGE FOUNDATION STUDIES ARE ALSO MADE ON THE BASIS OF GEOLOGY. PERSONNEL AND EQUIPMENT NEEDED FOR THESE GEOLOGICAL INVESTIGATIONS ARE DESCRIBED. PROBLEMS ENCOUNTERED ARE DISCUSSED WITH THE OBSERVATION THAT THE WORK OF THE ENGINEERING GEOLOGIST IS BECOMING MORE COMPLEX.

Burgat, VA *Highway Geology Symposium, Iowa State U* pp 1-13, July 1968

3A 229698

DISCUSSION OF EMBANKMENT PORE PRESSURES DURING CONSTRUCTION

MR. DE OLIVEIRA CALLS THE AUTHOR'S ATTENTION TO A PAPER BY GIBSON IN WHICH THE THEORETICAL ANALYSIS OF THE CONSOLIDATION OF A CLAY LAYER INCREASING IN THICKNESS WITH TIME IS EXTENDED TO PARTLY SATURATED SOILS BY INTRODUCING SKEMPTON'S PORE PRESSURE PARAMETER. THIS METHOD TAKES INTO ACCOUNT THE RATE OF CONSTRUCTION AND ALSO ALLOWS THE PREDICTION OF THE DISSIPATION OF PORE PRESSURES DURING CONSTRUCTION AND THOSE OCCURRING DURING SEASONAL SHUTDOWNS. HE ALSO POINTS OUT THAT THE AVAILABLE METHODS DO NOT CONSIDER THE NEGATIVE PORE PRESSURES ALWAYS PRESENT IN COMPACTED COHESIVE SOILS. MR. RAO CONGRATULATES THE AUTHORS ON THEIR EXCELLENT REVIEW WORK ON THE DEVELOPMENT OF PORE PRESSURES DURING THE CONSTRUCTION OF EARTH DAMS. WHILE MENTIONING THE VARIOUS FACTORS THAT INFLUENCE THE MAGNITUDE OF THE PORE-PRESSURE RATIO AT THE END OF CONSTRUCTION, THE AUTHORS HAVE INDICATED UNDER THE SUBHEADING COMPACTION EFFECT, THAT WATER CONTENT HAS A GREATER EFFECT ON THE DEVELOPMENT OF PORE PRESSURES, EVEN WHEN COMPACTION EFFORT IS RELATIVELY HIGH. MR. RAO FEELS THAT THE DEVELOPMENT OF PORE PRESSURES WILL ALWAYS BE GREATER WHEN COMPACTION EFFORT IS HIGH. HE ALSO POINTS OUT OBSERVED CORRELATIONS BETWEEN SOIL TYPE AND PORE PRESSURE RATIO. THE TYPE OF EQUIPMENT USED FOR HAULING AND COMPACTING FILL MATERIAL ALONG WITH THEIR DYNAMIC EFFECT PLAY A LEADING ROLE IN DEVELOPING CONSTRUCTION PORE PRESSURES. MR. LITTLE POINTS OUT TWO ERRORS IN THE PAPER. THE DRAINAGE BLANKETS AT USK WERE PLACED IN THE SHOULDERS AND NOT IN THE IMPERVIOUS CORE WHICH WAS OF THE OLD FASHIONED PUDDLE CLAY VARIETY. ALTHOUGH PORE PRESSURES IN THE CORE WERE NOT MEASURED DIRECTLY, IT WAS INFERRED THAT THEY WERE HIGH. A GRAPH IS PRESENTED OF TYPICAL PORE PRESSURES IN THE CORE AT DIDDINGTON DAM, MANGLA DAM AND AYER ITAM DAM. MR. LITTLE AGREES WITH MOST OF THE AUTHORS' CONCLUSIONS BUT HE HAS NOT SO FAR MET HIGH PORE PRESSURES IN A FILL OF HEAVILY OVERCONSOLIDATED CLAY NOR WITH THE TYPE OF FILL USED AT SHEK PIK DAM, EVEN AT WATER CONTENTS APPRECIABLY ABOVE OPTIMUM. REFERENCES: EMBANKMENT PORE PRESSURES DURING CONSTRUCTION, WALTER C. SHERMAN, GERALD W. CLOUGH, ASCE PROC. PAPER 5867, MARCH, 1968.

De, OLIVEIRA HG Rao, KK Little, AL *Am Soc Civil Engr J Soil Mech Div*

3A 229762

CONQUEST OF THE DARIEN

A MEANS OF UNITING THE AMERICAS BY LAND COMMUNICATION HAS BEEN FRUSTRATED BY THE INACCESSIBILITY OF

THE VAST JUNGLE REGION ADJOINING THE REPUBLICS OF PANAMA AND COLOMBIA IN THE REGION KNOWN AS THE DARIEN GAP. THE BUREAU OF PUBLIC ROADS NEGOTIATED AN AGREEMENT WITH THE COLOMBIAN MINISTER OF PUBLIC WORKS PERMITTING RECONNAISSANCE SURVEYS IN 1964 OF THE ATRATO SWAMPS. THESE STUDIES AND THE SUBSEQUENT DETAILED GEOPHYSICAL SURVEYS CONDUCTED ARE DESCRIBED. THE ATRATO RIVER SWAMPS ARE APPROXIMATELY 65 TO 100 K WIDE AND MORE THAN 250 K LONG. ALL SOURCES OF AERIAL PHOTOGRAPHY, AND PARTIAL PHOTOGRAPHIC COVERAGE OF THE AREA WERE ASSEMBLED AND STEREOSCOPIC EXAMINATION AND PHOTOGRAPHIC INTERPRETATION MADE OF THESE UNCONTROLLED EARLY PHOTOGRAPHS. INFORMATION FROM THESE PHOTOGRAPHS LED TO THE SELECTION OF FIVE POSSIBLE ROUTE LOCATIONS THAT MET THE CRITERIA ESTABLISHED FOR THE LEAST DIFFICULT CROSSINGS OF THE SWAMP. THE FIVE SELECTED ROUTES WERE DELINEATED ON THE UNCONTROLLED PHOTOMOSIAC AND COMPARATIVE INTERPRETATION OF THE FIVE TENTATIVE ROUTES WAS PLANNED USING AERIAL INFRARED IMAGERY. THE INFRARED IMAGERY OBTAINED DID NOT CONTAIN SUFFICIENT THERMAL DIFFERENCES TO REVEAL SUBSURFACE CONDITIONS AND MATERIALS. THE ONLY OTHER ALTERNATIVE WAS VISUAL INSPECTION ON THE GROUND IN THE SWAMP BY HELICOPTER ACCESS. A LIMITED GEOPHYSICAL SURVEY WAS UNDERTAKEN, UTILIZING ELECTRORESISTIVITY METHODS AUGMENTED BY SOUNDINGS WITH A PEAT SAMPLER AND BY PROBING. THESE TESTS LEAD TO THE CONCLUSION THAT THE HIGHWAY CROSSING OF THE SWAMP APPEARED FEASIBLE. IN 1967, THE DARIEN SUBCOMMITTEE OF THE PAN AMERICAN HIGHWAY CONGRESS PROVIDED FUNDING AND REQUESTED THE BUREAU OF PUBLIC ROADS TO DIRECT THE COMPREHENSIVE GEOPHYSICAL STUDIES OF THE ATRATO AREA. THREE METHODS OF CONSTRUCTION ARE CONSIDERED ACCEPTABLE ALTHOUGH THE FIRST IS RECOMMENDED AS LEAST COSTLY: (1) PLACEMENT OF FILL MATERIAL OBTAINED FROM THE LOMAS LAS AISLADAS AND THE HILLS WEST OF THE ATRATO RIVER ON THE ORGANIC MAT WITH CONSEQUENT COMPRESSION OF THE ORGANIC MATERIAL AND THE SOFT SUBSURFACE LAYERS, (2) REMOVAL OF ORGANIC MATERIAL AND THE SOFTER SUBSURFACE MATERIAL AND REPLACEMENT WITH FILL MATERIAL OBTAINED FROM THE LOMAS LAS AISLADAS, AND (3) USE OF TRESTLE CONSTRUCTION ACROSS THE ENTIRE SWAMP.

Ghiglione, AF *Highway Research Record, Hwy Res Board*

3A 229921

VIBRATION STUDIES

OWNERS OF HOMES AND OTHER STRUCTURES FREQUENTLY COMPLAIN OF DAMAGE CAUSED BY BLASTING, RUBBER Tired VEHICLES, AND CONSTRUCTION EQUIPMENT, USUALLY IN ASSOCIATION WITH A LOUD AND/OR UNEXPECTED NOISE. THE CORRELATION OF NOISE WITH VIBRATION AND OF CONSTRUCTION WITH STRUCTURAL DAMAGE HAS LED THE VIRGINIA DEPARTMENT OF HIGHWAYS TO INVEST IN A SEISMOGRAPH AND TO PERFORM AN ANALYSIS OF THE CAUSES OF STRUCTURAL DAMAGE, THEREBY STRENGTHENING ITS HAND IN DEALING WITH COMPLAINTS AND PERMITTING IT TO ASSESS MORE REALISTICALLY THE ACTUAL DAMAGE THAT CAN BE ANTICIPATED FROM ITS ACTIVITIES. A DETAILED PRESENTATION IS GIVEN OF TYPES OF STRUCTURAL DAMAGE CAUSED BY DEFICIENCIES IN THE STRUCTURE ITSELF BUT OFTEN ATTRIBUTED TO HIGHWAY CONSTRUCTION.

Meadors, GS *Southeast Assoc St Hwy Officials Proc* pp 117-120, Oct. 1968

3A 230054

STEPS IN THE STAIRS TO GREENER HIGHWAY CUT SLOPES DEVELOPING PRACTICE IN THE DESIGN, CONSTRUCTION, AND STABILIZATION OF HIGHWAY SLOPES COMPOSED OF SOIL AND ROCK IS TRACED AS A MEANS OF DESCRIBING THE

3A 230837

PRECAST TUNNEL SEGMENTS ARE BIGGEST EVER
SEVEN PRECAST AND PRESTRESSED CONCRETE SEGMENTS EACH COVERING ONE ACRE OF THE RIVER BOTTOM ARE PART OF THE 4 561- FT VEHICULAR TUNNEL UNDER THE ST. LAWRENCE RIVER BETWEEN MONTREAL AND THE CHARLON ISLAND. THE THREE-CELLED PRECAST UNITS ARE 120 FT BY 360 FT AND 26 FT HIGH, AND TO CAST THESE UNITS A COFFERDAM WAS CONSTRUCTED, THE FLOOR OF WHICH IS 85 FT BELOW MEAN HIGH-WATER LEVEL, WHILE THE BOTTOM OF THE EXCAVATION ON THE MONTREAL SIDE IS 65 FT BELOW WATER LEVEL. SUCTION DREDGES REMOVED 1.1 MILLION CU. YD. OF SOIL FROM THE RIVER BED IN BUILDING THE COFFERDAM. /RRL/

Engineering News-record

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 230859

BIBLIOGRAPHY ON BITUMINOUS STABILIZATION OF SOILS
THE VERY RAPID EXPANSION OF VEHICLE OWNERSHIP IN DEVELOPING COUNTRIES HAS NECESSITATED DRASTIC IMPROVEMENTS TO THE EXISTING ROAD SYSTEMS. THE USE OF BITUMINOUS BINDERS HAS PLAYED A LARGE PART IN IMPROVEMENTS BOTH IN CONVENTIONAL SURFACINGS AND IN STABILIZING LOCALLY OCCURRING MATERIALS TO PROVIDE BASES AND SURFACINGS. STABILIZATION HAS NOW BEEN USED FOR A PERIOD OF 30 YEARS AND A GREAT DEAL OF PUBLISHED WORK EXISTS COVERING CONSTRUCTION AND EXPERIMENTAL EXPERIENCE, NOTABLY IN THE UNITED STATES OF AMERICA. THIS SELECTED BIBLIOGRAPHY PROVIDES, AS FAR AS POSSIBLE, A COMPREHENSIVE RANGE OF RECORDED WORK WITHOUT UNDUE REPETITION. REFERENCES HAVE BEEN CLASSIFIED UNDER THREE HEADINGS' I. RESEARCH. II. DESIGN AND CONTROL. III. CONSTRUCTION PRACTICE. THE BASIS OF THIS CLASSIFICATION IS SPECIAL RELEVANCE TO A GIVEN SECTION ALTHOUGH, OBVIOUSLY, EXAMPLES WILL BE FOUND WHERE THERE IS RELEVANCE TO MORE THAN ONE SECTION. /RRL/A/

Hitch, LS Road Research Laboratory Lib Bib /UK/

3A 230921

ALBERTA MAKES A FRIEND OUT OF MUSKEG
ROAD CONSTRUCTION THROUGH MUSKEG IS ALWAYS DIFFICULT, BUT THIS NEW TECHNIQUE UTILIZES THE PARTICULAR PROPERTIES OF MUSKEG TO AID IN CONSTRUCTION. BY COMPACTING AND PLACING FILL DURING WINTER WHEN THE GROUND IS FROZEN, AND WORKING 24 HOURS A DAY IN A RACE AGAINST FROST, ALBERTA WAS ABLE TO HEAT ITS SCHEDULE BY 6 MONTHS. /CGRA/

Hayter, R Heavy Construction News/canada/

3A 230924

90-FT CAISSONS PROVE UNUSUALLY HARD TO SINK
CAISSONS FOR A NEW BRIDGE ASSOCIATED WITH THE MACDONALD-CARTIER FREEWAY WIDENING PROJECT NEAR TORONTO WERE USUALLY DIFFICULT TO SINK. THE WORK INVOLVES THE CONSTRUCTION OF A 12-LANE STEEL AND CONCRETE OVERPASS. UNSTABLE SOILS COMPOSED OF BOULDERS, GLACIAL DEPOSITS, CLAY AND SILTY GRAVELS COMPOUNDED THE USUAL PROBLEMS WHILE WATE, FILLING DRILL HOLES IN AN RANDOM MANNER, NECESSITATED ABANDONMENT OF SOME DRILL HOLES AND OTHERS, THE FILLING WITH TREMIE CONCRETE. THE DRILL HOLES WERE SUPPLIED WITH LINERS DUE TO THE HIGH SOIL PRESSURE AND THEIR INSIDES CLEANED OUT WITH A SMALL AUGER. DIFFICULTIES ENCOUNTERED IN REMOVING THE LINES REQUIRED HEAVIER EQUIPMENT THAN WAS THOUGHT NECESSARY.. /CGRA/

Salmins, G Engineering and Contract Record /Can/

3A 230925

SURCHARGE DISPLACES 20 FT BOG
THE PROBLEM WAS TO BUILD A HIGHWAY OVER AN OLD LAKEBED OF UNSTABLE MARL. TO CONSTRUCT A STABLE FOUNDATION, THE MUCK WAS DISPLACED BY A ROLLING SURCHARGE OF SAND. THE WORK HAD TO BE CARRIED OUT DURING THE WINTER AND COMPLETED BEFORE THE SPRING THAW TO PREVENT THE MACHINERY FROM GETTING BOGGED DOWN. /CGRA/

Salmins, G Engineering and Contract Record /Can/

3A 230928

EFFECT OF SANDWICH LAYER SYSTEM OF PAVEMENT FOR SUBGRADES OF LOW BEARING CAPACITY BY MEANS OF SOIL CEMENT

THE AUTHOR DESCRIBES THE SANDWICH LAYER SYSTEM, WHICH INVOLVES INCREASING THE RIGIDITY OF A PAVEMENT ON A SUBGRADE OF LOW BEARING CAPACITY BY PLACING A RELATIVELY RIGID LAYER DIRECTLY ON THE SUBGRADE. THE AUTHOR HAS FOUND SOIL CEMENT TO BE BEST SUITED FOR THE LOWER RIGID LAYER. IN THIS PAPER, THE AUTHOR IS CONCERNED WITH PAVEMENT DESIGN ON VOLCANIC ASH SOILS OF LOW BEARING CAPACITY. THE STUDY CONSISTS OF COMPARATIVE ELASTIC APPROXIMATIONS AND MODEL EXPERIMENTS OF BOTH STATIC AND DYNAMIC REPEATED LOADING ON BOTH THE CONVENTIONAL PROGRESSIVE LAYER SYSTEM AND THE SANDWICH LAYER SYSTEM. /AUTH/

Yamanouchi, T Intl Conf Soil Mech & Fdn Eng Proc

ACKNOWLEDGMENT: Canadian Good Roads Association

3A 230940

STABILIZATION OF GRANULAR BASE ON COUNTY ROADS USING PORTLAND CEMENT, LIME FLY-ASH AND SODIUM CHLORIDE

A ONE AND ONE-HALF MILE EXPERIMENTAL SECTION OF HIGHWAY WAS CONSTRUCTED IN ESSEX COUNTY, ONTARIO IN 1964 TO COMPARE THE EFFECTIVENESS OF THREE DIFFERENT TYPES OF BASE STABILIZING AGENTS, I. E., PORTLAND CEMENT, LIME-FLYASH AND SODIUM CHLORIDE. IN ALL, TEN DIFFERENT MIXES WERE INVESTIGATED. THIS PAPER INCLUDES A DISCUSSION OF THE DESIGN OF THE STABILIZATION MIXES, THE LABORATORY STUDIES CONDUCTED AND A DESCRIPTION OF THE FIELD STUDIES INCLUDING CONSTRUCTION PROCEDURES AND THE FIELD TESTING PROGRAMME. THE CEMENT AND LIME-FLYASH STABILIZED BASES ARE CHARACTERIZED BY HIGH STRENGTHS, LOW BENKELMAN BEAM REBOUND VALUES AND CONSIDERABLE TRANSVERSE AND LONGITUDINAL CRACKING IN THE PAVEMENT SURFACE. THE SALT STABILIZED BASES AND THE PLAIN CONTROL SECTION ARE CHARACTERIZED BY LOW STRENGTHS, HIGHER REBOUND VALUES BUT NO CRACKING IN THE PAVEMENT SURFACE. ON THE BASIS OF BENKELMAN BEAM REBOUND READINGS AND COMPRESSIVE STRENGTHS, BEST PERFORMANCES TO DATE ARE SHOWN BY THE 5% CEMENT STABILIZED BASE AND THE TWO 4.5% LIME, 15% FLYASH STABILIZED BASES. ON THE BASIS OF A VISUAL ASSESSMENT OF THE PAVEMENT SURFACE CONDITIONS, THE THREE SALT STABILIZED BASES AND THE PLAIN CONTROL SECTION ARE SHOWING THE BEST PERFORMANCE IN THAT THEY EXHIBIT NO INDICATION OF DISTRESS OF ANY KIND TO DATE. /AUTHOR/

Lee, RL Canadian Good Roads Association Proc

ACKNOWLEDGMENT: Canadian Good Roads Association

3A 230952

PERFORMANCE MONITORING OF A DEEP COFFERDAM IN SENSITIVE CLAY

A DEEP, STEEL SHEET PILED, FIGURE-EIGHT COFFERDAM WITH CIRCULAR STEEL WALES WAS INSTALLED AS A TEMPO-

RARY SUBSTRUCTURE DURING THE CONSTRUCTION OF THE CITY OF OTTAWA POLLUTION CONTROL CENTRE PROJECT. A PROGRAM OF STRAIN MONITORING WAS DEVELOPED AND CARRIED OUT AND THE RESULTS, INCLUDING INFERRED SOIL PRESSURES, ARE PRESENTED. THE SUBSOIL INFORMATION, DESIGN OF THE SUBSTRUCTURE AND MONITORING STRAIN GAUGE SYSTEM AND CONSTRUCTION PROCEDURES ARE DISCUSSED. A SPECIAL DISCUSSION IS PRESENTED OF EXCESS PRESSURES OWING TO FREEZING. /CGRA/

Pappas, ND Sexsmith, DP *Canadian Geotechnical Journal*

ACKNOWLEDGMENT: Canadian Good Roads Association

3A 230957

CONSTRUCTION METHOD AND STABILITY OF EMBANKMENTS ON MUSKEG

A METHOD FOR THE DESIGN AND CONSTRUCTION OF RELATIVELY THICK HIGHWAY EMBANKMENTS ACROSS MUSKEG DEPOSITS IS DESCRIBED. USING THEORETICAL SOIL MECHANICS CONCEPTS, IT IS PREDICTED THAT THE LONG TERM STABILITY OF THE MUSKEG NECESSITATES THE USE OF BERMS DESPITE THE FACT THAT AN UNDRAINED STRENGTH ANALYSIS BASED ON IN-SITU VANE TESTS MAY PREDICT A REASONABLE FACTOR OF SAFETY. CONSIDERATION OF BOTH THEORETICAL SOIL MECHANICS CONCEPTS AND PRACTICAL CONSIDERATIONS SUGGESTED THAT THE INTERACTION BETWEEN THE SOIL AND THE BERM DICTATES THAT BERM CONSTRUCTION SHOULD BE FROM THE OUTER LIMITS TOWARDS THE CENTRE AND SHOULD BE PLACED PRIOR TO THE CENTRAL FILL. SEVERAL CASE RECORDS ARE PRESENTED TO SUPPORT THE CONCLUSIONS DRAWN AND FURTHERMORE SUGGEST THAT THE WIDTH OF THE BERM SHOULD BE 1 1/2 TO 2 TIMES THE THICKNESS OF THE MUSKEG (PEAT PLUS LAKE MARL). /CGRA/

Raymond, GP *Canadian Geotechnical Journal*

ACKNOWLEDGMENT: Canadian Good Roads Association

3A 231021

CURRENT SPECIFICATIONS, FIELD PRACTICES AND PROBLEMS IN COMPACTION FOR HIGHWAY PURPOSES

THE CURRENT STATUS OF HIGHWAY SPECIFICATIONS AND FIELD PRACTICES FOR COMPACTION OF EMBANKMENTS, SUBGRADES AND GRANULAR BASES IS SUMMARIZED. THE INFORMATION HAS BEEN OBTAINED FROM THE PUBLISHED STANDARD SPECIFICATIONS OF THE 50 STATES AND FROM AN EXTENSIVE INTERVIEW PROGRAM WITH STATE HIGHWAY ENGINEERS. CONSTRUCTION SPECIFICATIONS AND PROCEDURES FOR EMBANKMENTS, SUBGRADES AND GRANULAR BASES ARE SUMMARIZED AND FOLLOWED BY DISCUSSIONS OF THE PROBLEMS RELATED TO THE PRACTICAL APPLICATION OF THE SPECIFICATIONS TO FIELD CONSTRUCTION. QUALITY CONTROL PROCEDURES AND RELATED PROBLEMS ALSO ARE DISCUSSED. THE REVIEW INDICATES THAT THE MAJORITY OF EMBANKMENT AND SUBGRADE COMPACTION IS ACCOMPLISHED BY CONTROLLING LIFT THICKNESS AND MOISTURE CONDITIONS AND BY SPECIFYING MINIMUM DENSITY REQUIREMENTS, USUALLY AS A PERCENT OF THE MAXIMUM DENSITY DETERMINED FROM THE AASHO T-99 TEST. THE MAJOR PROBLEMS ARE ENCOUNTERED IN SILTS, VERY WET CLAYS OF HIGH PLASTICITY AND EXPANSIVE CLAYS. CONSTRUCTION PRACTICES TO OVERCOME THESE PROBLEMS ARE NOTED. CONTROL PROBLEMS NOTED INCLUDE THE TIME REQUIRED FOR CONVENTIONAL FIELD DENSITY MEASUREMENTS AND THE DIFFICULTY IN ESTIMATING THE PROPER AASHO T-99 MAXIMUM DENSITY FOR HETEROGENEOUS FIELD MATERIALS. THE ROLE OF STATISTICAL QUALITY CONTROL TECHNIQUES IS DISCUSSED. THE RELATION OF ENGINEERING JUDGMENT TO STATISTICAL PROCEDURES IS PRESENTED. A SUMMARY OF THE MAJOR COMPACTION PROBLEMS AS DETERMINED FROM INTERVIEWS WITH MANY HIGHWAY ENGINEERS IS ALSO INCLUDED. /AUTHOR/

Wahls, HE *Highway Research Record, Hwy Res Board*

3A 231038

ASPHALTIC COLD-MIX STABILIZATION

A PERSPECTIVE IS PRESENTED OF SOME OF THE TRENDS AND DEVELOPMENTS SINCE THE SECOND WORLD WAR IN THE FIELD OF STABILIZATION OF SANDS AND SOILS BY MEANS OF ASPHALTIC CUTBACKS AND EMULSIONS. A TREND TOWARD MORE CONSERVATIVE PRACTICE REGARDING GRADATION AND PLASTICITY REQUIREMENTS IS TRACED FROM 1946 TO THE PRESENT. IT IS POINTED OUT THAT IN MANY CASES THE FINER GRAINED AND MORE PLASTIC SOILS WHICH HAVE BEEN DISQUALIFIED FOR ASPHALT STABILIZATION BY THIS GRADUAL TIGHTENING OF REQUIREMENTS MAY BE STABILIZED EASILY AND ECONOMICALLY BY LIME. LABORATORY TESTING PROCEDURES HAVE BEEN DEVELOPED TO MEASURE THE EFFECTS OF WATER ABSORPTION, A MOISTURE VAPOR SUSCEPTIBILITY TEST, WHICH OFFERS ADVANTAGES OVER THE CBR AND HUBBARD-FIELD PROCEDURES. THE UNCONFINED COMPRESSION TEST WAS ADAPTED TO THE DESIGN OF SOIL-ASPHALT MIXTURES, AND IT IS PROPOSED THAT THE CONSTRUCTION CONTROL OF THESE MIXES BE EXPEDITED BY MEANS OF SMALL SPECIMENS WHICH COULD BE TESTED FOR UNCONFINED STRENGTH AFTER BRIEF PERIODS OF DRYING AND ABSORPTION. THE CONSTRUCTION TECHNIQUE OF SPREADING IN THIN LAYERS AND COMPACTING BY PNEUMATIC ROLLERS IS URGED FOR WIDER USE, ESPECIALLY FOR EMULSION STABILIZATION. THE ADVANTAGES OF RECENTLY DEVELOPED CATIONIC EMULSIONS ARE PRESENTED.

Parsonson, PS
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3A 231073

SYMPOSIUM ON ROADING EARTHWORKS

A SYMPOSIUM SPONSORED BY THE NEW ZEALAND ROADS BOARD, WAS CONVENED TO DISCUSS THE PROBLEMS OF ROAD FOUNDATIONS, AND PROVIDE A BETTER UNDERSTANDING OF THE SUBJECT OF SOIL MECHANICS SO THAT WAYS OF EXTENDING OR APPLYING CURRENT KNOWLEDGE MIGHT BE IMPROVED. PAPERS WERE PRESENTED ON PROSPECTING, DESIGN OF FOUNDATIONS, AND SOIL COMPACTION. THE SESSIONS, COVERED SOIL IDENTIFICATION AND CLASSIFICATION, DESIGN AND SPECIFICATION OF FOUNDATIONS, SOIL COMPACTION, AND ROAD BUILDING EQUIPMENT.

National Roads Board /New Zealand/

ACKNOWLEDGMENT: Highway Res Abstracts Hwy Res Board

3A 231075

CONSTRUCTION IN MUSKEG: A SUMMARY AND COMPILATION OF CURRENT PRACTICE

THE BASIC APPROACHES TO CONSTRUCTION IN MUSKEG AREAS ARE TO /1/ AVOID MUSKEG, /2/ REMOVE THE PEAT, OR /3/ DESIGN FOR AND UTILIZE THE MUSKEG. THE COMPLETE REMOVAL OF PEAT AND ITS REPLACEMENT BY GOOD FILL TO PROVIDE A SOLID FOUNDATION IS USUALLY EMPLOYED FOR ROADS CROSSING SHALLOW DEPOSITS OR MAIN HIGHWAYS CARRYING HEAVY TRAFFIC. CURRENT PRACTICE IN CANADA AND IN THE NORTHERN U. S. APPEARS TO FAVOR MECHANICAL EXCAVATION, ALTHOUGH DEEP PEAT DEPOSITS ARE TROUBLESOME. IN THIS CASE, GRAVITY DISPLACEMENT METHODS, WITH OR WITHOUT PARTIAL EXCAVATION, ARE OFTEN USED. EXPLOSIVES ARE USED LESS NOW THAN PRIOR TO WORLD WAR II, DUE TO THE UNPREDICTABLE RESULTS. THE USE OF HYDRAULIC STABILIZATION OR JETTING IS ALMOST CONFINED TO THE STATE OF MINNESOTA, ALTHOUGH THE METHOD HAS CONSIDERABLE POTENTIAL WHERE LARGE AMOUNTS OF GRANULAR FILL AND WATER ARE AVAILABLE. STABILITY, SETTLEMENT, AND FROST ACTION MUST BE CONSIDERED WHEN BUILDING ON PEAT. WITH FLOTATION METHODS THE BEARING CAPACITY IS UTILIZED AND CONTINUED SETTLEMENTS ARE ACCEPTED. THE SAND-DRAIN TECHNIQUE HAS BEEN APPLIED TO STABILIZE

SOFT DEPOSITS BUT IT IS NOW QUESTIONABLE. PILE FOUNDATIONS ARE THE LEAST AFFECTED BY PEAT PROPERTIES. DRAINAGE OF A MUSKEG AREA IS USUALLY EXTREMELY DIFFICULT AND OFTEN IMPOSSIBLE. EXTRACTS OF SELECTED REFERENCES ON MUSKEG AND PEAT HAVE BEEN GROUPED IN THE APPENDIXES. /AUTHOR/

Pihlainen, JA *Crrrel Technical Reports, Army Dept /US/*

ACKNOWLEDGMENT: Highway Res Abstracts Hwy Res Board

3A 231095

A DECADE OF PREFABRICATED FOUNDATION CONSTRUCTION

Eltremov, MG *Soil Mechanics & Foundation Engineering*

ACKNOWLEDGMENT: Transportation Curr Literature Dot Lib

3A 231115

ASPHALT-STABILIZED BASE

THE HISTORY AND USE OF ASPHALT STABILIZED BASE ARE PRESENTED. EIGHT BASIC ADVANTAGES OF ASPHALT BASES IN HIGHWAY CONSTRUCTION ARE: /1/ THEY DECREASE THE STRESSES ON THE SUBGRADE AND PERMIT REDUCTION OF TOTAL PAVEMENT THICKNESS, /2/ THEY MAKE MANY LOW-QUALITY AGGREGATES USABLE, /3/ THEY MINIMIZE CONSTRUCTION DELAYS BY PROTECTING THE SUBBASE AND/OR SUBGRADE FROM RAIN, AND BY PROVIDING A SOUND ROADBED FOR CONSTRUCTION HAUL TRAFFIC, /4/ THEY PROVIDE EASE AND UNIFORMITY OF COMPACTION WHICH PREVENTS WHEEL-TRACK RUTTING, /5/ THEY DO NOT REQUIRE RECOMPACTION AFTER RAINS AS DO MANY UNTREATED BASES, /6/ ASPHALT BASES ARE MOISTURE AND FROST RESISTANT, /7/ THEY ADD UNIFORMITY TO THE PAVEMENT THEREBY IMPROVING THE RIDING QUALITIES OF THE FINAL SURFACE, AND /8/ ASPHALT BASES ALLOW STAGE CONSTRUCTION, WHICH PROVIDES GREATER TRAFFIC UTILIZATION AND INSURES ADDED DURABILITY AND SMOOTHNESS BECAUSE NEW GRADES ARE GIVEN TIME TO SETTLE AND STABILIZE.

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3A 231121

THE CONSTRUCTION OF EMBANKMENTS ON COMPRESSIBLE SOILS

AFTER EXPLAINING THE PROBLEM OF THE CONSTRUCTION OF EMBANKMENTS ON POOR QUALITY SOILS, THE AUTHORS GIVE AN ACCOUNT OF WORK UNDERTAKEN ON THIS SUBJECT IN THE PONTS ET CHAUSSEES LABORATORIES. THESE STUDIES, CARRIED OUT WITH A VIEW TO BOTH SHORT TERM AND MEDIUM TERM EFFICACY, WERE CONDUCTED IN SEVERAL STAGES. STARTING FROM MODEST OBSERVATIONS ON THE BEHAVIOUR OF SOME EMBANKMENTS ON SOFT SOILS /PEAT IN PARTICULAR/ SOME IDEAS WERE FORMED WHICH GUIDED SUBSEQUENT INVESTIGATIONS. THE CONCLUSION WAS GRADUALLY REACHED THAT ONLY SYSTEMATIC EXPERIMENTS ON EXPERIMENTAL EMBANKMENTS COULD PROVIDE REAL SOLUTIONS TO THE PROBLEMS POSED. SUCH EMBANKMENTS WERE BUILT ON THREE DIFFERENT SITES. AT THE SAME TIME, A STUDY GROUP WAS FORMED TO WIDEN THE SCOPE OF THE RESEARCH AND TO MAKE FULL USE OF THE RESULTS OBTAINED FROM THE EXPERIMENTAL EMBANKMENTS. THIS STUDY GROUP /CALLED GERSC/ HAS BEEN OPERATING SINCE JUNE 1965 AND CONSISTS OF SEVEN ENGINEERS FROM THE LABORATOIRE DES PONTS ET CHAUSSEES. THE SUBJECTS COVERED RELATE TO SOIL RECONNAISSANCE, LABORATORY STUDIES, METHODS OF CALCULATION /SETTLEMENT AND STABILITY/, MEASURING APPARATUS, METHODS OF CONSTRUCTION, ETC. THE FOLLOWING METHODS OF STUDY ARE ENVISAGED: /1/ A COMPLETE BIBLIOGRAPHY ON THE SUBJECT, AND /2/ THE EXPLOITATION OF MEASUREMENTS MADE ON THE THREE EXPERIMENTAL EM-

BANKMENTS AND ON OTHER EMBANKMENTS BUILT ON SOFT SOIL. THIS EXPLOITATION MAY LEAD TO CERTAIN LINES OF RESEARCH NECESSARY FOR THE INTERPRETATION OF THESE MEASUREMENTS.

Karst, H Bourges, F *Bull Liaison Labs Routiers /France/*

3A 231181

SLOPE STABILITY AND FOUNDATION INVESTIGATION
THESE NOTES HAVE BEEN PREPARED FOR THE SHORT COURSE ON SLOPE STABILITY AND FOUNDATION INVESTIGATION, PRESENTED BY THE INSTITUTE OF TRANSPORTATION AND TRAFFIC ENGINEERING AND UNIVERSITY OF CALIFORNIA EXTENSION. THEY ARE INTENDED TO ACQUAINT PRACTICING HIGHWAY ENGINEERS WITH CURRENT METHODS OF DESIGNS, CONSTRUCTION, AND MAINTENANCE OF STABLE CUT SLOPES. IT IS HOPED THAT THEY MAY ALSO CONSTITUTE A SORT OF HIGHWAY FOUNDATION MANUAL WHICH WILL ASSIST THE PRACTICING ENGINEERING IN APPLYING RATIONAL METHODS TO SOIL MECHANICS PROBLEMS WITHIN THE SUBJECT AREA. /AUTHOR/

Itte, California University

3A 231195

PILE AND CAISSON FOUNDATIONS

AN EXPLANATION IS PRESENTED OF THE USEFUL DETAILS OF PILES AND CYLINDRICAL CAISSON FOUNDATIONS AS PRESENTLY UTILIZED IN THE UNITED STATES TO RESIST AXIAL LOADS, AND TO A GENERAL DESCRIPTION OF THE CONSTRUCTION EQUIPMENT AND PROCEDURES USED TO INSTALL THESE UNITS AND THE BASES OF PAYMENT. A LOGICAL APPROACH IS PRESENTED TO SELECT A PROPER TYPE OF FOUNDATION BASED ON THE FOLLOWING: (1) RELIABLE SUB-SURFACE INFORMATION, INCLUDING ACCEPTABLE SOIL SAMPLES, (2) KNOWLEDGE OF THE FORCES TO BE RESISTED AT A FIXED ELEVATION, AND (3) KNOWLEDGE OF COSTS OF COMPETITIVE TYPES OF FOUNDATIONS, OR A RELIABLE SOURCE OR SOURCES FOR THESE COSTS. PILES CONSIST OF ONE OF THREE MATERIALS, OR A COMBINATION OF THESE, NAMELY: WOOD, CONCRETE AND METAL. THE VARIOUS TYPES OF PILES IN EACH OF THESE CATEGORIES ARE REVIEWED.

Mohr, HA *Boston Society Civil Engineers Journal*

3A 231227

CEMENT-TREATED SOIL MIXTURES 1931-1961 (ANNOTATED)

A SELECTIVE BIBLIOGRAPHY IS PRESENTED ON THE STABILIZATION OF SOILS WITH PORTLAND CEMENT FOR ROADS, STREETS, AIRPORT AND PARKING AREAS. THE REFERENCES ARE ARRANGED IN THREE SECTIONS: (1) GENERAL, (2) RESEARCH, TESTS AND DESIGN, AND (3) CONSTRUCTION PROCEDURES AND EQUIPMENT.

Highway Research Board Bibliography

3A 231239

PLANNING OF PROJECTS-EARTHWORKS-FRANCE

EXPERIENCE OF SOME 100 MILLION CUBIC METERS OF HIGHWAY AND HIGHWAY EARTHWORKS IN FRANCE INDICATE TWO FUNDAMENTAL FACTORS: (1) RELATIVE TO THE ESTABLISHMENT OF PROJECTS, CONTROL WILL BE HENCEFORTH EXERCISED BY AN ELECTRONIC COMPUTER ASSOCIATED WITH AUTOMATIC DESIGN, AND (2) THE PLANNING AND EXECUTION OF EARTHWORKS ARE CONTROLLED NOW BY A REGULATION OF THE STANDARD BOOK OF SPECIFICATIONS STANDARDIZATION OF THE PROJECTS AND IMPROVEMENT OF THE QUALITY OF CONTRACTS ARE DISCUSSED. SOIL AND CUT CLASSIFICATIONS IN THE CATEGORIES RELATED TO USE OR NECESSARY EQUIPMENT ARE DESCRIBED. PROBLEMS ON THE COMPACTION OF FILLS, THE STABILITY OF SLOPES TOLERANCES AND CONTROL ON THE WORKS ARE DISCUSSED. AN EXAMPLE IS GIVEN OF MOTORWAY EARTHWORKS IN DIFFICULT TERRAIN IN DEEP CUT. SELECTED FIL-

IS CONSIDERED AS A DESIRABLE ELEMENT IN THE UPPER PART OF EARTHWORKS SO AS TO FACILITATE THE CONSTRUCTION OF THE HIGHWAYS.

Thiebault, A *Perm Intl Assoc Road Congresses Proc*

3A 231240

PLANNING OF PROJECTS-EARTHWORKS-GERMANY

THE SITE INVESTIGATION FOR PLANNING AND CONSTRUCTION OF ROADS COVERS TWO STAGE: A PRELIMINARY SURVEY IS MADE TO COMPARE ALTERNATIVE ROUTES, AND EXTENSIVE EXPLORATORY WORKS INCLUDING DRILLING ARE NECESSARY. THE APPLICATION OF AIR PHOTO-INTERPRETATION GIVES NO ADDITIONAL INFORMATION IN GEOLOGICALLY WELL SURVEYED COUNTRIES. THE APPLICATION OF THE GEO-ELECTRIC METHOD CAN SAVE DRILLING. PENETROMETER EQUIPMENT HAS BEEN STANDARDIZED. DRILLING METHODS ARE DISCUSSED. BETWEEN THE COMPACTION (INDICATED AS PERCENTAGE OF PROCTOR DENSITY) AND THE BEARING VALUE OF COHESIVE SOILS NO DIRECT RELATION EXISTS, BECAUSE THE REQUIRED COMPACTION CAN BE OBTAINED AT DIFFERENT MOISTURE CONTENTS. THE DRY BULK DENSITY OF STONY COHESIVE SOILS (MIXED SOILS) CAN BE CALCULATED FROM THE DRY BULK DENSITY OF THE COHESIVE PROPORTION, ONLY IF THE STONE FRACTION IS UNDER 25% WT. THE DETERMINATION OF WATER CONTENT BELOW THE PROTECTION LAYERS SHOWS AS AN INTERIM RESULT, THAT AFTER TWO YEARS OF OBSERVATION A CONSTANT MOISTURE CONTENT CAN BE EXPECTED. THE ADEQUACY OF BULK DENSITY MEASUREMENT WAS FOUND TO DEPEND ON THE GRADING. DIFFERENT METHODS OF DENSITY MEASUREMENTS GIVE FOR SILT THE SAME VALUES AS THE WATER CONTENT BELOW THE PLASTIC LIMIT. FOR WET SILT THE REPLACEMENT METHODS ARE NOT ACCEPTABLE. THE PLANNING OF EARTHWORKS BY MEANS OF NETWORK PLANNING HAS BEEN PROVED VERY SUITABLE. IN THE TECHNICAL ANALYSIS EACH PROCESS OF THE CONSTRUCTION WORK IS LISTED AND GRAPHICALLY DESCRIBED. FROM THESE THE PRODUCTION SYSTEM CAN BE DEVELOPED. ADDITIONAL VELOCITY PLANS MAKE IT POSSIBLE TO DISCOVER PRODUCTION GAPS.

Siedek, P *Perm Intl Assoc Road Congresses Proc*

3A 231243

PLANNING OF PROJECTS-EARTH WORKS-INDIA

THE MAJOR OBJECTIVES IN PRELIMINARY SURVEYS CONDUCTED TO STUDY EARTHWORKS IN HIGHWAY PROJECTS ARE DETAILED. TERMINAL POINTS, SETTLED FROM ECONOMIC AND SIMILAR CONSIDERATIONS, FIXED THE GENERAL BAND OF AN ALIGNMENT, WHILE GEOLOGICAL, TOPOGRAPHICAL AND CLIMATIC CONDITIONS GENERALLY HELP TO FIX THE FINAL ALIGNMENT WITHIN THIS BAND. IMPROVED AND STRINGENT GEOMETRIC DESIGN STANDARDS HAVE CONSIDERABLE INFLUENCE ON A PROJECT, ESPECIALLY ON THE COST OF EARTHWORKS. FINAL ALIGNMENT AND PROFILE ARE FIXED, BY TRIAL, USING MANUAL COMPUTATION. THE PREVALENT PRACTICE OF MANUAL METHOD OF EARTHWORKS, GENERALLY USING THE ROAD-SIDE BORROW PITS, MAKES THE PROBLEM OF SOIL INVESTIGATION AND EXECUTION CONTROL DIFFICULT. EMBANKMENT DESIGN AND GUIDANCE FOR QUICKLY IDENTIFYING UNSUITABLE SOILS ARE IMPORTANT. STABILITY OF SLOPES RECEIVED SPECIAL ATTENTION IN CASE OF HIGH BANKS OR CUTS. A CASE OF A DESIGN OF A HIGH EMBANKMENT CROSSING A DEAD RIVER CHANNEL IS DISCUSSED. THE MAIN FIELD CONTROLS FOR AN EMBANKMENT ARE MOISTURE AND COMPACTION. THE SAND CONE METHOD OF IN-SITU DENSITY MEASUREMENTS HAS CERTAIN LIMITATIONS DUE TO VARIATIONS IN CERTAIN SOILS. TEST RESULTS NEED TO BE STUDIED BY STATISTICAL ANALYSIS. NORMAL TESTS OF AN ENTIRE EMBANKMENT ARE PREFERRED TO MORE EXACT TESTS OF ONLY A SECTION OF THE FILL. LOCAL SOIL, SUITABLY MODIFIED IF NECESSARY, IS USED AS A

POSITIVE LAYER IN A PAVEMENT STRUCTURE. DIFFERENT ADMIXTURES LIKE SAND, LIME, CEMENT OR LIME AND CEMENT, DEPENDING ON THE TYPE OF SOIL HAVE RESULTED IN CONSIDERABLE INCREASE IN THE SOAKED CBR VALUES AND SOMETIME IMPROVEMENT IN THE PLASTIC PROPERTIES. EARTHWORKS CONSTRUCTION BY MANUAL LABOR IS GENERALLY ECONOMICAL IN INDIA AND PREFERRED BECAUSE OF CHEAP SEASONAL LABOR. SOME SPECIAL STUDIES CONCERNING EMBANKMENT CONSTRUCTION ON SWAMP SOIL, MARSHY CLAY, AND OTHER TYPES OF SOIL OF LOW BEARING CAPACITY ARE REPORTED. STABILITY TREATMENTS OF EXPANSIVE CLAY & BLACK COTTON SOIL ARE DISCUSSED. ADMIXTURE WITH LIME, CEMENT AND LIME AND CEMENT HAVE GIVEN ENCOURAGING RESULTS. A BLANKET LAYER OF SAND OR SAND AND MOORUM HAS SHOWN PROMISE IN SOME CASES. SILTY AND SANDY SOILS RESPOND BETTER IN THE TREATMENT WITH 3-4 PERCENT CEMENT. SATISFACTORY RESULTS WERE OBTAINED WITH AN ADMIXTURE OF SAND AND MOORUM MIX IN CASE OF SANDY COASTAL STRIP OF LOW BEARING CAPACITY. HILLSIDE EROSION IS TREATED WITH ASPHALT MULCH TECHNIQUE. THE SLOPE AREA IS FIRST TREATED WITH PLANTING GRASS SOD AFTER WHICH AN OPTIMUM QUALITY OF BITUMINOUS EMULSION IS SPRAYED.

Sinha, SN *Perm Intl Assoc Road Congresses Proc*

3A 231250

PLANNING OF PROJECTS-EARTHWORKS-RHODESIA

THE STABILITY OF EMBANKMENTS AND EARTH SLOPES IN RHODESIA IS PRIMARILY A MATTER OF PROPER DESIGN WITH DUE REGARD TO THE EXTERNAL FACTORS WHICH CAN INFLUENCE THE STRENGTH PARAMETERS OF SUCH STRUCTURES. RHODESIAN SOILS HAVE INHERENT STRENGTH AND ARE GENERALLY STABLE. A FIELD EXPERIMENT WAS CONDUCTED IN THE STABILIZATION OF GRANITIC SAND VELD WITH CEMENT AND BITUMEN EMULSION. THE EXPERIMENTAL BRIDGE APPROACH WAS CONSTRUCTED WITH LOW STABILIZER CONTENTS USING 2, 3 AND 4 PERCENT CEMENT AND 2 PERCENT BITUMEN ADDED AS 4 PERCENT EMULSION. THIS ROAD WAS CONSTRUCTED IN JANUARY, 1959 AND HAS SHOWN NO SIGNS OF DISTRESS OR CHANGE IN RIDING QUALITY. A FIELD EXPERIMENT WAS CONDUCTED TO DETERMINE THE COST OF, AND CONSTRUCTIONAL PROBLEMS INVOLVED, IN THE VARIOUS METHODS OF TREATING AN ACTIVE CLAY FORMATION. EXPERIMENTAL SECTIONS OF ROAD WERE CONSTRUCTED ON BLACK COTTON SOIL OF THE MONTMORILLIONITE GROUPS FORMED BY THE CHEMICAL WEATHERING OF DOLERITE. THREE ALTERNATIVE DESIGN SECTIONS WERE BUILT, (TWO WITH LIME STABILIZATION AND ONE WITH A RIVER SAND LUBRICATING LAYER). VARIOUS CONSTRUCTION TECHNIQUES WERE TRIED AND THE COST OF EACH ASSESSED. SOME RECOMMENDATIONS WERE MADE AND A SYSTEM OF BENCHMARKS WAS ESTABLISHED TO OBSERVE THE PERFORMANCE OF THE VARIOUS SCHEMES IN THE FUTURE. INVESTIGATION INTO THE CAUSES OF THE DEFORMATION OF KARIBA AERODROME RUNWAY INDICATED THAT THE DEFORMATION IS THE RESULT OF MOISTURE CHANGES IN AN EXPANSIVE SUB-SOIL.

Holden, A Burgers, A *Perm Intl Assoc Road Congresses Proc* No li-17, 1967

3A 231251

PLANNING OF PROJECTS-EARTHWORKS-ROUMANIA

A REVIEW IS PRESENTED OF THE MEANS USED IN ROUMANIA TO DEAL WITH PROBLEMS CONCERNING THE STUDY AND EXECUTION OF HIGHWAY EARTHWORKS. TERRAIN RECONNAISSANCE IS CONDUCTED, FOLLOWED BY ESTABLISHMENT OF THE THEMES FOR THE STUDIES OF TERRAIN (TOPOGRAPHY AND SOIL STUDIES). THE MANNER IS PRESENTED IN WHICH THE PROBLEMS CONCERNING THE STUDIES OF THE GEOMETRIC CHARACTERISTICS OF THE ALIGNMENT, NOTABLY THE CRITERIA WHICH LEAD TO THE CHOICE OF THE

VALUES OF THE CHIEF GEOMETRIC ELEMENTS OF THE HIGHWAYS ARE TREATED. MEANS ARE REVIEWED BY WHICH THE CO-RELATION IS TREATED BETWEEN THE QUANTITIES OF EARTH IN CUT AND FILL. SOILS CLASSIFICATION IS REPRESENTED FROM THE POINT OF VIEW OF THEIR POSSIBILITIES OF USE IN THE EARTHWORKS FILL. SPECIFICATIONS ARE PRESENTED FOR THE DEGREE OF COMPACTION OF EARTHWORKS, IN RELATION TO THEIR DEPTH BENEATH THE ROAD PAVEMENT. IN ORDER TO REDUCE THE EFFECT OF VARIATIONS IN HUMIDITY AND TEMPERATURE, THE ENGINEERS PROPOSED TO PLACE A SPECIAL LAYER CALLED THE FORMATION LAYER IN THE UPPER PART OF THE EARTHWORKS. MATERIALS USED WILL BE STABILIZED WITH LIME FOR A THICKNESS OF 10 TO 15 CM IN THE FORMATION LAYER. THIS SYSTEM HAS GIVEN GOOD RESULTS FOR THE BEARING CAPACITY OF THE SOILS THUS IMPROVED. THE DEGREE OF COMPACTION OBTAINED IS CONTINUOUSLY CHECKED AND RAPID CONTROLS ARE CARRIED OUT WITH THE AID OF DEFLECTOMETER BEAMS OR RADIOMETRY. THE CONSTRUCTION OF THE EARTHWORKS IS CONDUCTED WITH THE AID OF MECHANICAL EQUIPMENT. AN EXPERIMENT CONCERNING THE EXECUTION OF SAND AND LIME PILES USING THE UNIDIRECTIONAL ENHARMONIC ELECTRIC VIBRATOR AS A METHOD OF SOIL CONSOLIDATION IS DESCRIBED.

Marinesco, C Avadenci, C Albeanu, D *Perm Intl Assoc Road Congresses Proc*

3A 231285

EMBANKMENT PORE PRESSURE DURING CONSTRUCTION
THEORETICAL METHODS FOR PREDICTING PORE PRESSURES IN EARTH DAMS ARE REVIEWED, AND OBSERVED PORE PRESSURE DATA FROM SELECTED DAMS CONSTRUCTED BY THE CORPS OF ENGINEERS (CE) AND OTHER AGENCIES ARE SUMMARIZED TO INDICATE THE DEVELOPMENT AND MAGNITUDES OF CONSTRUCTION PORE WATER PRESSURES IN EARTH DAMS. CONSTRUCTION CHARACTERISTICS AND PORE PRESSURE DATA FROM 10 CE DAMS, 24 USBR DAMS, AND 9 FOREIGN DAMS ARE SUMMARIZED AND COMPARED. THE STUDY DETERMINED THAT BECAUSE OF THE NUMEROUS FACTORS WHICH INFLUENCE PORE PRESSURE BUILDUP, BROAD CONCLUSIONS FOR ALL EARTH DAMS ARE DIFFICULT TO MAKE AND EACH DAM MUST BE TREATED INDIVIDUALLY WITH RESPECT TO PREDICTING CONSTRUCTION PORE PRESSURES. IT IS CONCLUDED THAT: (1) PROVISIONS FOR INTERNAL DRAINAGE EFFECTIVELY RELIEVE CONSTRUCTION PORE PRESSURES IN EARTH EMBANKMENTS, (2) PORE-PRESSURE RATIOS IN EMBANKMENT MATERIALS INCREASE RAPIDLY AS PLACEMENT-WATER CONTENT INCREASES, ESPECIALLY ABOVE OPTIMUM WATER CONTENT, AND (3) PORE PRESSURES INCREASE WITH INCREASING DAM HEIGHT, BUT EVEN LOW DAMS (LESS THAN 100-FT HIGH) CAN DEVELOP LARGE PORE PRESSURES. /ASCE/

Sherman, WC Clough, GW *Am Soc Civil Engr J Soil Mech Div*

3A 231365

SOIL STABILIZATION WITH PORTLAND CEMENT
THIS REPORT SURVEYS THE AVAILABLE INFORMATION ON MIXTURES OF SOIL AND CEMENT. INCLUDED ARE DATA ON (1) PROPERTIES OF CEMENT-TREATED SOIL, (2) FACTORS INFLUENCING PROPERTIES OF CEMENT-TREATED SOIL, (3) USES OF CEMENT-TREATED SOIL AND BITUMINOUS SURFACING REQUIREMENTS, (4) PRELIMINARY SURVEYING, SAMPLING, TESTING AND MIX DESIGN FOR CEMENT-TREATED SOIL CONSTRUCTION, (5) STRUCTURAL DESIGN OF SOIL-CEMENT BASES, (6) CEMENT-TREATED SOIL CONSTRUCTION, (7) ENGINEERING CONTROL OF CONSTRUCTION, AND (8) FIELD PERFORMANCE OF SOIL-CEMENT BASE COURSES.

Highway Research Board Bulletin

3A 231371

FOUNDATIONS OF BRIDGES AND OTHER STRUCTURES
THESE REFERENCES ON FOUNDATIONS OF BRIDGES AND OTHER STRUCTURES INCLUDE SELECTIONS ON APPLICATION

OF ELASTICITY AND PLASTICITY THEORIES TO FOUNDATION PROBLEMS, SOIL MECHANICS AND FOUNDATION ENGINEERING, CEMENT GROUTING OF FOUNDATIONS, STRAIN GAGE OPERATIONS UNDER WATER, EARTH PRESSURE MEASUREMENTS, BEARING CAPACITY OF FOUNDATIONS, FOUNDATION VIBRATIONS, APPROXIMATIONS FOR BEAMS ON ELASTIC FOUNDATIONS, STRESSES UNDER A FOUNDATION, FOUNDATION MOVEMENTS, PILE FOUNDATIONS AND PILE STRUCTURES, EFFICIENCIES OF PILE GROUPS, BEARING CAPACITY OF PILES, PILE LOAD TESTS, PREDETERMINING PILE LENGTHS, PRESSURE DISTRIBUTION ALONG FRICTION PILES, SKIN FRICTION OF FOUNDATION PILE, PILE DRIVING BY ELECTROOSMOSIS AND BY VIBRATION STRESSES IN PILES DURING DRIVING, DRIVING CHARACTERISTICS OF PILES IN SOIL, EXPERIENCES WITH PRESTRESSED CONCRETE PILES, STEEL H-B PILES, SHEET STEEL PILES, TIMBER PILES, SOIL MODULUS FOR LATERALLY LOADED PILES, STABILITY OF FOUNDATION PILE AGAINST BUCKLING UNDER AXIAL LOAD, PILE HEAVE AND REDRIVING, FREEZING FACILITATES SHAFT SINKING, DEFLECTION AND STRENGTH OF ANCHORED BULKHEADS, SEALING A COFFERDAM, CAISSON FOUNDATIONS BELLED CAISSONS ANCHOR WALLS, BRIDGE PIERS BUILT IN CELLULAR COFFERDAMS, ENGINEERING SEISMOLOGY, LATERAL FORCES OF EARTHQUAKE AND WIND, SCOUR AT BRIDGES, SUBSOIL CORROSION OF STEEL, SOIL CONDITIONS AND SAMPLING, TESTS OF CYLINDRICAL SHELLS, SUBWAY CONSTRUCTION, SOIL COMPACTION BY VIBROFLOTATION AND BY EXPLOSIVES, BUILDING CODE REQUIREMENTS FOR EXCAVATIONS AND FOUNDATIONS, CONSTRUCTION OF CUT-OFF WALLS, UNDERWATER CONCRETING, AND SETTLEMENT OF STRUCTURES.

Highway Research Information Service

3A 231376

FOUNDATION ENGINEERING

CONTENTS: PROPERTIES OF SUBSURFACE MATERIALS IDENTIFICATION OF SOILS AND ROCKS PHYSICAL PROPERTIES OF SOIL AND ROCK TECHNIQUES OF SUBSURFACE INVESTIGATION CHARACTER OF NATURAL DEPOSITS PROGRAM OF SUBSURFACE EXPLORATION TYPES OF FOUNDATIONS AND METHODS OF CONSTRUCTION EXCAVATING AND BRACING DRAINAGE AND STABILIZATION FOOTING AND RAFT FOUNDATIONS PILE FOUNDATIONS PIER FOUNDATIONS PIER SHAFTS, RETAINING WALLS, AND ABUTMENTS SHORING AND UNDERPINNING SELECTION OF FOUNDATION TYPE AND BASIS FOR DESIGN FACTORS DETERMINING TYPE OF FOUNDATION FOUNDATIONS ON SAND FOUNDATIONS ON CLAY FOUNDATIONS ON SILT AND LOESS FOUNDATIONS ON NONUNIFORM SOILS DAMAGE DUE TO CONSTRUCTION OPERATIONS STRUCTURAL DESIGN OF FOUNDATION ELEMENTS INDIVIDUAL COLUMN AND WALL FOOTINGS FOOTINGS SUBJECTED TO MOMENT COMBINED FOOTINGS AND RAFTS RETAINING WALLS AND ABUTMENTS PROBLEMS.

Peck, RB Hansen, WE Thornburr, TH
Wiley, John & Sons, Inc

3A 231417

STUDIES OF FILL CONSTRUCTION OVER MUD FLATS INCLUDING A DESCRIPTION OF EXPERIMENTAL CONSTRUCTION USING VERTICAL SAND DRAINS TO HASTEN STABILIZATION

STUDIES WERE CONDUCTED OF FILL CONSTRUCTION OVER MARSH LANDS IN CALIFORNIA TO DETERMINE: (1) METHOD OF CONSTRUCTING THE FILL WITH MINIMUM SLIPPAGE, (2) REQUIRED YARDAGE OF FILL MATERIAL, INCLUDING YARDAGE NECESSARY TO COMPENSATE FOR UNAVOIDABLE LATERAL DISPLACEMENT AND LOSS BETWEEN DREDGER CUT AND FILL, AND (3) PROBABLE RATE OF SUBSIDENCE AND TOTAL SETTLEMENT SUBSEQUENT TO INITIAL CONSTRUCTION DUE TO SLOW DEHYDRATION AND CONSOLIDATION OF THE MUD STRATA. THE DATA FROM DEEP BORINGS, STUDIES OF THE FOUNDATION PRESSURE, AND LABORATORY ANALY-

SES OF FOUNDATION MATERIAL, INCLUDING THE DETERMINATION OF UNIT WEIGHT, DENSITY, MOISTURE CONTENT, GRAIN SIZE, CONSOLIDATION, COHESIVE STRENGTH, AND ANGLE OF INTERNAL FRICTION, WERE USED IN THE FILL DESIGN AND CONSTRUCTION TO DETERMINE THE PROBABLE SETTLEMENT AND EMBANKMENT QUANTITIES. A STANDPIPE TEST DEVELOPED BY THE AUTHOR, WAS USED TO CHECK THE ASSUMPTIONS AND THEORETICAL ANALYSES OF FOUNDATION PRESSURES. A HEAVY SIX-IN. DIAMETER CASING WAS DRIVEN THROUGH THE FILL INTO AN IMPERMEABLE CLAY MUD STRATUM, THUS PREVENTING WATER FROM FLOWING READILY UP ALONG THE OUTSIDE OF THE PIPE. THE CASING WAS CLEANED TO THE BOTTOM AND CONTINUOUS UNDISTURBED CORE SAMPLES OBTAINED FROM THE BOTTOM OF THE CASING TO ELEVATION. A TWO-IN. DIAMETER PERFORATED SAND FILLED PIPE WAS PLACED BETWEEN CERTAIN ELEVATIONS TO SERVE AS A FILLER, THUS ALLOWING THE WATER BELOW THE ELEVATION TO PASS UPWARDS THROUGH THE STANDPIPE. THE BOTTOM 2 FT. OF THE 6-IN. CASING WAS ALSO FILLED WITH SAND TO PREVENT MUD FROM ENTERING. THE TEST WAS FOUND SUFFICIENTLY SENSITIVE TO REFLECT THE INCREASED WEIGHT OF THE FILL DURING WET SEASON AND THE LOAD RESULTING FROM PLACEMENT OF SUBGRADE MATERIAL, BASE, AND PAVEMENT. THE HYDRODYNAMIC EXCESS PRESSURE AGREES CLOSELY WITH THE THEORETICAL ANALYSIS MADE PRIOR TO CONSTRUCTION. THE TEST PROMISES TO BE USEFUL FOR MEASURING THE RATE OF CORE SOLIDIFICATION AND THE HORIZONTAL COMPONENT IN HYDRAULIC-FILL DAMS. VERTICAL SAND DRAINS WERE INSTALLED IN THE MARSH FOR TESTING UNDER FIELD CONDITIONS. THREE TEST SECTIONS WERE USED TO MAKE BORINGS AND OBTAIN SOIL PROFILES AND THEORETICAL PRESSURE CONTOURS. SUBSTRATA DRAINAGE WAS FOUND NECESSARY TO RELIEVE HYDRODYNAMIC PRESSURE AND STABILIZE IMPERMEABLE SATURATED GROUND. THEORETICAL ADVANTAGES OF VERTICAL DRAINS IN CONNECTION WITH FILL CONSTRUCTION OVER DEEP MARSH LANDS HAVE BEEN CONFIRMED BY THE EXPERIMENTAL CONSTRUCTION DESCRIBED. IT IS POSSIBLE, WITH PROPER SPACING OF THE DRAINS, TO OBTAIN PRACTICALLY ALL OF THE SETTLEMENT DURING THE 6 MONTHS TO ONE YEAR'S TIME FOLLOWING CONSTRUCTION. WATER USUALLY TRAVELS THROUGH SOIL DEPOSITS MORE READILY HORIZONTALLY (WITH THE BEDDING) THAN VERTICALLY. THE DRAINS MAY ACCELERATE THE RATE OF SETTLEMENT BY PROVIDING AN OUTLET FOR HORIZONTAL MOVEMENT OF EXCESS MOISTURE. DRAINS, WITH A SPACING CONSISTENT WITH THE TYPE OF MATERIAL AND THE DESIRED RATE OF LOADING, READILY RELEASE THE EXCESS WATER, RELIEVE THE HYDRODYNAMIC PRESSURE, AND THUS PREVENT LATERAL DISPLACEMENT DURING FILL CONSTRUCTION.

Porter, OJ *Highway Research Board Proceedings*

3A 231439

CALCIUM CHLORIDE SURFACE-CONSOLIDATED ROADS

A DESCRIPTION IS PRESENTED OF THE CONSTRUCTION AND MAINTENANCE METHODS NECESSARY TO OBTAIN A SURFACE CONSOLIDATED ROAD. THE SURFACE STABILIZATION ROAD IS DENOTED BY MANY DIFFERENT TERMS INCLUDING PARTIAL STABILIZATION, SEMI-STABILIZATION, ACCELERATED TRAFFIC BOUND, MAINTENANCE WITH CALCIUM CHLORIDE, SURFACE COMPACTION, AND SURFACE CONSOLIDATION. NECESSARY CONSTRUCTION OPERATIONS ARE DESCRIBED WHEN ROADS LACK BINDER, AGGREGATE, MOISTURE, NEW ROADS, AND DRAINAGE AND CROWN. THE ADVANTAGES OF THIS TYPE OF SURFACE CONSOLIDATION ARE: (1) A VARIETY OF LOCAL SURFACING MATERIALS AVAILABLE IN MOST REGIONS CAN BE UTILIZED, (2) SPECIAL TECHNICAL KNOWLEDGE IS NOT REQUIRED IN THE SELECTION OF THESE MATERIALS, (3) THE COST IS LOW, AND (4) THIS ROAD TYPE FITS WELL INTO A STAGE CONSTRUCTION PROGRAM. /AUTHOR/

Elleman, JH Halbfass, FPG DISCUSSEER Van, AUKEN WT DISCUSSEER *Highway Research Board Proceedings*

3A 231453

DESIGN AND CONSTRUCTION OF AGGREGATE BASE COURSES WITH CALCIUM CHLORIDE

AGGREGATE BASE COURSES ARE DEFINED AS THE USE OF WELL GRADED, SOUND AND DURABLE CRUSHED STONE, GRAVEL OR OTHER SUITABLE AGGREGATES AS FOUNDATION COURSES FOR BITUMINOUS PAVEMENTS. FINAL PERFORMANCE DEPENDS UPON DESIGN, MATERIALS AND CONSTRUCTION. THE DESIGN TREND NOW IS TOWARD THE USE OF EQUATIONS OR FORMULAS BASED ON RELATIONSHIPS BETWEEN TRAFFIC AND VARIOUS PAVEMENT DESIGNS. BETTER CONSTRUCTION CONTROL AND PRACTICES ARE ADVOCATED TO HELP ATTAIN MAXIMUM PERFORMANCE FROM THE NATURAL SUBGRADE, SUBBASE AND BASE COURSE MATERIALS AND THUS IMPROVE PAVEMENT PERFORMANCE. SEVEN EXAMPLES ARE OUTLINED OF POOR CONSTRUCTION PRACTICES OFTEN ASSOCIATED WITH AGGREGATE BASE COURSE CONSTRUCTION. IT IS POINTED OUT THAT THE USE OF CALCIUM CHLORIDE IN BASE CONSTRUCTION, WITH THE RESULTING UNIFORM MOISTURE CONTROL, PROVIDES THE FOLLOWING BENEFITS: (1) IT AIDS COMPACTION AND INCREASES DENSITY, (2) IT REDUCES OR ELIMINATES THE NEED FOR SURFACE APPLICATIONS OF WATER (3) IT PERMITS CARRYING OF TRAFFIC WITHOUT RAVELLING OR DUST, (4) IT PROVIDES A MORE STABLE PLATFORM FOR PLACING EQUIPMENT, (5) IT PERMITS USE OF MINIMUM FINES OR BINDER, AND (6) IT ACTS AS A QUALITY CONTROL INGREDIENT TO HELP INSURE DESIRED RESULTS. IT IS CONCLUDED THAT HIGH QUALITY GRADED AGGREGATE BASE COURSES HAVE A DEFINITE PLACE IN BALANCED DESIGN OF MODERN FLEXIBLE PAVEMENTS BASED ON YEARS OF ACCUMULATED PERFORMANCE, THE AASHO ROAD TEST AND LATEST RESEARCH. THE PROPER USE OF CALCIUM CHLORIDE IN AGGREGATE BASE COURSES INSURES AN EFFECTIVE METHOD OF ACHIEVING MAXIMUM PERFORMANCE FROM QUALITY MATERIALS.

Smith, HA

Am Assoc State Highway Officials Oct. 1965

ACKNOWLEDGMENT: Calcium Chloride Institute

3A 231457

SOIL-PORTLAND CEMENT STABILIZATION

THESE REFERENCES ON SOIL-PORTLAND CEMENT STABILIZATION INCLUDE SELECTIONS ON SOIL-CEMENT PAVING PRACTICE, DESIGN AND CONSTRUCTION OF LEAN-MIX ROAD BASES, CEMENT STABILIZED PAVEMENT CONSTRUCTION IN SANDY AREAS, STABILIZED SOIL AS A STRUCTURAL MATERIAL, STABILIZATION OF BASES FOR HIGHWAYS, ALKALI SOILS AND SALINE SOILS AND THEIR STABILIZATION, SOIL CEMENT CONSTRUCTION, MODIFICATION OF FROST-HEAVING SOILS WITH ADDITIVES, MODULUS OF RUPTURE OF STABILIZED SOIL, UNCONFINED COMPRESSIVE STRENGTHS OF COMPACTED SOIL-CEMENT, PROPERTIES OF A SAND FOR THE CONSTRUCTION OF SOIL-CEMENT BASES, DESIGN AND TESTING OF SOIL-CEMENT MIXTURES, FIELD AND LABORATORY TESTS FOR STABILIZED SOIL CONSTRUCTION, EFFECT OF DENSITY ON COMPRESSIVE STRENGTH OF SOIL-CEMENT MIXTURES, CEMENT STABILIZED PIT AND QUARRY WASTE, STABILIZATION OF MOORUM AND LATERITIC SOILS, SOIL-CEMENT SHOULDER AND PATCHING, SOIL STABILIZATION FOR HEAVILY TRAFFICKED ROADS, LOW-COST STABILIZED ROADS, STRUCTURAL BEHAVIOR OF SOIL-CEMENT PAVEMENT, FUNDAMENTAL CONSIDERATIONS IN THE USE OF SOIL-CEMENT PAVEMENTS, AND THE USE OF MACHINERY AND TOOLS IN CONSTRUCTION OF SOIL-CEMENT BASES.

Highway Research Information Service

3A 231461

SOIL-CEMENT MIXTURES FOR ROADS

BRIEFLY REVIEWED ARE THE LABORATORY TESTS (DENSITY, MOISTURE CONTENT, AND DURABILITY TO FREEZING AND

THAWING AND WETTING AND DRYING) USED IN CONTROL OF SOIL-CEMENT MIXTURES AND WITH OUTLINES ON THE GENERAL CONSTRUCTION PROCEDURES WHICH THE VARIOUS STATE REPORTS HAVE SHOWN TO BE SUCCESSFUL.

Catton, MD *Highway Research Board Proceedings*

3A 231462

PROGRESS IN SOIL-CEMENT CONSTRUCTION

A SYMPOSIUM OF PAPERS FROM SIX HIGHWAY DEPARTMENTS (SOUTH CAROLINA, NORTH CAROLINA, MISSISSIPPI, OHIO, MARYLAND, AND OKLAHOMA) COVERS CONSTRUCTION PROCEDURES, SOIL SAMPLING, SOIL CLASSIFICATION, COMPACTION CONTROL, SUBGRADE CONTROL AND COSTS OF SOIL-CEMENT.

Highway Research Board Proceedings

3A 231464

CONDITION SURVEY OF SOIL-CEMENT ROADS-REPORT OF SUBCOMMITTEE ON USE OF PORTLAND CEMENT IN SOIL STABILIZATION

A QUESTIONNAIRE DESIGNED TO YIELD INFORMATION ON THE DESIGN, CONSTRUCTION, MAINTENANCE AND SERVICEABILITY OF SOIL-CEMENT BASE COURSES WITH BITUMINOUS WEARING SURFACES WAS CIRCULATED TO ALL STATE HIGHWAY DEPARTMENTS. SPECIAL ATTENTION WAS GIVEN TO THE FOLLOWING ITEMS: (1) CLIMATIC CONDITIONS, (2) DESIGN OF ROADWAY, (3) TYPES OF SOIL IN BASE AND SUBGRADE, (4) CEMENT CONTENT, (5) CONSTRUCTION METHODS, (6) WEATHER CONDITION DURING CONSTRUCTION, (7) TYPE AND CONDITION OF WEARING SURFACE, AND (8) TRAFFIC AND MAINTENANCE. CEMENT QUANTITIES VARIED BETWEEN 3.5 AND 14%, DEPENDING ON THE TYPE OF SOIL. THE BEST SOILS REQUIRED LOW CEMENT FACTORS, ALTHOUGH THIS FACTOR INCREASED WITH INCREASING CLAY CONTENT.

Mills, WH *Highway Research Board Proceedings*

3A 231466

USE OF SOIL-CEMENT MIXTURES FOR BASE COURSE

THE LATEST INFORMATION IS AVAILABLE ON THE MATERIALS AND CONSTRUCTION METHODS IN USE FOR BUILDING SOIL-CEMENT BASE COURSES FOR PAVEMENTS. THE TYPES OF SOIL-CEMENT CONSTRUCTION DESCRIBED COVER THE INCORPORATION OF CEMENT WITH SUBGRADE SOILS, BORROW SOILS, PIT-RUN MATERIALS AND COMBINATIONS OF THESE MATERIALS BY MIXED-IN-PLACE, TRAVELING AND STATIONARY PLANT METHODS.

Highway Res Board Current Road Problems

ACKNOWLEDGMENT: Highway Research Board Bibliography

3A 231470

STABILIZATION OF DISINTEGRATED GRANITE FOR BASE COURSES OF HIGHWAYS EXPOSED TO SEVERE FROST CONDITIONS

A DESCRIPTION IS PROVIDED OF HOW MATERIALS SUSCEPTIBLE TO FROST HEAVE WERE STABILIZED FOR BASE COURSES OF ROADS. IMPORTANCE IS ATTACHED TO MAKING LABORATORY TESTS BEFORE STARTING THE FIELD WORK AND OF CONDUCTING FREEZING TESTS. BY ADDING ONLY A SMALL PERCENTAGE OF STABILIZING AGENTS, SUCH AS PORTLAND CEMENT, TAR OR SULFITE SOLUTION, IT IS POSSIBLE TO REDUCE THE FROST HEAVE OF THE MATERIAL CONSIDERABLY OR TO RENDER IT COMPLETELY FROSTPROOF. THE CONSTRUCTION METHODS ARE DESCRIBED IN DETAIL.

Aichborn, W Steinbrenner, W *Intl Conf Soil Mech & Fdn Eng Proc*

ACKNOWLEDGMENT: Highway Research Board Bibliography

3A 231658

CONSTRUCTION OF EXPERIMENTAL STABILIZED SOIL-CEMENT HIGHWAY

A DETAILED DISCUSSION IS PRESENTED OF EQUIPMENT AND PROCEDURE IN CONSTRUCTING FIRST STABILIZED SOIL-CEMENT HIGHWAY IN ILLINOIS IN WINNEBAGO COUNTY, SEPTEMBER 1936.

Erickson, RO *Illinois Univ Eng Exp Sta Circulars, Engineering Index*

ACKNOWLEDGMENT: Highway Research Board Bibliography

3A 231660

ROAD STABILIZED WITH DRY CEMENT

DETAILS OF CONSTRUCTION PROCEDURES FOR 3.3-MI CEMENT-STABILIZED EXPERIMENTAL SECTION IN ADAMS COUNTY, WISC., ARE DESCRIBED.

Larson, GH *Contractors & Engineers*

ACKNOWLEDGMENT: Highway Research Board Bibliography

3A 231661

SOIL-CEMENT STABILIZATION IN MISSOURI

THE FIRST EXPERIMENTAL SOIL-CEMENT-STABILIZED SECTION BUILT IN MISSOURI DURING 1936-1937 IS DESCRIBED. SOIL CONSTANTS AND AMOUNT OF CEMENT FOR DIFFERENT SOILS ENCOUNTERED, WEATHER CONDITIONS, COST DATA AND CONSTRUCTION METHODS ARE GIVEN.

Reigel, FV *Highway Research Board Proceedings*

3A 231666

SINGLE MACHINE METHODS AND CONTROL OPERATIONS
CONSTRUCTION PROCEDURES USED IN 1939 ON THE FIRST SOIL-CEMENT ROAD BUILT BY THE OHIO DEPARTMENT OF HIGHWAYS ARE DESCRIBED. A 'SINGLE PASS' MIXING MACHINE WAS USED.

Litchiser, RR Brooks, HE *Highway Research Board Proceedings*

3A 231672

SOIL STABILIZATION METHODS AT MARCH FIELD

NEARLY A HALF MILLION SQUARE YARDS OF SOIL WERE STABILIZED BY THE ADDITION OF 12% PORTLAND CEMENT. A TOPPING MIXTURE CONSISTING OF A THIN LAYER OF CEMENT WAS SPREAD.

Excavating Engineer

ACKNOWLEDGMENT: Highway Research Board Bibliography

3A 231675

SOIL-CEMENT STABILIZED SHOULDERS IN TEXAS

AN ILLUSTRATED ACCOUNT IS GIVEN OF METHOD OF CONSTRUCTION AS WELL AS THE DETAILS AND COSTS OF STATE WORK IN LAMAR COUNTY.

Pirie, JE Ward, JR *Roads and Streets, Engineering Index*

ACKNOWLEDGMENT: Highway Research Board Bibliography

3A 231678

SOIL-CEMENT PAVING COSTS REDUCED BY USE OF CLAY MARL

EQUIPMENT, CONSTRUCTION METHODS AND SOILS USED FOR SOIL-CEMENT SURFACING ON AN AIRBASE IN FLORIDA ARE REPORTED. ELIMINATION OF SIDE FORMS WHEN PROCESSING THE INDIVIDUAL LANES WAS MADE POSSIBLE BY MINOR MODIFICATION OF PAVING PROCEDURE. COST OF CONSTRUCTION IS GIVEN. CEMENT CONTENT WAS REDUCED FROM 16 TO 9% BY USING A CLAY MARL BORROW.

Friday, CB *Engineering News-record*

ACKNOWLEDGMENT: Highway Research Board Bibliography

3A 231690

SOIL-CEMENT STABILIZATION AS PRACTICED IN COLUMBUS, GEORGIA

A STEP-BY-STEP REPORT IS GIVEN OF HOW COLUMBUS DECIDED TO USE SOIL-CEMENT FOR PAVING ITS STREETS, THE CONSTRUCTION PROCEDURES FOLLOWED, AND THE RESULTS OBSERVED.

Graddy, JM *American Road Builders Assoc Tech Bull*

ACKNOWLEDGMENT: Highway Research Board Bibliography

3A 231704

SPECIFICATIONS FOR THE CONSTRUCTION OF HOUSING ESTATE ROADS USING SOIL-CEMENT

TWO SPECIFICATIONS ARE INCLUDED TO COVER THE PREPARATION OF SOIL-CEMENT ROAD BASES BY (1) THE MIX-IN-PLACE METHOD AND (2) THE USE OF STATIONARY MIXERS. THEY DEAL WITH MATERIALS (CEMENT, HYDRATED LIME, CALCIUM CHLORIDE, WATER, SOIL, CURING MATERIALS), SPREADING, WATERING, SHAPING AND COMPACTION, AND METHODS OF CONSTRUCTION.

Road Abstracts /UK/, Road Research Lab Road Notes /UK/

ACKNOWLEDGMENT: Highway Research Board Bibliography

3A 231713

SOIL-CEMENT ROAD FOUNDATIONS BY CONTRACT AT CASTLEFORD

THE CONSTRUCTION TECHNIQUE USED AT FERRY FRYSTON HOUSING ESTATE IS DISCUSSED. INCLUDED IN THE REPORT ARE: DESIGN AND PREPARATION OF CONTRACT DOCUMENTS FOR SOIL-CEMENT, ROAD FOUNDATIONS, INVESTIGATIONS ON SITE AND IN LABORATORIES, COMPACTION TESTS, AND COST DATA.

Mellar, E *Surveyor and Municipal Engineer /UK/, Engineering Index*

ACKNOWLEDGMENT: Highway Research Board Bibliography

3A 231722

USE OF SOIL-CEMENT IN ROAD CONSTRUCTIONS (IN SPANISH)

THE PAPER SUMMARIZES ROADWORK EXECUTED IN SOIL-CEMENT BY THE ROAD DEPARTMENT OF THE PROVINCE OF BUENOS AIRES. SEPARATE SECTIONS CONSIDER SOIL-CEMENT AS A BASE FOR CONCRETE PAVEMENTS AND FOR FLEXIBLE PAVEMENTS. CHARACTERISTICS OF THE BASE ARE: LOAD TRANSFER TO THE SOIL, REDUCTION OF VOLUME CHANGES, AND AVOIDANCE OF SWELLING EFFECTS. TECHNICAL AND ECONOMICAL REASONS ARE EXPLAINED FOR THE ADOPTION OF SOIL-CEMENT SUBBASES AS A REPLACEMENT OF GRANULAR BASES. CONSTRUCTION METHODS, ESPECIALLY PULVERIZING, SPRINKLING OF SOIL BEFORE ADDING THE CEMENT, DISTRIBUTION OF THE MIX AND COMPACTION OF SOIL-CEMENT ARE OUTLINED. EXISTING PROJECTS AND NUMERICAL VALUES ARE CITED.

Carri, V
Portland Cement Institute /Argentina/

ACKNOWLEDGMENT: Highway Research Board Bibliography

3A 231724

IDEAS ABOUT THE DESIGN OF BASES OF THE SOIL-CEMENT TYPE FOR NATIONAL HIGHWAYS (IN SPANISH)

A STUDY ON THE BEHAVIOR OF THE PAVEMENT SECTION CANO-ROJAS, ROUTE 188, 15 KM. LONG, BUILT DURING 1942 FOR THE NATIONAL ROAD DEPARTMENT IS REPORTED. THE PAVEMENT CONSISTED OF A SUBBASE OF SELECTED SOIL 0.30 M. THICK, OF A SOIL-CEMENT BASE 0.12 M. THICK AND A BITUMINOUS TREATMENT OF THE 'SANDWICH' TYPE. THE AUTHOR RECORDS THAT THE SOIL-CEMENT BASE HAS SATISFACTORILY WITHSTOOD HEAVY TRAFFIC.

Lanne, A
Portland Cement Institute /Argentina/

ACKNOWLEDGMENT: Highway Research Board Bibliography

3A 231725

SOIL-CEMENT CONSTRUCTION. HANDBOOK.
THE HANDBOOK PRESENTS IN PRACTICAL FORM THE COMPLETE PROCEDURES FOR BUILDING SOIL-CEMENT ROADS, STREETS, AIRPORTS, PARKING, AND STORAGE AREAS AND SHOULDERS. PROCEDURES FOR SOIL SAMPLING AND FOR INSPECTION AND FIELD CONTROL ARE INCLUDED.

Portland Cement Association

ACKNOWLEDGMENT: Highway Research Board Bibliography

3A 231726

MODERN METHODS USED IN CONSTRUCTION 4 MILLION SQ. YDS. OF SOIL-CEMENT IN LOUISIANA DURING 1955
IN GENERAL, SOIL-CEMENT BASES IN LOUISIANA HAVE BEEN ECONOMICAL AND HAVE PROVED SATISFACTORY UNDER TRAFFIC; MAINTENANCE HAS ALSO BEEN RELATIVELY LOW. CONSTRUCTION PROCEDURES AND EQUIPMENT ARE DESCRIBED.

Breaux, JC *American Road Builders Assoc Tech Bull*

ACKNOWLEDGMENT: Highway Research Board Bibliography

3A 231733

SOIL-CEMENT ROADS AND ROAD BASES IN HOLLAND
KINDS OF SOIL, METHODS OF CONSTRUCTION, SUMMER 'BLOW-UPS', AND COST FACTORS ARE PRESENTED. THE MIX-IN-PLACE, SINGLE-PASS METHOD WAS ADOPTED. BLAST FURNACE SLAG CEMENT WAS USED.

Sluis, FA *Surveyor and Municipal Engineer /UK/, Engineering Index*

ACKNOWLEDGMENT: Highway Research Board Bibliography

3A 231759

A HANDBOOK OF SOIL-CEMENT CONSTRUCTION
CONTENTS: THE ADVANTAGES OF SOIL-CEMENT FACTORS AFFECTING SOIL-CEMENT IDENTIFICATION AND CLASSIFICATION OF SOILS SOIL SURVEYS AND SOIL SAMPLING TESTING OF SOILS CONSTRUCTION OF A SOIL-CEMENT BASE SPECIFICATIONS FOR THE CONSTRUCTION OF A SOIL-CEMENT BASE BY THE PRE-MIX METHOD SPECIFICATIONS FOR THE CONSTRUCTION OF A SOIL-CEMENT BASE BY THE MIX-IN-PLACE METHOD MODIFICATION OF SOILS WITH PORTLAND CEMENT UNIFIED SOIL CLASSIFICATION SYSTEM.

Concrete Association /India/ 88 pp, 1962

ACKNOWLEDGMENT: Portland Cement Association

3A 231769

SOIL-CEMENT IN COLD WEATHER
THE MOST OBVIOUS FEATURE OF SOIL-CEMENT CONSTRUCTION IN COLD WEATHER AREAS IS THAT IT NEEDS NO SPECIAL PRECAUTIONS OTHER THAN THOSE NORMALLY TAKEN TO ENSURE PROTECTION AGAINST FREEZING DURING AND IMMEDIATELY AFTER CONSTRUCTION. ONCE THE SOIL-CEMENT HAS HARDENED, EXTREMELY LOW TEMPERATURES WILL HAVE LITTLE EFFECT ON THE FINISHED PAVEMENT. SOIL-CEMENT IS NO CURE-ALL FOR FROST CONDITIONS, HOWEVER, WHEN BUILT ON A SOFT OR WET SUBGRADE. SOME TYPICAL NORTHERN SOIL-CEMENT PAVEMENTS ILLUSTRATE BEHAVIOR.

Soil-cement News, Pca

ACKNOWLEDGMENT: Portland Cement Association

3A 231803

LEAN CONCRETE ROAD BASES
MATERIALS, CONSTRUCTION TECHNIQUES, AND DESIGNS OF LEAN CONCRETE BASES COMMONLY USED IN GREAT BRITAIN, AND THE GENERAL PERFORMANCE OF THE BASES ARE REVIEWED.

Wright, PJ *Norsk Vegtidsskrift /Norway/, Road Abstracts /UK/
ACKNOWLEDGMENT: Portland Cement Association*

3A 231806

**CONTROL OF CEMENT-STABILIZED BASES
METHODS USED IN VARIOUS COUNTRIES FOR CONTROLLING
SOILS AND CONSTRUCTION MATERIAL BEFORE, DURING,
AND AFTER CONSTRUCTION ARE REVIEWED.**

Kirk, JM *Norsk Vegtidsskrift /Norway/, Road Abstracts /UK/*

ACKNOWLEDGMENT: Portland Cement Association

3A 231858

**BASE CONSTRUCTION OF SOIL/SAND EMULSION USING A
SINGLE ACTION STABILISING MACHINE: PROVINCIAL
ROUTE NO. 13- SECTION LAS ROSAS, K. 40.8 (PROVINCE OF
SANTA FE) /IN SPANISH/**

THE SOIL WAS CLAY AND MUD WITH A LIQUID CONTENT OF
LESS THAN 32% AND WAS BROUGHT A DISTANCE OF 5 KM. THE
SAND WAS TAKEN FROM THE PARANA RIVER. THE DRYING
OF THE MIXTURE WITH EMULSION WAS DONE WITH A
ROTARY MIXER AND THE CONSOLIDATION WITH CROWBAR
ROLLERS, PNEUMATICALLY VIBRATED, IN THICKNESSES OF
12 TO 15 CM. ON THIS BASE A TRIPLE BITUMINOUS TREAT-
MENT WAS PLACED ON A PRIMER OF 1.4 LITERS PER SQAURE
METER. THE MACHINE USED IS DESCRIBED, THE PERSONNEL,
AND YIELDS OBTAINED. SIMULTANEOUS LABORATORY
TESTS WERE MADE TO OBTAIN THE CBR OF THIS BASE
/LTE/LCPC/RRL/

Marini, AH *Permanent Asphalt Comm Proc /Argentina/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 231871

**SOIL STABILIZATION WITH CEMENT OR LIME /IN FRENCH/
BASIC PRINCIPLES OF SOIL STABILIZATION ARE REVIEWED
INCLUDING NEED FOR SCIENTIFIC PRELIMINARY TESTS TO
DETERMINE THE NECESSARY CRITERIA, METHODOICAL CON-
TROL DURING THE EXECUTION OF THE WORKS, AND RATIO-
NAL ORGANIZATIONS OF THE SITE AND EQUIPMENT.
DATA ARE GIVEN ON GRAVEL, SAND DEPOSITS, CONSTRU-
TION METHODS AND NEW ROAD NETWORKS UNDER CON-
STRUCTION IN SWITZERLAND. THE ECONOMIC IMPORTANCE
OF CEMENT-STABILIZED GRAVEL FOR THE CONSTRUCTION
OF HIGH- QUALITY SUBBASES IMPERVIOUS TO FROST AND
WITH A HIGH BEARING CAPACITY, IS DISCUSSED. /
LCPC/RRL/**

Vogt, K

La Route En Beton /Switzerland

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 231886

**HIGHWAY ENGINEERING. CHAPTER 8' EARTHWORK
FORMATION**

AFTER AN INTRODUCTION INTO STABILITY AND SETTLE-
MENT PROBLEMS THIS CHAPTER DEALS WITH SUBSOIL
DRAINAGE, COMPACTION OF SOIL, FROST DAMAGE TO SUB-
GRADE AND CONSTRUCTIONAL METHODS. /RRL/

Ashworth, R

Heinemann Educational Books Ltd

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 231887

**HIGHWAY ENGINEERING. CHAPTER 9'SOIL STABILIZATION
MECHANICAL STABILIZATION, STABILIZATION WITH CE-
MENT, OTHER STABILIZING AGENTS AND CONSTRUCTIONAL
METHODS ARE EXAMINED. THE USE OF PULVERIZED FUEL
ASH, LIME AND BITUMEN ARE REFERRED TO, AND METHODS
OF PREPARING THE STABILIZED SOIL ARE DESCRIBED. /RRL/**

Ashworth, R

Heinemann Educational Books, Ltd

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 231893

**THE MIXING OF STABILIZERS WITH SOIL
BASIC REQUIREMENTS AND AVAILABLE METHODS FOR MIX-
ING ADDITIVES WITH SOIL ARE EXAMINED BOTH PRACTI-
CALLY AND THEORETICALLY. THE EFFECT OF VARIOUS
IMPORTANT FACTORS ON STRENGTH DEVELOPMENT IN STA-
BILIZED SOILS IS STUDIED. FOLLOWING AN ASSESSMENT OF
THE PRACTICAL AND ECONOMIC SIGNIFICANCE OF THESE
EFFECTS, RECOMMENDATIONS ARE MADE FOR POSSIBLE
IMPROVEMENTS IN SOIL STABILIZATION CONSTRUCTION
PRACTICE. /RRL/A/**

Ingles, OG Metcalf, JB Frydman, S *Inst Engrs Civil Eng Trans
/Australia/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 231896

**SOIL CEMENT BASE COURSES IN STREET CONSTRUCTION
INFORMATION IS GIVEN BASED UPON EXPERIENCE GAINED
FROM THE USE OF SOIL CEMENT COURSES IN STREET CON-
STRUCTION IN THE CITY OF LUANDA. IN ADDITION TO
DESCRIBING THE GEOTECHNICAL CHARACTERISTICS OF THE
MUCEQUE, THE RESULTS OF THE SOIL CEMENT TEST ON THIS
SOIL AND THE STANDARD CONSTRUCTION TECHNIQUES OF
SUCH COURSES, SPECIAL REFERENCE IS MADE TO THE LIMI-
TATIONS IMPOSED ON THIS TYPE OF CONSTRUCTION WHEN
CARRIED OUT IN A CITY, LIMITATIONS WHICH DO NOT EXIST
IN OPEN AREAS. /RRL/LNEC/**

Meireles, JM *Fomento, Lisbon /Portugal/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 231921

**SOIL STABILIZATION WITH BASIC BROWN COAL-FLY ASH
(IN HUNGARIAN)**

A DISCUSSION AND EVALUATION OF LABORATORY TESTS AND
EXPERIENCES ON TEST ROADS IS PRESENTED. THESE IN-
CLUDE QUALIFICATION TESTS, FOR EXAMPLE FINENESS,
BULKING, BINDING TIME AND RADIO ACTIVITY OF THE
FLY-ASH; COMPRESSION TESTS WITH VARYING FLY-ASH CON-
TENT; AND INFLUENCE OF AN ADMIXTURE OF CEMENT OF
DIFFERENT SOILS. THE RESULTS OF THE FIELD TESTS
SHOWED THAT THE CONSTRUCTION METHODS ARE IDENTI-
CAL TO THE METHODS USED IN CEMENT STABILIZATION
MEASURES TO PROTECT INDUSTRIAL HEALTH MUST ALSO BE
CONSIDERED. THE DISADVANTAGE IS THAT THE QUALITY OF
THE ASH VARIES A GREAT DEAL, THUS RENDERING CON-
STANT CONTROL NECESSARY. CONSIDERABLE SAVINGS IN
COSTS CAN BE ACHIEVED. /FG/RRL/

Fulop, I *Melyepitestudományi Szemle /Hungary/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 231925

**SOIL STABILIZATION WITH LIME IN EARTHWORKS AND
ROAD CONSTRUCTION /IN GERMAN/**

THIS BOOK CONTAINS THE FOLLOWING REPORTS, WHICH
ARE MAINLY REPRINTS FROM VARIOUS JOURNALS: KUONEN,
V., AND R. HIRT, RESULTS OF RESEARCH INTO THE EFFECT OF
LIME IN SOIL STABILIZATION; BRAND, W., POSSIBILITIES AND
LIMITS OF USING LIME TO STABILIZE COHESIVE SOILS; KLEM-
PERT, B., CODES OF PRACTICE AND THEIR APPLICATION IN
RURAL ROAD CONSTRUCTION IN NORDRHEIN-WESTFALEN;
BEHR, H., OBSERVATIONS OF MOISTURE CONTENT IN THE
SUBGRADE AND SUBSOIL OF A MOTORWAY; AND KNOLL, B.,
AND F. STEINMANN, SOIL STABILIZATION WITH LIME IN
EARTHWORKS-A NEW, PARTICULARLY EFFICIENT METHOD.
THE DEPARTMENT OF FOUNDATIONS OF THE BUNDESAN-
STALT FÜR STRASSENWESAN REFERS TO THE IMPROVEMENT
AND STABILIZATION OF COHESIVE SOILS WITH LIME IN
EARTHWORKS FOR ROAD CONSTRUCTION. THERE IS A BIBLI-

OGRAPHY ON GENERAL PRINCIPLES, THEIR PRACTICAL APPLICATION IN ROAD AND RAIL CONSTRUCTION AND EARTHWORKS, AND THE VALID CODES OF PRACTICE AND SPECIFICATIONS. TWO INDEXED RECORDS OF SOIL STABILIZATION AND IMPROVEMENT OF COHESIVE SOILS WITH LIME CONCLUDE THE BOOK. /FG/RRL/

Bundesverband Kalkindustrie /Germany/ 24 pp, 1966

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 231944

SOIL STABILIZATION IN THEORY AND PRACTICE (IN GERMAN)

THIS INSTRUCTION MANUAL CONTAINS: MODIFICATION OF THE NATURAL PROPERTIES OF SOIL; TERMINOLOGY; METHODS OF SOIL STABILIZATION AND ITS ECONOMICS AND AREAS OF USE; PRINCIPLES OF MECHANICAL STABILIZATION METHODS; SITE TESTS, MAINTENANCE OF MECHANICALLY STABILIZED WEARING COURSES; INSTRUCTORS, SPECIFICATIONS AND TEST METHODS FOR SOIL STABILIZATION WITH CEMENT; LIME STABILIZATION OF COHESIVE SOILS, ECONOMIC SIGNIFICANCE, LIME AS A STABILIZER, SUITABILITY TESTS; SOIL STABILIZATION WITH BITUMINOUS BINDERS; AREAS OF USE AND CONSTRUCTION METHODS; SOIL STABILIZATION WITH CHEMICALS: POSSIBILITIES AND EXAMPLES OF APPLICATION; USE OF MACHINES IN GRADING OPERATIONS, WORKING ON BINDERS AND WATER, MIXING, COMPACTION AND CURING; CONSTRUCTION OF LOW-COST ROADS THROUGH SOIL STABILIZATION; EARTHWORKS, LOADING, TRANSPORTING AND DISTRIBUTING; AND SURFACING AND CONSTRUCTION OF STABILIZED ROADS. /RRL/

Lindemann, K
Bauwesen, Berlin /Germany/

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 231947

PRINCIPLES AND APPLICATION OF SOIL STABILIZATION /GERMAN/

AFTER AN HISTORICAL SURVEY OF SOIL STABILIZATION METHODS, THE MECHANICAL STABILIZATION OF SOIL WITH CEMENT, LIME, BITUMINOUS MATERIALS AND CHEMICALS IS DISCUSSED. SOIL PROPERTIES, BINDER PROPERTIES AND THEIR REACTION WITH SOIL ARE ALSO OUTLINED, TOGETHER WITH SUITABILITY TESTS FOR SOIL STABILIZATION WITH LIME AND CEMENT. THE INFLUENCE OF SOIL STABILIZATION ON THE DESIGN OF THE ROAD STRUCTURE, AND WORKING PROCESSES AND EQUIPMENT INVOLVED IN CONSTRUCTION ARE DESCRIBED /FG/RRL/

Jessberger, HL *Vdi Zeitschrift* /Germany/

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 231959

SUBMERGED TUNNELS, UNDERWATER SETTING OF TUNNEL SECTIONS /FRENCH/

THE CONSTRUCTION OF SEVERAL UNDERWATER TUNNELS IS REVIEWED AND METHODS OF SINKING CONNECTIONS AND FOUNDATIONS FOR TUNNEL SECTIONS ARE DISCUSSED. /CRIC/FESR/LCPC/RRL/

Havuo, K
Ingenieursblad, Antwerp /Belgium/

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 231961

CONSTRUCTION OF EMBANKMENTS ON MARSHY GROUND USING A HYDRAULIC METHOD WITHOUT PRELIMINARY HEAT BLASTING /IN RUSSIAN/
DETAILS ARE GIVEN OF A NEW HYDRAULIC METHOD OF CONSTRUCTING EMBANKMENTS ON MARSHY GROUND. IT CONSISTS IN INJECTING INTO THE PEAT A MIXTURE OF MUD

AND SAND THROUGH A VERTICAL TUBE. THIS MIXTURE PARTIALLY LIQUEFIES THE PEAT AND DISPOSES OF IT BY FORMING A CONE IN WHICH THE HEAVIER SAND PARTICLES SETTLE THUS REPLACING THE PEAT BY SAND. CONSTRUCTION COSTS ARE APPROXIMATELY 50% LOWER THAN THOSE OF STANDARD CONSTRUCTION METHODS. /LCPC/RRL/

Dmitrienko, YD Levchenko, IM Nazarov, PA Gavrilov, RN *Automobil Nye Dorogi* /Ussr/

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 231965

THE CONSTRUCTION OF TRENCHES AND WELLS BY MEANS OF TIMBERING /FRENCH/

THE NEED FOR TIMBERING IS DISCUSSED & EGGS GIVEN WHERE TIMBERING IS NOT NECESSARY. CASES WHERE OPEN-WORKED TIMBERING IS SUFFICIENT ARE CITED. TIMBERING TECH. ARE OUTLINED: VERTICAL TIMBERING IN COHESIVE SOIL, VERTICAL TIMBERING IN NON-COHESIVE SOIL, HORIZONTAL TIMBERING, TIMBERING WITH INITIALLY DRIVEN METAL POSTS, COMPOSITE METHODS, TIMBERING OF TRENCHES EXCAVATED WITH A MECHANICAL SHOVEL, AND TIMBERING OF WELLS AND SHAFTS. RECOMMENDATIONS ARE GIVEN FOR THE DESIGN OF TIMBERING FOR SHALLOW TRENCHES WITHOUT OVERLOAD, AND FOR DEEP TRENCHES TOGETHER WITH SOME EXAMPLES OF APPLICATION. /CRIC/FESR/LCPC/RRL/

Delire, G
Scientific & Tech Cntr for Constr /Belg

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 231968

REINFORCED SOIL-CEMENT (IN RUSSIAN)

AN INVESTIGATION INTO THE PROPERTIES OF REINFORCED SOIL-CEMENT SUBJECTED TO SHORT-TERM LOADING, AND ITS APPLICATION TO ROAD CONSTRUCTION IS PRESENTED. THE EFFICIENCY OF THE REINFORCEMENT WAS TESTED ON SOIL-CEMENT SAMPLES MADE WITH LOESS SILTS FROM THE REGION OF VOLGOGRAD, WHICH HAD A LIQUID LIMIT EQUAL TO 31.8 AND 18.1 PER CENT. THE TESTS SHOW THAT, EVEN WITH A LOW PERCENTAGE OF REINFORCEMENT, THE BEARING CAPACITY OF SOIL-CEMENT CAN BE DOUBLED. BECAUSE SOIL-CEMENT HAS A HIGH RESISTANCE TO CRACKING, ITS IMPORTANCE IN THE DISTRIBUTION OF THERMAL STRESSES IN THE PAVEMENT LAYERS TREATED IS EMPHASIZED. THIS CONSTRUCTION METHOD SHOULD PROVE ECONOMICAL FOR THE CONSTRUCTION OF BASE COURSES AS IT ENABLES THE QUANTITY OF SOIL-CEMENT USED TO BE REDUCED; THE COST OF A CUBIC METER OF REINFORCED SOIL-CEMENT IS QUOTED. /LCPC/RRL/

Dobrinskii, LK
Stroitel' Stvoi Arkhitektura /Ussr/

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 231985

OPTICAL CONTROL OF EARTHWORKS MACHINERY (IN RUSSIAN)

AN OPTICAL DEVICE IS DESCRIBED WHICH FACILITATES THE REMOTE CONTROL OF EARTHWORKS MACHINERY. IT CONSISTS OF (1) A LIGHT RAY TRANSMITTER PUL3, AND (2) A RECEIVING DEVICE WHICH CONTAINS A PHOTORECEIVER ATTACHED TO THE WORKING PART OF THE MACHINE, AND AN AMPLIFIER AND CONTROL PANEL IN THE DRIVER'S CAB. THIS DEVICE WAS SUCCESSFULLY USED DURING THE CONSTRUCTION OF STRAIGHT AND CURVED STRETCHES OF ROAD. /LCPC/RRL/

Kardaev, MA Malyar, VS *Mekh Stroitel' Stva* /Ussr/

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 232004

GENERAL REPORTS PRESENTED BY THE USSR AT THE SECOND CONFERENCE ON ROAD CONSTRUCTION PROBLEMS HELD BY SOCIALIST COUNTRIES IN WARSAW, IN 1966 (IN RUSSIAN)

THIS PUBLICATION CONTAINS THE FOLLOWING REPORTS: (1) METHODS OF SOIL STABILIZATION BY THE COMBINED ACTION OF BINDERS AND CHEMICAL ACTIVATORS, (2) CONSTRUCTION METHODS FOR ASPHALTIC CONCRETE SURFACINGS AND WORK MECHANIZATION, (3) CONSTRUCTION OF ROADS WITH ROUGH SURFACINGS AND COMPOSITION OF NON-SKID LAYERS APPLIED DURING ROAD MAINTENANCE, AND (4) CONSTRUCTION TECHNOLOGY FOR PRESTRESSED CONCRETE SURFACINGS. /LCPC/RRL/

Soyuzdornii /Ussr/

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 232014

TESTING D-357 OF SCRAPERS /IN RUSSIAN/

A BRIEF DESCRIPTION IS GIVEN OF A SCRAPER CAPABLE OF PERFORMING EARTHWORK OPERATIONS IN WINTER ON FROZEN SOIL. /LCPC/RRL/

Tatarov, EN Kemarskii, BA *Stroitel Nye I Dorozhnye Mashiny /Ussr/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 232039

TRAIL PAVEMENTS OF LATERITE BASE COURSE

A DESCRIPTION IS GIVEN OF TWO ROAD TEST SECTIONS-CATOFE AND QUIZENGA-WHICH WERE USED TO INVESTIGATE THE INFLUENCE OF VARIOUS PARAMETERS ON THE BEHAVIOR OF LATERITE PAVEMENTS RELATIVE TO THE CONSTRUCTION METHODS, QUALITY OF THE LATERITE AND TYPES OF SURFACING. THE RESULTS HAVE CONFIRMED THE EXISTING OPINION THAT IT IS POSSIBLE TO USE LATERITICE SOILS OF HIGH PLASTICITY, AND THAT STRICT CONTROL OF CONSTRUCTION IS NECESSARY, IN PARTICULAR, FOR THE COMPACTION. THE IMPERMEABILITY OF THE SURFACING WOULD APPEAR TO BE IMPORTANT. /RRL/A/

Meireles, JM *Soil Mech & Fdn Eng Proc /South Africa/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 232047

APPLICATION OF SOIL STABILIZATION ON SMALL AND MEDIUM-SIZED CONSTRUCTION SITES /IN GERMAN/

THE MIXED-IN-PLACE METHOD OF SOIL STABILIZATION AND ITS USE ON SMALL AND MEDIUM-SIZED CONSTRUCTION SITES ARE DISCUSSED. THE IMPORTANCE OF SOIL STABILIZATION AS A CONSTRUCTION METHOD IS EMPHASIZED. /FG/RRL/

Bergmann, FW *Strassenbautechnik, Cologne /Ger/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 232067

CONSTRUCTION OF ROCK FILLS IN WINTER /IN GERMAN/

EXAMPLES OF EMBANKMENT-TYPE DAMS IN AUSTRIA, SWEDEN THE U.S.S.R., CZECHOSLOVAKIA AND EAST GERMANY ARE USED TO ILLUSTRATE THE PROBLEMS OF ROCK-FILLING IN WINTER, AND THE SOLUTIONS TO THESE PROBLEMS. THE EXAMPLES SHOW THAT ROCK FILLS CAN BE CONSTRUCTED IN FROSTY WEATHER IF HEAVY VIBRATING ROLLERS ARE USED. THE IMPORTANCE OF CONSTRUCTION SITE ORGANIZATION, CLEARANCE OF SNOW AND QUALITY SUPERVISION OF WINTER CONSTRUCTION IS EMPHASIZED. /FG/RRL/

Grossmann, S Hoffmann, H
Wasserwirtschaft-wassertechnik /Ger/

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 232071

CONSTRUCTION OF THE ELANSKER BOG EMBANKMENT WHICH FORMS PART OF THE TJUMEN-SURGUT RAILWAY /IN RUSSIAN/

THE CROSSING OF 6 KM OF THE ELANSKER BOG WAS CARRIED OUT IN WINTER 1966/67, AND TOOK 4 MONTHS. EXCAVATION OF THE PEAT BY DRAGLINE EXCAVATORS, FILLING OF THE FOOT OF THE EMBANKMENT, PUMPING OF WATER AND COMPACTION ARE DESCRIBED. THE EMBANKMENT WAS RE-COMPACTED AFTER THE THAW PERIOD, AND PROCTOR DENSITIES OF 0.93-0.95 WERE OBTAINED. THE EQUIPMENT USED IS DESCRIBED IN DETAIL. /FG/RRL/

Glyzin, AP
Transport'noe Stroitel'stvo /Ussr/

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 232082

SOIL STABILIZATION IN THE FEDERAL REPUBLIC OF GERMANY /IN GERMAN/

AN OUTLINE IS GIVEN OF THE DEVELOPMENT OF SOIL STABILIZATION SINCE THE 1930'S AND THE SUCCESSFUL APPLICATION OF THE MEASURE IN ROAD AND AIRFIELD CONSTRUCTION. PARTICULAR REFERENCE IS MADE TO THE STANDARD USE IN GERMANY OF TAR-STABILIZED SOILS UNDER RIGID PAVEMENTS AND CEMENT-STABILIZED SOILS UNDER FLEXIBLE PAVEMENTS. CONSTRUCTION METHODS BOTH IN AND OUTSIDE EUROPE ARE COMPARED TO ILLUSTRATE THE VERSATILITY OF SOIL STABILIZATION. /FG/RRL/

Buchholz, H *Strasse, Bruecke, Tunnel /Ger/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 232085

SOIL STABILIZATION WITH BITUMEN /IN GERMAN/

AN EXPLANATION IS GIVEN OF THE STANDARD LEAFLET SNV 640 506-"SOIL STABILIZATION WITH BITUMINOUS BINDERS" IN RELATION TO THE PERTINENT SECTIONS OF THE BASIC STANDARD SNV 640 500-"SOIL STABILIZATION-GENERAL." BITUMEN STABILIZATION UNDERTAKEN IN SWITZERLAND IS SURVEYED AND COMPARED WITH THE HOT MIX METHOD NORMALLY USED FOR SURFACING CONSTRUCTION. SPECIAL REFERENCE IS MADE TO THE VARIOUS TYPES OF SOIL AND BINDER. DATA ARE GIVEN ON THE USE OF BITUMEN-STABILIZED SOIL IN ROAD CONSTRUCTION. THE SUITABILITY TESTING OF THE CONSTRUCTION MATERIALS, ESTABLISHMENT OF BINDER CONTENTS, CHOICE OF LAYER THICKNESSES AND WORKING METHODS AND EQUIPMENT ARE DESCRIBED. /VSS/FG/RRL/

Bissegger, E *Strasse Und Verkehr /Switzerland/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 232101

FIELD TRIAL OF THE CONSTRUCTION OF A CEMENT-STABILIZED CHALK SUB-BASE BY THE MIX-IN-PLACE PROCESS

AN ACCOUNT IS GIVEN OF TRIALS MADE ON A.34 AT TIDBURY RING, HAMPSHIRE TO TEST THE FEASIBILITY OF THE MIX-IN-PLACE STABILIZATION PROCESS IN THE CONSTRUCTION OF CEMENT-STABILIZED CHALK SUB-BASES. THE EXPERIMENT SHOWED THAT, WITH THE SPECIAL SINGLE-PASS TYPE OF MACHINE EMPLOYED, A VERY LOW MIXING EFFICIENCY OF ABOUT 40 PER CENT WAS OBTAINED EVEN AFTER THREE PASSES. AS A RESULT THE STRENGTH OF THE MATERIAL WITH 14 PER CENT OF CEMENT WAS MUCH BELOW THE REQUIREMENTS OF THE CURRENT M. O. T. SPECIFICATIONS. IT IS THEREFORE CONCLUDED THAT THE MIX-IN-PLACE PROCESS IS NOT SUITABLE FOR THE CONSTRUCTION OF CEMENT-STABILIZED CHALK SUB-BASES FOR MAJOR ROAD WORKS. /RRL/AUTHOR/

Pocock, RG
Ministry of Transport, London /UK/

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 232120

PFA THE EVOLUTION OF A METHOD SPECIFICATION FOR COMPACTION

THE PROPERTIES AND THE TRIALS CARRIED OUT TO DETERMINE A COMPACTION METHOD SPECIFICATION FOR LAGOON ASH, A TYPE OF PULVERIZED FUEL ASH, ARE DESCRIBED. COMPACTION TESTS CARRIED OUT IN THE LABORATORY, TOGETHER WITH FIELD TRIALS NEAR BRISTOL DURING CONSTRUCTION OF MOTORWAYS M4 AND M5 ARE DESCRIBED. THE ADVANTAGES AND PROBLEMS OF USING THIS MATERIAL AS A LIGHTWEIGHT FILL ARE DISCUSSED. METHODS OF SOLVING PROBLEMS ENCOUNTERED DURING CONSTRUCTION ARE MENTIONED. THE ARTICLE CONTAINS A BRIEF DESCRIPTION OF THE USE OF THE MATERIAL AT THE ALMONDSBURY INTERCHANGE AND THE TRIAL EMBANKMENT AT AVONMOUTH. A METHOD SPECIFICATION FOR THE COMPACTION OF THIS TYPE OF PULVERISED FUEL ASH HAS NOW BEEN EVOLVED. /RRL/

Eyre, WA *Surveyor and Municipal Engineer /UK/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 232152

CAST-IN-SITU WALL TECHNIQUE USED DURING ROAD CONSTRUCTION WORKS IN PARIS /IN FRENCH/

THE APPLICATION IS DESCRIBED OF THE CAST-IN-SITU WALL TECHNIQUE TO (1) THE BUILDING OF THE BUTTRESSES OF THE CONCORDE BRIDGE AND WIDENING OF THE LATTER BY MEANS OF SEVEN ONE-METER THICK REINFORCED CONCRETE WALLS REACHING DOWN TO THE LEVEL OF THE FRESH WATER LIMESTONE IN WHICH THEY WERE ANCHORED BY MEANS OF PRESTRESSED RODS, AND (2) THE CONSTRUCTION OF THE WATER STORAGE CHAMBER OF THE BERCY INTERCHANGE. /LCPC/RRL/

Schneebeil, G *Construction, Paris /France/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 232158

THE CONSTRUCTION OF SOIL-CEMENT ROADBASES IN THE NORTHERN PART OF THE LUGANSK PROVINCE /IN RUSSIAN/

DETAILS ARE GIVEN OF SECTIONS OF ROAD WITH A 20 CM THICK SOIL-CEMENT BASE. LACK OF LOCAL ROADSTONE MATERIALS LED TO THE USE OF SOIL-CEMENT RESULTING IN LOW CONSTRUCTION COSTS (TWICE AS LOW AS FOR A ROADBASE BUILT WITH CRUSHED STONE AGGREGATES). THE CROSS SECTION OF THE PAVEMENT IS DESCRIBED TOGETHER WITH THE CHARACTERISTICS OF THE STABILIZED SOIL, LABORATORY TESTS, AND CONSTRUCTION METHODS. IN-SITU OBSERVATIONS SHOWED THAT THE TREATMENT SHOULD NOT BE INTERRUPTED FOR MORE THAN 50 MINUTES, AND VIBRATORY COMPACTION WAS BETTER THAN ANY OTHER FORM OF COMPACTION. AFTER TWO YEARS THE PERFORMANCE OF THESE SECTIONS IS QUITE SATISFACTORY. /LCPC/RRL/

Mel'man, MA *Avtomobil Nye Dorogi /Ussr/*

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 232216

UTILIZATION OF LOW COST MATERIALS IN AREAS DEFICIENT IN ROADSTONE

THE POTENTIAL IS DISCUSSED FOR THE USE OF CEMENT IN STABILIZING WASTE OR LOW GRADE MATERIALS TO PRODUCE A DIFFERENT MATERIAL WHICH IS STRONGER AND MORE DURABLE THAN THE ORIGINAL. THE CHARACTERISTICS, DESIGN AND TESTING OF CEMENTED MATERIALS ARE DISCUSSED AND GUIDANCE IS GIVEN ON THE DESIGN OF PAVEMENTS USING THESE MATERIALS. CONSTRUCTION METHODS ARE BRIEFLY ENUMERATED. TREATMENT OF A

NUMBER OF RAW MATERIALS USED WITH CEMENT, INCLUDING GRAVELS, SANDS LIMESTONE, CHALK, SHALE, PULVERIZED FUEL ASH, INDUSTRIAL WASTE, AND SOILS ARE INVESTIGATED. /RRL(A)/

Sharp, DR *Inst Hwy Engineers Journal, London /UK/*

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 232261

GROUTING OF SOIL. VOLUME 1: PRINCIPLES AND METHODS /IN FRENCH/

THE DEVELOPMENT OF GROUTING AS A CONSTRUCTION METHOD IS DISCUSSED. THEORETICAL CONSIDERATIONS BASED ON LABORATORY AND IN-SITU OBSERVATIONS ARE PRESENTED TOGETHER WITH A DESCRIPTION OF METHODS AND EQUIPMENT USED. /LCPC/RRL/

Cambefort, H
Eyrolles, Paris /France/

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 232282

MANUAL FOR THE HIGHWAY ENGINEER

CONTENTS: GENERAL INFORMATION ON ROADS, BORODACHEV, I. P. MATERIALS USED IN ROAD CONSTRUCTION, BORODACHEV, I. P. ELECTRICAL EQUIPMENT AND AUTOMATION OF ROAD CONSTRUCTION MACHINERY, POGARSKII, N. A. HYDRAULIC TRANSMISSION FOR ROAD CONSTRUCTION MACHINES, LEIKO, V. S. CABLE DRIVE, PLESHKOV, D. I. CALCULATION OF THE TRACTION OF EARTHMOVING EQUIPMENT, UL'YANOV, N. A. WHEELED TRAILERS AND CHASSIS, PLESHKOV, D. I. PORTABLE SCARIFIERS, YARKIN, A. A. BULLDOZERS, SCAPERS, MOTOR GRADERS, BORODACHEV, I. P. AND GOLISTEIN. GRADER-ELEVATORS, GARBUZOV, Z. E. SOIL COMPACTION MACHINES FOR SUBBASE AND SURFACINGS, BORODACHEV, I. P. AND VARGANOV, S. A. BITUMEN HEATING, PUMPING, TRANSPORT AND SPREADING EQUIPMENT; SOIL STABILIZATION EQUIPMENT; CONCRETE MIXERS; BITUMINOUS MIXERS; EQUIPMENT FOR THE DISTRIBUTION AND LAYING OF STONE MATERIALS AND BITUMEN-FILLER MIXTURES, GABER, M. R. AND KLIMEC, M. V. EQUIPMENT FOR THE PREPARATION OF SUBBASES UNDER CONCRETE SURFACINGS, KLEMENTEV, V. G. AND ESTRIN, M. I. EQUIPMENT FOR SPREADING, LAYING, AND LEVELING CONCRETE SURFACINGS, KLEMENTEV, V. G. AND ESTRIN, M. I. EQUIPMENT FOR SUMMER MAINTENANCE, KLEMENTEV, V. G. EQUIPMENT FOR WINTER MAINTENANCE, SALMAN, D. A. CALCULATION OF THE TECHNICAL AND ECONOMIC OUTPUT OF CONSTRUCTION MACHINERY. TESTING OF EQUIPMENT, BORODACHEV I. P. SPARE PARTS, PRUSSAK, B. N. /TRRL/

1965, 723 pp, 371 Fig, 380 Tab, 8 Phot

3A 232284

STUDY OF EMBANKMENTS ON COMPRESSIBLE SOIL. RECOMMENDATIONS FROM THE "LABORATORIE DES PONTS ET CHAUSSEES" /IN FRENCH/

FOLLOWING A DEFINITION OF COMPRESSIBLE SOIL, DETAILS ARE GIVEN OF GEOTECHNICAL SURVEY METHODS AND EQUIPMENT FOR GENERAL AND DETAILED STUDIES OF STABILITY AND SETTLEMENT MEASUREMENTS AND OBSERVATIONS DURING AND AFTER THE CONSTRUCTION OF AN EMBANKMENT ON COMPRESSIBLE SOIL. DIFFERENT CONSTRUCTION METHODS ARE GIVEN FOR EMBANKMENTS ON SOFT SOIL. /TRRL/

Dunod, Paris /France/ 1971, 216 pp, Figs, Tabs, Photos, Refs

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 232337

SOIL ANCHORS

FOLLOWING A NOTE ON THE BACKGROUND TO RECENT INJECTION ANCHOR DEVELOPMENTS IN THE UK, THE MAIN

APPLICATIONS ASSOCIATED WITH PRESTRESSED SOIL ANCHORS ARE DESCRIBED. THE TYPE OF SITE INVESTIGATION AND THE SOIL PROPERTIES REQUIRED TO FACILITATE ANCHORAGE DESIGN AND CHOICE OF CONSTRUCTION TECHNIQUE ARE THEN DISCUSSED. AS A RESULT OF TESTING SOIL ANCHORS TO FAILURE EMPIRICAL DESIGN RULES ARE PRESENTED WHICH RELATE ULTIMATE LOAD HOLDING CAPACITY TO LOCAL SOIL PROPERTIES AND ANCHOR DIMENSIONS, FOR COARSE SANDS AND GRAVELS, FINE TO MEDIUM SIZED SANDS, STIFF CLAY, STIFF TO HARD CHALK AND KEUPER MARL. SAFETY FACTORS WHICH ARE APPLIED TO THESE RULES ARE INCLUDED TOGETHER WITH RECOMMENDATIONS FOR THE POST-TENSIONING AND TESTING OF INDIVIDUAL ANCHORS. DATA ON THE LONG-TERM BEHAVIOR OF SOIL ANCHORS IS LIMITED, BUT PRESTRESS LOSSES DUE PRIMARILY TO FIXED ANCHOR DISPLACEMENT ARE LISTED FOR GUIDE PURPOSES WHEN ESTIMATING REALISTIC OVERLOADS. CORROSION PROTECTION IS DISCUSSED IN RELATION TO FULLY RESTRESSABLE CABLES FOR TEMPORARY AND PERMANENT WORKS. FINALLY, THE IMPORTANCE OF PULL-OUT TESTS IS EMPHASIZED TOGETHER WITH FIELD OBSERVATIONS OF ANCHORAGE PERFORMANCE, WHERE THESE FIELD DATA ARE RELATED TO THE ORIGINAL DESIGN CRITERIA. /RRL(A)/

Littlejohn, GS *Inst Civil Engineers Proc, London /UK/*

ACKNOWLEDGMENT: Rrl Reports, Road Research Lab /UK/

3A 232339

LATERAL SUPPORT OF DEEP EXCAVATIONS

THE DEVELOPMENT OF CONSTRUCTION METHODS FOR SUPPORTING DEEP EXCAVATIONS IS BRIEFLY REVIEWED. CURRENT DESIGN METHODS ARE DESCRIBED FOR CALCULATING THE EARTH PRESSURE ON SHEETED EXCAVATIONS. THESE PRESSURES DEPEND ON THE TIME OVER WHICH THE EXCAVATION MUST REMAIN OPEN AND IN SUPPORT CONDITION AND THE AMOUNT OF LATERAL YIELDING OF THE SUPPORTS WHICH CAN BE TOLERATED. THE AMOUNT OF YIELDING IS REFLECTED IN THE SETTLEMENT OF THE GROUND SURFACE AROUND THE EXCAVATION. CURRENT CONSTRUCTION PRACTICES, INCLUDING SUPPORT BY SHEET PILING, TIMBER SHEETING, CAST IN SITU DIAPHRAGM WALLING AND CONTIGUOUS BORED PILES. THE EFFICACY OF GROUND-TREATMENT PROCESSES INCLUDING GROUT INJECTIONS AND GROUNDWATER LOWERING IS MENTIONED. /RRL/

Tomlinson, MJ *Inst Civil Engineers Proc, London /UK/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 232340

PRODUCTION, CONSTRUCTION TIME AND CONSTRUCTION COSTS RELATED TO EARTHMOVING OPERATIONS

AN EFFORT WAS MADE TO DETERMINE PRODUCTION CURVES FOR EARTH MOVING EQUIPMENT, I.E. THE PRODUCTION IN CUBIC METERS PER HOUR FOR VARIOUS SOILS AS A FUNCTION OF HAUL DISTANCE AND TO DETERMINE COST CURVES FOR THE SAME EQUIPMENT, REPRESENTING COSTS FOR MOVING ONE CUBIC METER OF VARIOUS SOILS OVER A GIVEN DISTANCE. THESE CURVES SHOULD BE USED AS FOLLOWS: (1) TO EVALUATE THE DIFFERENCE IN EARTHMOVING COSTS FOR ALTERNATIVE LONGITUDINAL PROFILES; (2) TO ESTABLISH THE DURATION OF A GIVEN JOB FOR A GIVEN TYPE OF EQUIPMENT, OR TO ESTIMATE THE EQUIPMENT NECESSARY WHEN CONSTRUCTION TIME IS GIVEN; AND (3) TO ESTIMATE THE TECHNICAL COSTS OF EARTHMOVING AND COMPACTION. /RRL/

Schacke, I *Plng Transp Res & Computation Proc /UK/*

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 232356

HIGHWAYS EARTHWORKS FEATURE

SIX AUTHORS REVIEW ASPECTS OF THE DESIGN AND PRACTICE OF EARTHWORKS, SOIL MECHANICS, RECENT EARTH-

WORKS PROJECTS, AND EARTHMOVING METHODS. TITLES AND AUTHORS ARE AS FOLLOWS: EARTHWORKS ON MOTORWAYS FROM THE VIEWPOINT OF THE DESIGN ENGINEER, E. J. ARROWSMITH. EARTHWORKS AND THE SPECIALIST CONTRACTOR, D. HAMPTON. EARTHMOVING PROBLEMS ON CONTRACTS C6 AND C7, MIDLAND LINKS MOTORWAYS, K. A. STEUART. SITE INVESTIGATION OR LOOK BELOW BEFORE YOU BUILD, J. C. FINNEGAN. SIZING HAULING EQUIPMENT TO GET MAXIMUM PRODUCTIVITY, R. C. GESSEL. SELECTION OF CORRECT TIRE TREAD FOR EARTHMOVER OPERATIONS, B. MCKINLEY. /TRRL/

Highways and Traffic Engineering /UK/ Vol. 39 No 1736/7, Apr. 1971, pp 18-37, Figs, Photos

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 232379

USE OF LIME STABILIZED MOORUM IN THE SCIENTIFIC CONSTRUCTION OF AN AIRFIELD WITH A VIEW TO EFFECTING ECONOMY

THE CONSTRUCTION OF AN AIRFIELD AT KHAJURAH, ACCORDING TO SPECIFICATIONS PROPOSED BY THE CENTRAL ROAD RESEARCH, NEW DELHI, IS DESCRIBED: LOCALLY AVAILABLE MOORUM, STABILIZED WITH LIME IN THE LOWER LAYERS WAS USED FOR ALMOST 2/3 OF THE PAVEMENT THICKNESS. THIS METHOD OF CONSTRUCTION RESULTED IN CONSIDERABLE SAVINGS IN COST, COMPARED WITH CONVENTIONAL METHODS. /RRL/

Uppal, HL Wason, OP *Indian Roads Congress Road Res Bull* No. 14, 1970, pp 101-18, 4 Fig, 4 Tab

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 232453

STABILIZATION OF SOILS WITH LIME, LIME-FLYASH, AND OTHER LIME REACTIVE MATERIALS

DESIRABLE TESTING AND CONSTRUCTION TECHNIQUES ARE REPORTED TO BE USED FOR CONSTRUCTION OF SUCCESSFUL LIME STABILIZATION PROJECTS. THE REPORT DISCUSSES THE HISTORY OF THE PROCESS, THE COMPOSITION AND CHARACTERISTICS OF THE LIMES USED, AND THE TYPES OF LIME STABILIZATION GENERALLY USED. A BRIEF DISCUSSION OF SOME OF THE CHEMICAL REACTIONS EXPLAINS WHY AND HOW LIME CHANGES PHYSICAL CHARACTERISTICS OF SOILS. A PORTION OF THE REPORT PERTAINS TO TESTING OF MIXTURES AND TO INTERPRETATION OF TEST RESULTS. DISCUSSION OF CONSTRUCTION PRACTICE COVERS SUCH SUBJECTS AS APPLICATION OF LIME, MIXING, COMPACTING, CURING, AND REWORKING. RECOMMENDATIONS WITH REGARD TO THESE PRACTICES AND THEIR RELATIONSHIP TO CRACKING AND PERMANENCE ARE MADE. A NUMBER OF TESTS TO BE MADE SUBSEQUENT TO CONSTRUCTION ARE SUGGESTED AND THE BENEFITS OF LIME AS A STABILIZER AND OF PROPERLY CONSTRUCTED LIME STABILIZED PROJECTS ARE SUMMARIZED. /AUTHOR/

Mcdowell, C *Highway Research Board Bulletin*

3A 232456

FIELD STUDIES TO DETERMINE THE VALUE OF CALCIUM CHLORIDE FOR COMPACTION OF SOILS

FIELD INVESTIGATIONS ARE UNDERWAY IN VIRGINIA AND ALABAMA TO STUDY CONSTRUCTION METHODS, DURABILITY, AND PERFORMANCE, AS WELL AS DENSITY, MOISTURE, COMPACTIVE EFFORTS AND STRENGTH OF SAND-CLAY BASE MATERIALS STABILIZED WITH CALCIUM CHLORIDE. TEST SECTIONS WERE CONSTRUCTED WITH A 10-INCH STABILIZED SAND-CLAY BASE AND A TWO COAT ASPHALT WEARING SURFACE. EXPERIMENTAL SECTIONS OF THE BASE MATERIAL WERE BROUGHT UP TO APPROXIMATE GRADE AND PROFILE. THE DESIGNATED AMOUNT OF CALCIUM CHLORIDE WAS THEN SPREAD UNIFORMLY OVER THE TWO TREATED SECTIONS. IT WAS THOROUGHLY MIXED WITH THE TOP 5 INCHES,

COMPACTED DEPTH, BY MEANS OF A SCARIFIER AND A SEAMAN PULVIMIXER. COMPACTION FOLLOWED MIXING. EIGHTEEN DAYS AFTER CONSTRUCTION THE ASPHALT WEARING SURFACE WAS PLACED. DURING THESE 18 DAYS THE ROAD WAS OPEN TO TRAFFIC. MAINTENANCE DURING THIS PERIOD CONSISTED OF A LIGHT BLADING AND THE ADDITION OF WATER TO THE UNTREATED SECTION FOR LAYING DUST. DENSITY MEASUREMENTS WERE MADE AT 1, 5, 7 AND 15 DAYS, FOLLOWING CONSTRUCTION AND ARE NOW BEING MADE EVERY 30 DAYS. OTHER MEASUREMENTS MADE BEFORE SURFACE TREATMENT INCLUDED PH-VALUES OF THE BASE MATERIALS, CALCIUM CHLORIDE CONTENTS OF ROADWAY SAMPLES, SURFACE ROUGHNESS AND STRENGTH MEASUREMENTS. FOR DETERMINING STRENGTHS, THE BURGGRAF SHEAR APPARATUS WAS ADOPTED.

Theuer, AU *Highway Research Board Bulletin*

3A 232472

SALT FOR ROAD STABILIZATION

METHODS ARE DESCRIBED FOR USING SALT TO STABILIZE ROADWAYS. CASE HISTORIES ARE PRESENTED FROM STATE AND LOCAL AGENCIES THAT HAVE USED SALT TO PROVIDE A FIRM, DENSE ROADBASE PRIOR TO PAVING OR PLACING A SEAL COAT. A COMPANION EIGHT-PAGE SPECIFICATION MANUAL TELLS HOW TO SELECT AGGREGATES, EQUIPMENT AND CONSTRUCTION METHODS FOR SALT STABILIZATION. GRADATION RECOMMENDATIONS FOR THE GRAVEL, CRUSHED STONE OR SLAG USED IN SALT-STABILIZED BASE OR SHOULDER CONSTRUCTION ARE LISTED. THE MOISTENING, MIXING AND COMPACTING EFFORTS NEEDED FOR OPTIMUM RESULTS ARE DESCRIBED.

Salt Institute

ACKNOWLEDGMENT: Highway Research News, Hwy Res Board

3A 232503

USE OF EMULSIFIED ASPHALT IN BASE STABILIZATION

STABILIZED SANDS ARE BEING USED FOR SUBBASE, BASE COURSE, AND ASPHALT SURFACE COURSE IN COLORADO. MC-AND RC-CUTBACK ASPHALTS, ASPHALT CEMENT OF VARIOUS PENETRATION GRADES, EMULSIFIED ASPHALTS, PORTLAND CEMENT AND HYDRATED LIME ARE BEING USED AS STABILIZING AGENTS. SINCE EMULSIFIED ASPHALT HAS BECOME AVAILABLE TO PLANTS IN COLORADO, THE LARGEST VOLUME OF SAND STABILIZATION IS OF THIS TYPE. THE LARGEST SINGLE USE HAS BEEN FOR STABILIZATION OF DUNE SAND FOR SUBBASE UNDER PORTLAND CEMENT CONCRETE PAVEMENT. FOR THIS PURPOSE, THE STABILIZED MATERIAL MUST NOT ONLY BE CAPABLE OF SERVING AS A SUBBASE UNDER THE COMPLETED PAVEMENT, BUT MUST ALSO BE CAPABLE OF SUPPORTING THE SLIP-FORM PAVER, THE HEAVILY LOADED BATCH TRUCKS, AND OTHER EQUIPMENT USED DURING CONSTRUCTION OPERATIONS. CONSTRUCTION METHODS ARE REVIEWED. IT IS CONCLUDED THAT THE USE OF EMULSIFIED ASPHALT HAS ENABLED ECONOMIC UTILIZATION OF LOCAL SANDS AS BASE COURSE FOR ASPHALT SURFACING, AND AS SUBBASE FOR PORTLAND CEMENT CONCRETE PAVEMENT.

Lowrie, CR
Colorado University

3A 232523

DESIGN AND CONSTRUCTION OF BASE COURSES

BASE COURSES IN FLEXIBLE PAVEMENT STRUCTURES THAT MUST CARRY HEAVY TRAFFIC REQUIRE CERTAIN IMPORTANT CONSIDERATIONS IN THEIR DESIGN AND CONSTRUCTION THAT ARE OFTEN NEGLECTED. THE THICKNESSES OF THESE BASES ARE 8 INCHES TO 16 INCHES, DEPENDING UPON THE TYPE OF SUBGRADE ON WHICH THEY REST, WHICH INTRODUCES A COMPACTION PROBLEM. IF THE BASES ARE NOT SUFFICIENTLY COMPACTED, ROUGH PAVEMENTS OR EVEN FAILURES WILL BE THE RESULT. IT IS ALSO IMPORTANT

THAT DURING THE CONSTRUCTION OF BASE COURSES EACH LAYER BE DENSE IN ORDER THAT WATER FROM RAINS WILL NOT SOFTEN THE SUBGRADE. THIS DENSENESS IS DEPENDENT UPON THE GRADING OF THE MATERIAL AND ITS DEGREE OF COMPACTION. THE USE OF CALCIUM CHLORIDE IN THE CONSTRUCTION OF THESE BASES HAS PROVEN VERY ADVANTAGEOUS. CALCIUM CHLORIDE ALSO FUNCTIONS AS AN ANTIFREEZE IN THESE BASE COURSES WHICH IS CONSIDERED AN IMPORTANT ADVANTAGE IN ITS USE. THIS PAPER DEALS WITH THE NORTH CAROLINA EXPERIENCE IN DESIGNING AND CONSTRUCTING BASE COURSES THAT ARE SERVING AS A PART OF HEAVY DUTY PAVEMENTS. THE SELECTION, PREPARATION, AND PLACEMENT OF BASE COURSE MATERIALS ARE DISCUSSED AS WELL AS CERTAIN EQUIPMENT USED IN THEIR COMPACTION. THE ADVANTAGES OF 'STAGE CONSTRUCTION' ARE DISCUSSED AND CERTAIN IMPORTANT CONSIDERATIONS NECESSARY IN USE OF THIS PROCEDURE ARE MENTIONED. /AUTHOR/

Hicks, LD *Highway Research Board Bulletin*

3A 232623

ROADBUILDING AROUND THE WORLD

CERTAIN ASPECTS OF ROADBUILDING ARE DESCRIBED IN JAPAN, SCOTLAND, NIGERIA, WEST BERLIN AND WEST GERMANY. JAPAN'S POOR SOIL CONDITIONS REQUIRE SOME KIND OF SOIL REHABILITATION. A COMBINATION OF SAND AND PAPER DRAINS IS BEING USED TO STABILIZE SUB-SOIL FOR A NEW ROADWAY. IN SCOTLAND TWIN DUAL-LANE BRIDGES ACROSS THE RIVER CLYDE IN GLASGOW ARE BUILT AS PRESTRESSED CONCRETE CANTILEVERS. SPECIAL COMPOSITE PILES OF STEEL PIPE FILLED AND TOPPED WITH CONCRETE ARE USED IN NIGERIA AS SUPPORT PIERS FOR THE NEW BRIDGE NOW UNDER CONSTRUCTION IN LAGOS. IN WEST BERLIN MODULAR STEEL OVER-PASS SPANS DROP INTO PLACE FOR A TEMPORARY TRAFFIC-RELIEF STRUCTURE. A NEW LINK IN THE AUTOBAHN SYSTEM IS BEING CONSTRUCTED USING AN ORTHOTROPIC STEEL BRIDGE TO CARRY TRAFFIC OVER THE WATERS OF THE NECKAR.

Construction Methods & Equipment

3A 232633

PRESSURE-INJECTED FOOTINGS CARRY EXPRESSWAY VIADUCT

THE FRANKI SYSTEM DEVELOPED 55 YEARS AGO IN BELGIUM IS A PRESSURE-INJECTION METHOD OF CONSTRUCTING PILE FOOTINGS. THE FRANKI PRESSURE INJECTED FOOTING CONSISTS OF A CYLINDRICAL CONCRETE SHAFT WITH GLOBE-SHAPED EXTRUSION OF CONCRETE BENEATH. THE METHOD SERVES BEST IN SAND OR GRAVEL SOIL IN WHICH THE INJECTED FOOTING CAN DEVELOP HIGH RESISTANCE THROUGH COMPACTION OF THE SOIL. A HEAVY STEEL TUBE IS USED TO REACH THE REQUIRED SHAFT DEPTH. THE TUBE IS PULLED INTO THE GROUND BY BLOWS OF A DROP HAMMER STRIKING A PLUG OF DRY CONCRETE OR GRAVEL IN THE BOTTOM OF THE TUBE. WHEN THE TUBE HAS REACHED THE DESIRED STRATA, THE PLUG IS EJECTED INTO THE UNDERLYING SOIL BY DROP HAMMER BLOWS WHILE HOLDING THE TUBE FROM FURTHER DESCENT. THE ZERO-SLUMP CONCRETE IS THEN RAMMED INTO THE SOIL WITH HIGH-ENERGY BLOWS CREATING A BELLED-OUT-PRESSURE-INJECTED FOOTING. THIS METHOD WAS USED IN AN EXPRESSWAY VIADUCT PROJECT IN NEW YORK CITY AND FOR 434 PILES UNDER A 300-FOOT ELEVATED SECTION OF QUEBENS MID-TOWN EXPRESSWAY. THE FRANKI METHOD HAS GAINED ACCEPTANCE BECAUSE IT DOES NOT WEAKEN THE SOIL BY DEWATERING OR EXCAVATION BUT STRENGTHENS IT BY COMPACTION TO A UNIFORM DEGREE THROUGHOUT A SITE. THE FOOTING IS MADE IN SUCH A WAY THAT IT IS HIGHLY RESISTANT AT POINT OF LOAD APPLICATION WITH RESISTANCE DECREASING GRADUALLY IN ALL DIRECTIONS UNTIL REACHING THE NATURAL RESISTANCE OF THE SURROUNDING SAND OR GRAVEL.

Roads and Streets

3A 232657

STABILIZATION OF SETTLING AND WEAK CLAYEY SOILS BY THERMAL TREATMENT

A METHOD FOR THE THERMAL STABILIZATION OF SETTLING LOESS AND OTHER SOILS OF POROUS STRUCTURE IS PRESENTED. THIS METHOD HAS BEEN SUCCESSFULLY APPLIED IN PRACTICAL CONSTRUCTION WORK. IT INVOLVES BURNING VARIOUS FUELS IN THE SOIL BEING TREATED, A PROCESS OF COMBUSTION TAKING PLACE IN SEALED BORE HOLES WITH CONTROL OF THE TEMPERATURE AND CHEMICAL COMPOSITION OF THE COMBUSTION PRODUCTS. HEATING OF THE SOIL TO A TEMPERATURE HIGH ENOUGH TO CAUSE THE NECESSARY CHANGES IN THE SOIL CHARACTERISTICS IS ACHIEVED MAINLY BY INFILTRATION OF THE COMPRESSED HEATED AIR OR OF THE INCANDESCENT PRODUCTS OF COMBUSTION THROUGH THE PORES IN THE SOIL. BY USING THE THERMAL METHOD OF CONSOLIDATION THE SETTLING PROPERTIES OF LOESS SOILS CAN BE ENTIRELY ELIMINATED TO A DEPTH OF 10-15 METERS BELOW THE FOOTING BASE WHILE THE LOAD BEARING CAPACITY OF THESE SOILS IS GREATLY INCREASED. THERMAL TREATMENT OF SOILS IS RECOMMENDED TO: (1) CONSOLIDATE LOESS SOILS IN THE FOUNDATIONS OF IMPORTANT RESIDENTIAL AND INDUSTRIAL BUILDINGS, (2) ELIMINATE THE POSSIBILITY OF FAILURES OF VARIOUS EXISTING BUILDINGS AND STRUCTURES DUE TO EXCESSIVE DIFFERENTIAL SETTLEMENT, AND (3) PREVENT LANDSLIDES AND MANY OTHER CAUSES OF FAILURES. THERMAL-CHEMICAL TREATMENT OF SOILS IS ENABLED BY MEANS OF THE HOT GASEOUS PRODUCTS OF COMBUSTION TO WHICH SPECIAL CHEMICALS ARE ADDED, IF NECESSARY. THE USE OF GASEOUS FUEL IS EFFECTIVE FOR MORE EVEN HEATING AND TEMPERATURE CONTROL IN THE BORE HOLE. THE HEAT TRANSFER FROM THE HOT GASES IN THE BORE HOLE TO THE SOIL MASS IS ACHIEVED BY: FILTRATION OF THE AIR AND INCANDESCENT GASEOUS PRODUCTS OF COMBUSTION THROUGH THE PORES OF THE SOIL TO BE CONSOLIDATED, AND BY DIRECT TRANSMISSION OF HEAT DUE TO TEMPERATURE DIFFERENCE AND THE CONTACT BETWEEN THE HEAT SOURCE AND THE SURFACE OF THE SOIL. SETTLING LOESS SOILS WHEN SUBJECTED TO THERMAL TREATMENT CHANGE THEIR PHYSICO-MECHANICAL PROPERTIES BY: (1) ABILITY TO SETTLE AND TO BE WETTED ARE ENTIRELY ELIMINATED, (2) COHESION, COMPRESSIVE AND SHEAR STRENGTHS ARE GREATLY INCREASED, (3) SETTLEMENT UNDER AN APPLIED LOAD WHEN THE GROUND IS WET IMMEDIATELY CEASES, AND (4) COLOR CHANGES FROM NATURAL PALE YELLOW TO VARIOUS SHADES OF RED. APPLICATION OF THE THERMAL METHOD OF CONSOLIDATION IS DESCRIBED.

Litvinov, IM *Highway Research Board Special Reports*

3A 232758

THE USE OF VOLCANIC CINDERS FOR LOW CLASS ROADS
EXISTING USES ARE REVIEWED OF VOLCANIC CINDERS FOR LOW-CLASS ROAD CONSTRUCTION, ESPECIALLY IN THE FORM OF A WEARING SURFACE. BASIC GEOLOGICAL INFORMATION IS PRESENTED REGARDING THE PROPERTIES OF VOLCANIC CINDERS, THE TYPES OF DEPOSITS AND THEIR COMMON LOCATIONS THROUGHOUT THE WORLD. THE USE OF THIS MATERIAL IN FOREIGN COUNTRIES IS REVIEWED INCLUDING NEW ZEALAND, GRENADA, AND GUATAMALA. CURRENT USAGE IN STATE FEDERAL ORGANIZATIONS ARE DISCUSSED TOGETHER WITH THEIR RESULTS AND RECOMMENDATIONS. SINCE ONE OF THE PRINCIPLE AGGREGATE MATERIALS IN CENTRAL OREGON AND NORTHERN CALIFORNIA IS VOLCANIC CINDERS, SPECIAL EMPHASIS IS GIVEN TO THE EXPERIENCES OF REGION 5 AND 6 OF THE U.S. FOREST SERVICE; OREGON STATE HIGHWAY DEPARTMENT; KLAMATH COUNTY, OREGON; LASSEN COUNTY, CALIFORNIA AND PRIVATE LOGGING FIRMS IN THE AREA. A SUMMARY OF PRESENT PREFERRED CINDER TYPES WITH ACCEPTABLE ROAD CONSTRUCTION PROCEDURES IS GIVEN. A BRIEF OUTLINE OF A CURRENT U.S. FOREST SERVICE STUDY, INCLUDING

ING A LOW-CLASS ROAD RATING SYSTEM RELATED TO LABORATORY TESTS AND FIELD QUALITY CONTROL OF VOLCANIC CINDERS IS PRESENTED. /AUTHOR/

Lund, JW Hendrickson, LG *Eng Geol & Soils Eng Symp Proc, Boise*

3A 232773

BRIDGE APPROACH DESIGN AND CONSTRUCTION PRACTICES

A THOROUGH LITERATURE SEARCH WAS CONDUCTED OF ALL PERTINENT PUBLICATIONS AND INTERVIEWS HELD WITH HIGHWAY PERSONNEL IN ANALYZING ALL INFORMATION ON CURRENT PRACTICES, PLANS, SPECIFICATIONS, MANUALS AND RESEARCH RECOMMENDATIONS ON BRIDGE APPROACH DESIGN AND CONSTRUCTION. SOIL, DESIGN CONSTRUCTION, AND MAINTENANCE ENGINEERS MUST CONSIDER THEMSELVES JOINTLY RESPONSIBLE FOR EFFORTS TO ELIMINATE ROUGH BRIDGE APPROACHES. MOST BRIDGE APPROACH PROBLEMS CAN BE MINIMIZED DURING THE DESIGN AND CONSTRUCTION BY ADEQUATE CONSIDERATION OF: (1) FOUNDATION CONDITIONS, (2) THE REMOVAL OF UNSUITABLE MATERIAL, (3) THE INSTALLATION OF SPECIAL DRAINS, (4) EMBANKMENT HEIGHT, MATERIAL, AND CONSTRUCTION METHODS, (5) SURCHARGES AND/OR WAITING PERIODS, (6) SUBGRADE, SUBBASE, AND BASE MATERIAL, (7) ABUTMENT TYPE, SUPPORT, DRAINAGE, AND BACKFILL, AND (8) SPECIAL APPROACH SLABS. EACH OF THESE CONSIDERATIONS ARE DISCUSSED, HOWEVER, CONSTRUCTION AND MAINTENANCE COSTS MUST ALSO AFFECT THE FINAL DESIGN. A SYSTEMS STUDY THAT WEIGHS PREVENTIVE COSTS, DRIVER BENEFITS, AND PROJECTED MAINTENANCE EXPENDITURES MAY ENABLE THE ENGINEER TO SELECT THE MOST FEASIBLE DESIGN.

Hrb Nchrp Synthesis of Hwy Practice

3A 232775

STABILIZATION OF SOILS WITH INORGANIC SALTS AND BASES: A REVIEW OF THE LITERATURE

AN ANNOTATED BIBLIOGRAPHY IS PRESENTED OF THE IMPORTANT LITERATURE ON SOIL AND AGGREGATE STABILIZATION WITH INORGANIC SALTS AND BASES PUBLISHED PRIOR TO 1965. IN ALL, APPROXIMATELY 70 REFERENCES OF THE 800 TO 1,000 AVAILABLE HAVE BEEN REVIEWED, AMONG WHICH ARE SEVERAL BIBLIOGRAPHIES PROVIDING ADDITIONAL REFERENCES. FROM THE MORE INFORMATIVE REFERENCES, THE AUTHORS HAVE ATTEMPTED TO SUMMARIZE INFORMATION ON STABILIZER PROPERTIES, MECHANICS OF STABILIZATION, PROPERTIES OF THE STABILIZED SOIL, CONSTRUCTION METHODS, FIELD RESULTS, AND THE USE OF SECONDARY ADDITIVES. PARTICULAR ATTENTION IS DEVOTED TO STABILIZATION WITH SODIUM CHLORIDE, AND SODIUM HYDROXIDE, WHICH ARE THE ONLY SALTS AND BASES THAT HAD BEEN EVALUATED SUFFICIENTLY TO DRAW MEANINGFUL CONCLUSIONS. /AUTHOR/

Thornburn, TH Mura, R *Highway Research Record, Hwy Res Board*

3A 232787

LIME-SOIL STABILIZATION: DEEP PLOW STYLE

LIME FOR STABILIZATION OF FINE-GRAIN SOIL WAS RIPPED INTO THE SUBGRADE TO 24-IN. DEPTH BY A NEW TECHNIQUE. INTERSTATE 180 NEAR PRINCETON IN BUREAU COUNTY, ILLINOIS, WAS CONSTRUCTED IN AN AREA WHERE 8-10 FT. OF LOESS OVERLIES WISCONSINAN TILL MATERIAL. THE CONSTRUCTION OPERATING SEQUENCE USED WAS: (1) BRING AREA TO PROPER LINE AND GRADE, (2) DISC THE BRIDE, (3) DISTRIBUTE LIME (3 PERCENT BY DRY WEIGHT OF SOIL) UNIFORMLY ON THE GRADE, (4) DISC LIME INTO UPPER 8-10 IN. OF THE GRADE, (5) PLOW TO 24-IN. DEPTH, (6) DISC PLOWED MATERIAL TO 8-10 IN. DEPTH, (7) SHAPE MIXTURE TO PROPER CROSS-SECTION AND GRADE, AND (8) COMPACT THE PROCESSED MIXTURE IN ONE LIFT. THE CONSTRUCTION PROCEDURE RESULTED IN A GOOD DISTRIBUTION OF THE LIME THROUGHOUT THE ENTIRE 24-IN. DEPTH. FIELD DENSITY

TESTS INDICATED THAT ADEQUATE COMPACTION WAS OBTAINED THROUGHOUT THE FULL DEPTH OF THE LAYER. BENKELMAN BEAM DEFLECTION MEASUREMENTS ON TREATED AND UNTREATED SECTIONS OF THE GRADE SHOW THE EFFECTIVENESS OF THE DEEP-PLOW LIME STABILIZATION. DEEP-PLOW LIME STABILIZATION WAS SHOWN TO EFFECTIVELY AND ECONOMICALLY IMPROVE IN-SITU GRADES. IN MANY SITUATIONS, DEEP-PLOW LIME CAN BE CONSIDERED AS AN ALTERNATE SOLUTION TO THE COMMON PRACTICE OF UNDERCUTTING AND BACKFILLING. A THOROUGH EVALUATION OF INDIVIDUAL JOB CONDITIONS IS REQUIRED TO DETERMINE THE APPROPRIATENESS OF THE DEEP-PLOW LIME TECHNIQUE AND THE REQUIRED THICKNESSES OF STABILIZATION.

Thompson, MR *Roads and Streets*

3A 232815

DISCUSSION OF FIELD STUDIES OF RESPONSE OF PEAT TO PLATE LOADING

THE DISCUSSER ADDS TO THE LIST OF THREE CONSTRUCTION METHODS ABOVE PEAT, THE TECHNIQUE OF CONTROLLED COMPACTED FILLS EITHER IMMEDIATELY UPON THE MOSS SURFACE MAT IF ADDITIONAL HEIGHT OF FOOTING PLACEMENT IS NO FACTOR, OR, IF IT IS, EXCAVATING A MINIMUM DEPTH OF THE PEAT AND PLACING CONTROLLED COMPACTED FILL UPON IT. IT IS ALSO SUGGESTED THAT THE AUTHORS MIGHT CONSIDER USING A MODIFIED OEDOMETER WHEREIN THE POROUS UPPER DISC IS SMALLER IN DIAMETER THAN THE RING, NECESSITATING A WELDED BRASS DOUGHNUT ON TOP OF THE RING THUS SIMULATING THE PLATE LOAD TESTS MADE IN THE FIELD AND PERMITTING A MEASURE OF THE EFFECT OF YIELDING OF THE PEAT AROUND THE PERIMETER OF THE PLATE. REFERENCES: FIELD STUDIES OF RESPONSE OF PEAT TO PLATE LOADING, J.B. FORREST, I.C. MACFARLANE, ASCE PROC. PAPER 6652, JULY 1969.

Lopinto, VJ DISCUSSER *Am Soc Civil Engr J Soil Mech Div*

HRIS 1P62 206460, 1P62209546

3A 232819

'MOLE' KEEPS TRAFFIC ON THE MOVE

THE 'MOLE' IS A LARGE-BORE HORIZONTAL DRILLING MACHINE BEING USED ON A DRAINAGE SYSTEM CONSTRUCTION PROJECT FOR A TULSA, OKLAHOMA, CROSSTOWN EXPRESSWAY. THE ALTERNATIVE TO USING THE EQUIPMENT WAS TO DIG AN OPEN TRENCH 25 FEET DEEP WHICH WOULD HAVE DESTROYED TREES, DEPOSITED HUGE MOUNDS OF DIRT IN YARDS, BROKEN UP A 22-FOOT-WIDE ROAD, AND BLOCKED THREE OTHER BUSY ROADS AT INTERSECTIONS. IN OVERALL SIZE, THE DRILL IS 22 FEET LONG, 6 FEET SQUARE, AND WEIGHS 65,000 POUNDS; THE DRILL FACE HAS 18 CUTTING FACES AND IS 9 1/2 FEET IN DIAMETER. IT IS POWERED BY A 400 HP DIESEL ENGINE. MOVEMENT IS SNAKE-LIKE, I.E. THE INNER FRAME WHICH CARRIES THE DRILL EXTENDS, AND THE OUTER FRAME THEN CREEPS FORWARD ON SUPPORT LEGS TO CATCH UP. THE MACHINE USES LASER BEAMS AND TARGETS TO SET VERTICAL AND HORIZONTAL GUIDES FOR CONTROL OF GRADE ALIGNMENT. AS THE UNIT MOVES THROUGH THE GROUND, THE SPOIL FROM THE DRILL HEAD IS CARRIED UP TO A CONVEYOR BELT, MOVED TO THE REAR AND DUMPED INTO CARTS ON A NARROWGAGE RAILROAD. PROBLEMS ENCOUNTERED INCLUDED VENTILATION PROBLEMS, GEAR REDUCTION FROM MOTOR TO DRILLHEAD, CAVE-INS IN THE TUNNEL, OVERHEATING, AND NEED TO SHORE UP THE TUNNEL INSTEAD OF PUSHING IN STEEL PIPE BEHIND THE DRILL. AFTER 240 FEET OF DRAIN PIPE HAD BEEN INSERTED INTO THE TUNNEL, CAVE-INS CAUSED JAMMING WHICH THE JACKS COULD NOT HANDLE; THE JACKING WAS STOPPED, AND THE PIPE WAS GROUTED IN PLACE USING A PUMP-CRETE TRUCK. THE CEILING OF THE REMAINDER OF THE TUNNEL WAS SHORED UP WITH CURVED METAL PLATES AND CHANNEL IRON; PIPE WILL THEN BE INSERTED FROM

THE OPPOSITE END OF THE SHAFT TO JOIN THE 240 FEET ALREADY CEMENTED IN PLACE. COST COMPARISONS ARE PRESENTED BETWEEN OPEN TRENCH TYPE CONSTRUCTION AND DRILLING OPERATIONS.

Carter, D *Public Works*

3A 232834

DECOMPOSED LITHIC SANDSTONE AS A FEASIBLE PAVEMENT MATERIAL

THE SANDSTONE USED FOR PAVEMENT CONSTRUCTION IN THE WINTON REGION COMES FROM A BORROW AREA IN THE IMMEDIATE VICINITY OF THE TOWN. THIS SOFT PLASTIC SANDSTONE DOES NOT MEET THE USUAL SPECIFICATION REQUIREMENTS FOR A PAVING MATERIAL. THE METHODS ADOPTED IN INVESTIGATING THE MATERIAL AND THE DEVELOPMENT OF CONSTRUCTION TECHNIQUES TO PRODUCE A PAVEMENT ARE DESCRIBED. THE EFFECT OF MOISTURE CHANGES IN THE SANDSTONE MUST BE REDUCED TO THE EXTENT THAT CRACKING AND MOISTURE INGRESS ARE ELIMINATED. COMPACTION AND HEAVY PRIMING ALONE WILL NOT PREVENT THE FAILURE MECHANISM WHICH COMMENCES WITH CRACKING. THE ALTERNATIVE (ARMOURING) WHICH REDUCES THE AMOUNT OF SANDSTONE IMMEDIATELY IN CONTACT WITH SEAL, AND ANY MOISTURE INGRESS THROUGH SEAL, APPEARS TO OFFER THE BEST SOLUTION SHORT OF COSTLY MECHANICAL OR ADMIXTURE STABILIZATION. IT APPEARS THAT THE REDUCTION OF PLASTIC SANDSTONE BY SUBSTANTIAL REPLACEMENT WITH ARMOURING STONE IMMEDIATELY BENEATH THE SEAL IS SUFFICIENT TO PREVENT THE ONSET OF THE FAILURE MECHANISM. ROLLING IN OF THE ARMOURING STONE MUST TAKE PLACE IMMEDIATELY AFTER COMPACTION OF THE SANDSTONE WHILE THE PAVEMENT IS STILL DAMP IN DEPTH. A 20-MILE SECTION OF ROAD IN THE THIRD YEAR OF SERVICE EVIDENCES NO PAVEMENT FAILURE. FURTHER TEST PAVEMENTS ARE UNDER CONSIDERATION IN AN ATTEMPT TO ELIMINATE THE ARMOURING.

Andrews, JH Vlastic, Z Pryor, AJ DISCUSSER Dickinson, EJ DISCUSSER Grant, K DISCUSSER *Australian Road Research Board Proc*

3A 232852

ASPECTS OF THE DESIGN AND CONSTRUCTION OF RURAL ROADS

A SUMMARY IS PRESENTED OF CONCLUSIONS REACHED FROM A REVIEW OF THE LONG-TERM PERFORMANCE OF MANY ROADS IN VARIOUS PARTS OF AUSTRALIA, AND WHERE, IN MANY CASES, VERY MANY OBSERVATIONS OF SUBGRADE MOISTURE AND DENSITY HAVE RECENTLY BEEN MADE. IT POINTS OUT THE GREAT EFFECT OF TYPE OF CONSTRUCTION AND ENVIRONMENT ON SUBGRADE EQUILIBRIUM MOISTURE CONTENT. THIS PARAMETER IS OF PARAMOUNT IMPORTANCE IN DETERMINING THE PAVEMENT THICKNESS REQUIRED AND THE CONCLUSION IS REACHED THAT IT IS IMPOSSIBLE AT PRESENT TO DETERMINE IT IN ADVANCE WITH ANY REASONABLE ACCURACY, PARTICULARLY IN THE AREAS INLAND OF THE COASTAL RANGES; UNLESS, OF COURSE, ADJOINING OLD ROADS ON SIMILAR SOILS ARE AVAILABLE FOR INVESTIGATION WITH COMPETENT STAFF. SUGGESTIONS ARE MADE AS TO METHODS FOR ECONOMICALLY ENSURING REASONABLY HIGH DENSITIES AND LOW MOISTURE CONTENTS FOR SUBGRADES OF ROADS IN THE CATEGORY BEING EXAMINED. INTERIM PROPOSALS ARE GIVEN INVOLVING THE TRIAL AND OBSERVATION APPROACH OF STAGE CONSTRUCTION FOR 'TAILORING' THE PAVEMENT THICKNESS TO THE ACTUAL SUBGRADE CONDITIONS. AN IMPORTANT SECTION OF THE REPORT DEALS WITH A WIDE VARIETY OF PAVEMENT MATERIALS WHICH HAVE BEEN SATISFACTORILY USED FOR ROAD PAVEMENTS, OFTEN UNDER VERY HEAVY TRAFFIC, ALTHOUGH MANY ARE UNUSUAL AND FALL OUTSIDE STANDARD SPECIFICATIONS. /AUTHOR/

Loder, LF *Australian Road Research Board Bulletin* Mar. 1970

3A 232903

AN EXPERIMENTAL SOIL-CEMENT ROAD IN ILLINOIS
THE FIRST SOIL-CEMENT ROAD TO BE CONSTRUCTED IN ILLINOIS WAS IN 1936 AND WAS ENTIRELY EXPERIMENTAL. PRELIMINARY SOIL SAMPLES WERE TAKEN BEFORE THE GRADING WORK WAS COMPLETED. DATA WAS GIVEN ON THE LABORATORY SOIL TESTS WHICH INCLUDED PHYSICAL TEST CONSTANTS AND GRAIN SIZE, MOISTURE-DENSITY TESTS, MOISTURE-PENETRATION TESTS, DURABILITY TESTS, WETTING AND DRYING TESTS, FREEZING AND THAWING TESTS, AND CHECK AND COMPRESSION TESTS. EQUIPMENT USED ON THE PROJECT WAS LISTED. A DESCRIPTION OF CONSTRUCTION PROCEDURE INCLUDED (1) SCARIFYING, PULVERIZING, AND SHAPING, (2) APPLYING, CHECKING AND MIXING THE CEMENT, (3) APPLYING WATER, (4) SHAPING AND COMPACTING, AND (5) CURING. CONSTRUCTION COSTS WERE GIVEN.

Glover, VL *Highway Research Board Proceedings* 1937

3A 232911

COMPACTION OF EARTH EMBANKMENTS

CONTENTS: THEORY PRELIMINARY SOIL STUDIES AND SURVEYS CONSTRUCTION METHODS SPECIFICATIONS NOTES ON GERMAN PRACTICE MISCELLANEOUS CONCLUSIONS APPENDIX.

Hamilton, LW Preece, EF Stanton, TE Johnson, AW Woods, KB Casagrande, L Allen, H *Highway Research Board Proceedings* 1938

3A 232998

EVALUATION OF VIBRATORY COMPACTION EQUIPMENT ON ROCKFILLS- INTERSTATE ROUTE 84

FIELD EVALUATION TESTS OF HEAVY VIBRATORY COMPACTORS ON ROCKFILLS ARE DESCRIBED. THE TESTING INDICATED THAT THE LIFT THICKNESS FOR ROCK FILLS COULD BE INCREASED FROM THE SPECIFIED TWO FEET TO FOUR FEET AND THE NUMBER OF ROLLER PASSES COULD BE REDUCED FROM THE SPECIFIED 6 TO 4 FOR THE MODELS OF HEAVY VIBRATORY COMPACTORS TESTED. THIS EVALUATION IS AN EXAMPLE OF HOW IMPROVED CONSTRUCTION EQUIPMENT CAN PROVIDE SAVINGS TO THE STATE WHEN THE CAPABILITY OF THE EQUIPMENT IS FULLY UTILIZED. IT ALSO DEMONSTRATES HOW THE PRINCIPLES OF "VALUE ENGINEERING" MAY BE APPLIED TO HIGHWAY CONSTRUCTION. /AUTHOR/

Geoffroy, DN

New York State Dept Transportation Dec. 1969

3A 233168

A LIME STABILIZED CLAY FOUNDATION

A HIGHLY PLASTIC CLAY WAS STABILIZED WITH 5 PERCENT CALCITIC QUICKLIME TO DEPTHS OF 5 TO 9 FEET BENEATH A CONCRETE FOOTING OF A LARGE POTASH STORAGE BUILDING. STABILIZATION PROCEEDED THROUGH AUGUST AND SEPTEMBER 1965 AND WAS COMPLETED WHEN THE MEAN AIR TEMPERATURE HAD DROPPED BELOW 40 F. THE FILL WAS THEN COVERED WITH 2 FEET OF CONCRETE OR SOIL BACKFILL AND LEFT SUBJECT TO A SEVERE CANADIAN WINTER. THE TEMPERATURE OF THE FILL STAYED CLOSE TO THE AIR TEMPERATURE AT THE TIME OF MIXING FOR SEVERAL WEEKS AFTER PLACEMENT. A MINIMUM UNCONFINED COMPRESSIVE STRENGTH AFTER 3 DAYS OF CURING WAS CHOSEN AS THE DESIGN CRITERION. BRIQUETTES COMPACTED IN 4-INCH MOLDS WITH STANDARD PROCTOR EFFORT WERE MADE FROM THE FIELD MIXTURES AND CURED IN THE LABORATORY AND THEIR 3-DAY STRENGTH WAS COMPARED TO THE DESIGN VALUE. THE DENSITY OF THE FILL EXCEEDED THE DENSITY OF THE BRIQUETTES. THE COMPRESSIVE STRENGTH OF THE STANDARD BRIQUETTES AFTER 3 DAYS OF LABORATORY CURING WAS INSENSITIVE OVER A WIDE RANGE OF MOISTURE CONTENTS. /AUTHOR/

Watt, WG Machibroda, P *Journal Materials* June 1971

3A 233213

SLURRY WALLS FOR BART CIVIC CENTER SUBWAY STATION
DEEP EXCAVATIONS IN DIFFICULT GROUND HAVE LONG BEEN AN ENGINEERING CHALLENGE. WITH THE SHARP INCREASE IN MASS RAPID TRANSIT SUBWAY CONSTRUCTION IN URBAN AREAS DURING THE 1960'S, MORE THAN EVER BEFORE DEEP EXCAVATIONS ARE BEING PLANNED AND CARRIED OUT IN DIFFICULT GROUND CONDITIONS. NEW TYPES OF STRUCTURES ARE BEING PROPOSED AND EXECUTED WITH NEW METHODS OF CONSTRUCTION AND IMPROVED GROUND-WATER CONTROL, AND ARE MORE FREQUENTLY BEING MEASURED TO MONITOR PERFORMANCE. GREAT EFFORT IS BEING MADE TO IMPROVE PREDICTION OF LATERAL EARTH PRESSURES. AT THE SAN FRANCISCO CIVIC CENTER STATION IT WAS NECESSARY TO CARRY OUT AN EXCAVATION APPROXIMATELY 700 FT LONG, 60 FT TO 99 FT WIDE, AND UP TO 78 FT DEEP. BECAUSE OF ADJACENT COMPRESSIBLE SOILS AND THE SENSITIVE STRUCTURES AROUND THE EXCAVATION, THE GROUND-WATER LEVEL HAD TO BE MAINTAINED AS NEAR THE PRECONSTRUCTION LEVEL AS POSSIBLE. A CONSTRUCTION METHOD WAS ADOPTED AND COMPREHENSIVE FIELD INVESTIGATIONS WERE CARRIED OUT, WITH LABORATORY TESTS AND ANALYSES TO ASSIST IN PREDICTING THE LATERAL SOIL PRESSURES. CRITERIA FOR STRUCTURAL DESIGN AND CONTROL OF CONSTRUCTION WERE DEVELOPED. THE STRUCTURE WAS INSTRUMENTED AND THE MEASURED DATA WERE EVALUATED AND COMPARED WITH PRECONSTRUCTION ESTIMATES.

Thon, JG Harlan, RC *Am Soc Civil Engr J Soil Mech Div* Sept. 1971

3A 233215

DISCUSSION OF CAISSON CONSTRUCTION PROBLEMS AND CORRECTION IN CHICAGO

THIS PAPER IS IN KEEPING WITH DR TERZAGHI'S OFTEN REPEATED PLEA FOR THE PUBLICATION OF GOOD CASE HISTORIES FROM FOUNDATION PRACTICE. THE LONG-STANDING REPUTATION OF THE CHICAGO-WELL METHOD OF CONSTRUCTING FOUNDATIONS TO BEDROCK AT MODERATE DEPTHS BENEATH THE SURFACE, AND ITS WIDE USE IN OTHER AREAS, LENDS SPECIAL VALUE TO THE PAPER. IT IS FORTUNATE THAT THE AUTHORS HAVE BEEN ABLE TO SHARE SOME OF THE WIDE EXPERIENCE OF THEIR ORGANIZATIONS. SOME OF THE TERMINOLOGY IN THE PAPER IS, HOWEVER, A LITTLE PUZZLING. HARDPAN IS A TERM WHICH, ONE THOUGHT, HAD HAD BEEN ELIMINATED FROM THE SOIL MECHANICS LITERATURE FOR MANY YEARS, DESPITE ITS REPEATED USE BY NONTECHNICAL WORKERS. MANY WRITERS HAVE POINTED OUT ITS LIMITATIONS. THE WRITER IS CONCERNED WITH THE REPEATED USE OF THE EXPRESSION POURING CONCRETE INSTEAD OF PLACING CONCRETE. IF THE CONCRETE USED FOR CAISSON CONSTRUCTION IN CHICAGO IS REALLY POURED, THEN IT IS NATURAL THAT SOME TROUBLES HAVE BEEN EXPERIENCED. AND IF IT IS REALLY POURED WITH A FREE FALL AND PLACED ON SURFACES WITH STANDING WATER THEREON, THEN THE CONCRETE INDUSTRY'S WORTHWHILE CAMPAIGN TO ENCOURAGE BETTER CONCRETING PRACTICES WOULD APPEAR TO HAVE A GREAT DEAL OF PROGRESS TO MAKE. EVEN MORE SURPRISING IS THE STATEMENT THAT "ONE CAUSE OF DEFECTIVE CAISSONS IS BAD CONCRETE DELIVERED TO THE SITE." THIS IS A DISTURBING STATEMENT. LENGTHY REFLECTION ON THE PAPER SUGGESTS A FUNDAMENTAL QUESTION ABOUT THE PHILOSOPHY OF DESIGN THAT THE AUTHORS MIGHT BE WILLING TO DISCUSS. THE PAPER APPEARS TO BE BASED ON THE ASSUMPTION THAT FAILURES WITH CAISSON FOUNDATIONS IN CHICAGO ARE INEVITABLE. SINCE THE USUAL DIAMETER OF FOUNDATION CAISSONS IN CHICAGO PERMITS VISUAL INSPECTION BEFORE CONCRETING AND REASONABLE INSPECTION DURING CONCRETING—CERTAINLY MORE THAN CAN BE GIVEN TO THE CONCRETING OF A HEAVILY REINFORCED CONCRETE COLUMN ABOVE GROUND—WHY SHOULD THIS ANTICIPATION OF FAILURE BE

SO OBVIOUSLY A GOVERNING FEATURE OF DESIGN? ONE HAS YET TO HEAR OF CORE BORINGS BEING USED TO CHECK THE SOUNDNESS OF MAJOR COLUMNS OF REINFORCED CONCRETE BUILDINGS. WHAT IS IT THAT MAKES THIS SO ACCEPTED A PRACTICE WITH CAISSONS IN CHICAGO? SURELY A BASIC PRECEPT OF CIVIL ENGINEERING IS THAT DESIGN SHOULD PRODUCE A STRUCTURE, OR COMPONENT, THAT WILL SAFELY AND ECONOMICALLY CARRY ALL DESIGNED LOADS WITH NO POSSIBILITY OF FAILURE OTHER THAN THAT CAUSED BY A MAJOR CATASTROPHE? IF THE AUTHORS COULD GIVE STATISTICS AS TO THE NUMBER OF SUCH FAILURES AS THEY DESCRIBE IN DISCUSSING THIS BASIC QUESTION, THE OVERALL PICTURE MIGHT THEN BE SOMEWHAT CLEARER. /DISCUSSE/

Legget, RF DISCUSSE *Am Soc Civil Engr J Soil Mech Div* Sept. 1971

HRIS 63 217277, IP62220565

3A 233265

PRELIMINARY OBSERVATIONS ON SOIL MOISTURE AND "DRY" COMPACTION IN PAVEMENT DESIGN ON THE DARLING DOWNS, QUEENSLAND, WITH DISCUSSIONS AND CLOSURE

THIS PAPER DESCRIBES THE FIRST STAGE OF A LONG TERM INVESTIGATION INTO THE EFFECTS OF PAVEMENT CONFIGURATION AND SUBGRADE COMPACTION AND MOISTURE ON PERFORMANCE AT A TEST SITE ON THE EXPANSIVE CLAY SOIL ON THE DARLING DOWNS, QUEENSLAND. ALTHOUGH IT WILL BE SEVERAL YEARS BEFORE FULL QUANTITATIVE INFORMATION BECOMES AVAILABLE, SOME PRELIMINARY AND QUALITATIVE CONCLUSIONS CAN BE MADE AT THIS STAGE. RESULTS SUGGEST THAT THE SUBGRADE EQUILIBRIUM MOISTURE CONTENT WILL BE CONSIDERABLY DRYER THAN OPTIMUM MOISTURE CONTENT FOR STANDARD COMPACTION. WHERE PAVEMENTS ARE CONSTRUCTED ON SOIL WITH A MOISTURE CONTENT SIGNIFICANTLY HIGHER THAN OR LOWER THAN THIS EQUILIBRIUM CONDITION, DISTRESS DUE TO VOLUME CHANGE IN THE SUBGRADE CAN BE EXPECTED AS MOISTURE CONDITIONS MOVE TOWARDS THE EQUILIBRIUM. CONSTRUCTION PROCEDURES WHICH ENSURE THAT THE SOIL IS AT ITS EQUILIBRIUM CONDITION WILL MINIMIZE THIS VOLUME CHANGE PROVIDED PRECAUTIONS ARE TAKEN TO ENSURE THE STABILITY OF THE SUBGRADE. THE COMPACTIVE EFFORT, THE TYPE OF CONSTRUCTION ADOPTED, AND THE MAINTENANCE OF THE SEALED PAVEMENT AND THE SHOULDERS HAVE A LARGE BEARING ON SUBGRADE STABILITY AND THEREFORE PAVEMENT PERFORMANCE. /ARRB/

Richards, BG Murphy, HW Chan, CY Gordon, R Neeson, JA DISCUSSE Shackel, B DISCUSSE Kick, SN DISCUSSE *Australian Road Research Board Proc* Vol. 5 1970, pp 116-46, 16 Fig, 4 Tab, 18 Ref

3A 233306

LIME STABILIZATION CONSTRUCTION MANUAL

THIS MANUAL CONTAINS RECOMMENDED CONSTRUCTION PROCEDURES FOR THE USE OF HYDRATED LIME IN THE STABILIZATION OF MODIFICATION OF SUBGRADE (SUBBASE) AND BASE COURSES. PROS AND CONS OF ALTERNATIVE CONSTRUCTION STEPS AND EQUIPMENT ARE DISCUSSED. NEW METHODS FOR LIME SPREADING AND THE USE OF QUICKLIME FOR STABILIZATION ARE ALSO INCLUDED. /NLA/

National Lime Association 1972

3A 233333

EARTHWORK ON THE ASO VOLCANIC ASH SOIL

JAPAN CONSISTS OF VOLCANIC ISLANDS, AND VOLCANIC ASH SOILS OF THE PLEISTOCENE EPOCH ABOUND THROUGHOUT THE COUNTRY. THE ASH SOIL DISCUSSED HERE IS A SENSITIVE SOIL DERIVED FROM VOLCANIC ASH DISTRIBUTED OVER THE ASO AREA OF KYUSHU ISLAND. THE WATER

CONTENT OF THE SOIL IS ABOUT 50%, WHICH IS LOW FOR JAPAN, WHERE CONTENTS APPROACHING 100% ARE NORMAL. HOWEVER, THE ASH SOIL SOON BECOMES SO SOFT THAT HEAVY CONSTRUCTION EQUIPMENT CANNOT WORK ON IT AFTER DISTURBANCE BY BULLDOZERS. THE DECREASE IN STRENGTH OF THE ASH SOIL IS NEARLY THE SAME AS THAT OF VOLCANIC ASH SOIL WITH A WATER CONTENT OF 200%. EARTH EMBANKMENTS WERE CONSTRUCTED WITH SUCH SOILS USING SUPER-WET-GROUND BULLDOZERS WITH 0.17 KG/SQ CM CATERPILLAR PRESSURE AGAINST A GROUND SURFACE 40 CM THICK. AFTER THREE PASSES THE WHEEL TRACES WERE LESS THAN 10 CM WHEN THE CONE VALUE OF THE UNDISTURBED SOIL WAS 4 KG/SQ CM OR MORE BUT MORE THAN 30 CM WHEN CONE VALUE WAS REDUCED TO 2 KG/SQ CM. VOLCANIC ASH SOILS HAVE A TENDENCY TO REGAIN THEIR STRENGTH AFTER BEING DISTURBED, PROBABLY AS A RESULT OF CONSOLIDATION. THE LATTER CAN BE INCREASED THROUGH THE USE OF FILTERS. IN THE TEST EMBANKMENTS THE WATER DRAINING FROM THE FILTERS WAS PLAINLY VISIBLE; A PROBLEM THAT HAD TO BE OVERCOME WAS SATURATION OF ASH SOIL JUST BELOW THE FILTER. ONCE THIS WAS SOLVED THE WATER CONTENT DROPPED FROM 50% TO 30%, AND CONE VALUE INCREASED TO MORE THAN 15 KG/SQ CM, SOMETIMES REACHING 50 KG/SQ CM A MONTH AFTER CONSTRUCTION, I.E., SUITABLE FOR CARRYING TRAFFIC. IT WAS NOTED THAT A SAND FILTER OF 40 CM DEPTH WAS REQUIRED TO DRAIN THE EMBANKMENT THOROUGHLY; FILTERS HAD TO BE INSTALLED AT EVERY 4 METERS OF EMBANKMENT HEIGHT.

Mochinaga, R *Japan Road Association Annual Reports* 1971, pp 42-7, 9 Fig, 1 Tab

3A 233380

CURRENT PAVEMENT DESIGN IN AUSTRALIA /IN JAPANESE/

THE PRINCIPAL DIFFERENCES IN SOIL PROPERTIES, SOIL TYPES, CLIMATE, TERRAIN, TRAFFIC DENSITY, POPULATION DENSITY, AND ROAD CONSTRUCTION COSTS BETWEEN JAPANESE AND AUSTRALIAN CONDITIONS ARE OUTLINED. THE USE OF STAGE CONSTRUCTION IN ESTABLISHMENTS OF A ROAD NETWORK IN AUSTRALIAN CONDITIONS, AND THE APPLICATION OF CBR AND SOIL SUCTION METHODS TO PAVEMENT DESIGN ARE DETAILED. MORE RECENT WORK ON RESILIENCE MODULUS AND CURRENT STABILIZATION PRACTICE ARE ALSO MENTIONED. THE PROBLEMS OF ROAD CONSTRUCTION ASSOCIATED WITH EXPANSIVE CLAYS AND EDGE CRACKING ARE DESCRIBED, AS WELL AS THE EFFICIENCY OF VARIOUS TYPES OF COMPACTION MACHINERY IN AUSTRALIAN CONDITIONS. THE WORK OF THE AUSTRALIAN ROAD RESEARCH BOARD IS PARTICULARLY NOTED AND COMMENDED. /CSIRO/

Ingles, OG

Pavements /Japan/ Vol. 6 No. 9, 1971, pp 34-6

ACKNOWLEDGMENT: Commonw Scient Indus Res Org /Austral/

3A 233437

PATENTED METHOD OF EXCAVATING SOFT GROUND TUNNELS BY DRIVING IN A SET OF ANTI-CRUMBLING NEEDLES

THE ARTICLE DESCRIBES A METHOD, PATENTED NY THE AUTHOR FOR EXCAVATING TUNNELS IN SOFT GROUND. THE METHOD USES A SYSTEM OF TUBULAR STEEL 'NEEDLES' ABOUT 2.50M LONG DRIVEN INTO THE GROUND FOR STRENGTHENING PURPOSES. THE 'NEEDLES' ARE POSITIONED USING A CENTERING MEMBER. FURHTER STRENGTHENING MAY BE OBTAINED BY INJECTING THROUGH THE NEEDLES LIQUID CEMENT OR BENTONITE, WHICH WILL BE ABSORBED BY THE SURROUNDING SOIL.

Giacobino, GP *Tunnels & Tunnelling /UK/* Vol. 4 May 1972, 3pp, 6 Fig

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/IRRD 201 661, 1C62232341

3A 233465

ROADS FOR LOW TRAFFIC FLOW--AUSTRALIA

THE USE OF LOCAL, NON-TRADITIONAL, NATURALLY OCCURRING MATERIALS IN RURAL ROADS IN AUSTRALIA IS DISCUSSED. THE MATERIALS DO NOT ALWAYS COMPLY WITH THE USUAL STANDARD SPECIFICATIONS, AND INVESTIGATIONS ARE CONTINUING TO EVALUATE THOSE MATERIALS WHICH GIVE SATISFACTORY PERFORMANCE. THE PERFORMANCE OF LOW COST ROADS UNDER TRAFFIC REINFORCEMENT OF ROAD SURFACES ON TROPICAL OR SUB-TROPICAL CLIMATES IS INVESTIGATED. THE SCARCITY OF WATER IN MANY AREAS HAS PROMPTED THE INVESTIGATION ON SECTIONS OF SEALED RURAL ROADS CONSTRUCTED WITHOUT THE ADDITION OF WATER FOR COMPACTION OF THE CLAYEY SUBGRADES. SECTIONS OF ROAD ARE ALSO BEING INVESTIGATED IN WHICH CLAY SOIL SUBGRADES WERE CONSTRUCTED AT MOISTURE CONDITIONS INTENDED TO REDUCE SUBSEQUENT SEASONAL MOISTURE DAMAGE AND SHRINKAGE CRACKING OF THE PAVEMENT. THESE INVESTIGATIONS ARE PROVIDING INFORMATION ON THE ADVANTAGES OF STAGE CONSTRUCTION, AND THE IMPORTANCE OF ADEQUATE PAVEMENT THICKNESS OVER "CLOSE TO SATURATED" SUBGRADE CONDITIONS IN ADVERSE ENVIRONMENTAL CIRCUMSTANCES ENCOUNTERED IN WETTER AREAS. A WIDER RANGE OF PAVEMENT MATERIALS CAN BE SUCCESSFULLY USED IN THE MORE FAVORABLE CIRCUMSTANCES IN DRIER AREAS. INFORMATION IS ALSO PROVIDED ON THE PREVALENCE OF DETERIORATION NEAR PAVEMENT EDGES ASSOCIATED FREQUENTLY WITH THE INGRESS OF SURFACE WATER THROUGH THE SHOULDERS. ROAD AUTHORITIES GIVE CLOSE ATTENTION TO EROSION PROBLEMS. WHILE THE POTENTIAL DESTRUCTIVENESS OF SOME ROAD STRUCTURES IS WIDELY APPRECIATED, THE CONTRIBUTION OF ROADS AND BORROW AREAS TO THE SILTATION AND DISCOLORATION OF STREAMS AND RESERVOIRS IS BEING INCREASINGLY RECOGNIZED. THE ROLE OF SECONDARY ROADS IN SOCIAL AND ECONOMIC DEVELOPMENT IS DISCUSSED. IN A DISCUSSION OF THE MAINTENANCE COSTS OF LIGHTLY TRAFFICKED ROADS, A STUDY THAT WAS MADE OF MAINTENANCE OF ROADS IN TASMANIA IS OUTLINED. A SYSTEM FOR THE ASSESSMENT OF AN ECONOMICAL AXLE LOAD FOR THE AUSTRALIAN ROADS IS REVIEWED. COMMENTS ARE ALSO MADE ON ASPECTS SUCH AS FLOODWAYS AND LOW LEVEL CROSSINGS OF WATER-WAYS.

Glynn, DF *Perm Intl Assoc Road Congresses Proc* Vol. 2 1971, 6 pp, 21 Ref

3A 233527

SHAFT FOUNDATIONS FOR THE NEW LONDON BRIDGE

THE NEW LONDON BRIDGE NOW BEING BUILT WILL COST OVER 4 MILLION AND WILL BE AN 860 FT LONG POST-TENSIONED CONCRETE STRUCTURE FORMED AS FOUR PARALLEL PRESTRESSED CONCRETE BOX BEAMS, EACH IN ITSELF A COMPLETE BRIDGE. IT WILL BE 105 FT WIDE AND WILL PROVIDE SIX LANES OF TRAFFIC AND TWO PEDESTRIAN FOOTWAYS OF 15 FT AND 26 FT WIDTH, UPSTREAM AND DOWNSTREAM RESPECTIVELY. IN PLACE OF THE FIVE SEMI-ELLIPTICAL ARCH SPANS OF THE EXISTING BRIDGE (REQUIRING FOUR PIERS), IT WILL CROSS THE THAMES IN THREE SPANS ON TWO RIVER PIERS. THE TWO SIDE SPANS ARE EACH 260 FT LONG AND THE CENTRAL SPAN 340 FT, DESIGNED AS A CANTILEVER WITH A CENTRAL SLUNG SECTION OF 107 FT. DETAILS ARE GIVEN OF THE CONSTRUCTION OF THE SHAFT FOUNDATION PIERS, COFFERDAMS, AND THE 900 FT TEMPORARY ERECTION GANTRY FOR INSTALLING THE NEW BRIDGE SUPERSTRUCTURE.

Ground Engineering /UK/ Vol. 4 No. 6, Nov. 1971, pp 23-5, 2 Fig, 5 Phot

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 233556

CURRENT OVERSEAS PRACTICE

THIS PAPER EXAMINES SOME OF THE USES OF CEMENT STABILIZED MATERIALS AND GIVES REASONS FOR THEIR ADOPTION FOR BASE AND SUBBASE CONSTRUCTION IN THE UNITED STATES, AUSTRALIA, GERMANY, AND HOLLAND. CONSTRUCTION AND SPECIFICATION METHODS ARE ALSO DISCUSSED, TOGETHER WITH THE PROBLEMS ENCOUNTERED ABROAD. THE EXTENSIVE USE OF CEMENT STABILISED MATERIALS IS CONSIDERED AS EVIDENCE OF THEIR ECONOMIC AND PRACTICAL VIABILITY AS BASES TO MINOR ROADS AND PARKING AREAS, AND AS SUB-BASE MATERIALS. CEMENT STABILISATION ALSO ALLOWS SUB-STANDARD MATERIALS, SUCH AS NATURAL SOIL AND INDUSTRIAL WASTE, TO BE CONVERTED TO GOOD ROAD CONSTRUCTION MATERIALS, WHICH RESULTS IN A SAVING OF THE LIMITED RESOURCES OF TRADITIONAL MATERIALS. MIX-IN-PLACE CONSTRUCTION IS PREFERRED AND SOME CURRENTLY USED PLANT IS MENTIONED, INCLUDING MACHINES CAPABLE OF PROCESSING IN A SINGLE LAYER TO A DEPTH OF 600MM. THE PAPER CONCLUDES BY DISCUSSING SPECIFICATIONS VALID IN VARIOUS COUNTRIES.

Lilley, AA *Inst Hwy Engineers Journal, London /UK/* Vol. 19 No. 3, Mar. 1972, pp 4-11, 1 Tab, 13 Photos, 17 Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 233576

DIAPHRAGM WALLING SAVES HOUSES ON A329 RELIEF ROAD PROJECT

THE DESIGN, CONSTRUCTION, AND COST OF STAGE 1 OF THE A 329 RELIEF ROAD NEAR READING IN BERKSHIRE ARE DISCUSSED. DIAPHRAGM WALLING WAS USED INSTEAD OF NORMAL REINFORCED CONCRETE RETAINING WALLS SINCE 15 TO 20 FEET LESS LAND WAS NEEDED TO CONSTRUCT SUCH WALLS AND THIS LED TO THE LOSS OF FEWER HOUSES. /TRRL/

Roads & Road Construction, London /UK/ Vol. 50 No. 589, Jan. 1972, pp 12-3, 1 Fig, 2 Phot

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 233582

CEMENT STABILIZATION

A COMPREHENSIVE SURVEY IS MADE OF CEMENT STABILIZATION IN EUROPE, AND A DETAILED DESCRIPTION IS GIVEN OF EXISTING ROAD CONSTRUCTION METHODS. (MJ 375)

Cederberg, KG
Cement Och Betong /Sweden/ Vol. 47 No. 2, 1972, pp 203-22, 5 Fig, 21 Phot

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 233588

CONSTRUCTION ON (VOLUMETRICALLY ACTIVE) SOILS

VOLUMETRICALLY ACTIVE SOILS OCCURRING EXTENSIVELY IN RHODESIA, MOSTLY IN VLEIS, HAVE USUALLY BEEN AVOIDED BY CIVIL ENGINEERS AND TOWN PLANNERS. IN RECENT YEARS INCREASING LAND VALUES HAVE DICTATED BUILDING CONSTRUCTION, AND CONSEQUENT ROAD AND RAILWAY CONSTRUCTION IN VLEI AREAS. THIS PAPER SUGGESTS METHODS OF IDENTIFYING THESE ACTIVE SOILS, GIVES A HISTORY OF CONSTRUCTION PRACTICE, AND RECOMMENDS DESIGN AND CONSTRUCTION METHODS FOR SUCH TERRAIN. /TRRL/

Mitchell, RL Mackechnie, WR *Rhodesian Engineer /Southern Rhodesia/* Vol. 10 No. 5, Sept. 1972, pp 43-50, 10 Fig, 1 Tab, 4 Phot, 14 Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 233628

SAND-CEMENT STABILIZATION IN THICK LAYERS

A NEW TYPE OF PAVEMENT STRUCTURE WAS USED IN THE NETHERLANDS FOR THE FIRST TIME IN 1969 ON A MOTORWAY. IT CONSISTS OF A 0.40M-THICK SAND-CEMENT LAYER UNDER A 0.26 M-THICK BITUMINOUS SURFACING COMPOSED OF 0.18 M GRAVEL ASHALTIC CONCRETE AND TWO LAYERS, EACH OF 0.04 M ASPHALTIC CONCRETE, AS BASECOURSE AND WEARING COURSE. THE AMOUNT OF CEMENT REQUIRED FOR THE BASE AND THE CONSTRUCTION EQUIPMENT AND METHOD ARE DISCUSSED. /TRRL/

Grevelt, ER *Polytechnisch Tijdschrift /Neth/* Vol. 26 No. 16, Aug. 1971, pp 639-42, 3 Tab, 5 Phot

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 233629

SIMPLE SOIL STABILIZATION METHOD PROMISES LOW-COST SECONDARY ROADS

THE ARTICLE DISCUSSES THE USE OF A STABILIZING/SOLIDIFICATION AGENT, KNOWN AS PERMASTER, TO CONVERT A COUNTRY ROAD IN GEORGIA INTO A DUST-FREE HARD SURFACE. THE AGENT WAS MIXED WITH THE SOIL IN PROPORTIONS, AND TO A DEPTH, INDICATED BY LABORATORY TESTS. COMPARABLE COSTS TO SOIL/CEMENT STABILIZATION TECHNIQUES ARE CLAIMED, WITH ADDITIONAL SAVINGS IN TIME AND LABOR COSTS. /TRRL/

Roads and Streets Vol. 115 No. 12, Dec. 1972, p 52, 2 Phot

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/IRRD 205 330, 2C62305330

3A 233635

LIME STABILIZATION OF ROADS IN CEYLON

THIS PAPER BROADLY DISCUSSES THE CASE FOR THE USE OF LIME TO IMPROVE THE PROPERTIES OF A SOIL. THE MECHANISM OF LIME STABILIZATION IS DESCRIBED, AND SOME LABORATORY FINDINGS ARE PRESENTED REGARDING THE IMPROVEMENT IN SOIL PROPERTIES. A LABOR INTENSIVE METHOD OF CONSTRUCTION, USING A MINIMUM OF MACHINERY, IS OUTLINED, AND THE PERFORMANCE TO DATE OF SOME LIME STABILIZED ROADS IN CEYLON, IS DESCRIBED.

Yoganandan, GM
Ceylon Institute of Engineers Trans R&d Rept Vol. 1 1972, pp 39-53, 9 Fig, 1 Tab, 4 Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 233643

A REVIEW OF SOIL-POLE BEHAVIOR

THE BEHAVIOR OF A POLE EMBEDDED IN SOIL IS REVIEWED IN THE LIGHT OF MODERN SOIL MECHANICS. A COMPILATION AND INTERPRETATION OF THE AVAILABLE PUBLISHED AND UNPUBLISHED TEST RESULTS PROVIDE THE BACKGROUND INFORMATION USED IN A DISCUSSION BEHAVIOR OF A SOIL-POLE SYSTEM. A THEORETICAL ANALYSIS IS PRESENTED THAT ACCOUNTS FOR VERTICAL, LATERAL AND MOMENT LOADS ON THE POLE; THE NATURE OF THE PREVIOUS THEORETICAL WORK AVAILABLE IN THE LITERATURE IS TABULATED FOR COMPARISON. THE PROPOSED ANALYTICAL TECHNIQUES ALSO INCLUDE A SIMPLE QUANTITATIVE MEANS FOR DETERMINING IF A FLEXURAL MEMBER IS RIGID ENOUGH THAT ITS DEFLECTION CAN BE DESCRIBED SOLELY AS A ROTATION. IN APPLICATION OF THE ANALYTICAL TECHNIQUES TO POLE DESIGNS A SIMPLE MEANS OF APPROXIMATING THE STRENGTH AND SUBGRADE MODULUS OF THE SOIL IS SHOWN TO BE NECESSARY. A SIMPLE STATIC SOIL PENETROMETER TEST IS SUGGESTED AS A PRACTICAL DEVICE FOR FIELD USE. OTHER VARIABLES THAT MUST BE CONSIDERED IN DEVELOPING POLE DESIGN STANDARDS ARE THE METHOD OF CONSTRUCTION, THE LOADING CONDITIONS AND THE GEOMETRICAL CONFIGURATION OF THE POLES. /AUTHOR/

Davisson, MT Prakash, S *Highway Research Record, Hwy Res Board* 1963

3A 233675

COOPERATIVE STUDY OF LANDSLIDES IN SOUTH DAKOTA

THIS INTERIM REPORT PRESENTS THE RESULTS OF THE FIRST YEARS WORK OF A PROPOSED THREE-YEAR STUDY, DESIGNED TO IDENTIFY SLIDE-PRONE GEOLOGICAL UNITS AND TO AID IN RECOGNITION AND PREVENTION OF SLIDES IN THESE AREAS. THE REPORT ILLUSTRATES THE VARIOUS PHYSIOGRAPHIC REGIONS OF SOUTH DAKOTA. GEOLOGICAL UNITS OF HIGH LANDSLIDE POTENTIAL ARE IDENTIFIED BY MEANS OF A LITERATURE SEARCH, AIR PHOTO AND MAP STUDIES, FIELD OBSERVATIONS, AND A QUESTIONNAIRE CIRCULATED TO STATE HIGHWAY ENGINEERS. NINETY TO 95 PERCENT OF ALL LANDSLIDES IN THE STATE WERE ASSOCIATED WITH THE PIERRE SHALE FORMATION. TWO EXPERIMENTAL SITES HAVE BEEN CHOSEN, WHERE DETAILED STUDIES OF CONSTRUCTION METHODS, AS WELL AS UNSTABLE SLOPE CONDITIONS, ARE IN PROGRESS. SLOPE INDICATORS, PIEZOMETERS, AND RESISTIVITY MEASUREMENTS HAVE BEEN UTILIZED. RESISTIVITY MEASUREMENTS WERE MADE IN AN ATTEMPT TO LOCATE THE CONTACTS BETWEEN VARIOUS MEMBERS OF THE PIERRE SHALE FORMATION. ORDINARY RESISTIVITY TESTS WERE OF LITTLE USE, HOWEVER, AS THE RESISTIVITY OF DIFFERENT SHALE MEMBERS DID NOT DIFFER APPRECIABLY. A SELF-POTENTIAL RESISTIVITY METHOD FOR LOCATING THESE CONTACTS IS BEING ATTEMPTED. /BPR/

Bruce, RL
South Dakota Department Highways Hps-hpr-1/26/

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4660002 65)

3A 233686

THE FORCES ON RIGID CULVERTS UNDER HIGH FILLS

THE FORCES ACTING ON THE BARREL OF A RIGID CULVERT DUE TO THE DEAD LOAD OF A HIGH FILL DEPEND UPON THE CONSTRUCTION METHOD, THE PRESENCE OF HETEROGENEOUS INCLUSIONS OR ORGANIC MATERIAL, THE MATERIAL OF THE EARTHS CRUST, THE FILL PROPERTIES AND FILL AND CULVERT GEOMETRIES. THESE FEATURES ARE ACCOUNTED FOR BY THE FINITE-ELEMENT METHOD FOR OBTAINING APPROXIMATE SOLUTIONS TO LINEAR ELASTICITY PROBLEMS. THE ANALYTICAL METHODS ARE APPLIED TO AN ACTUAL EMBANKMENT OVER A RIGID CULVERT, THE BARREL OF WHICH WAS INSTRUMENTED WITH PRESSURE METERS. THE ANALYTICAL RESULTS FOR TWO CONDITIONS OF THE EARTHS CRUST, VARIOUS FILL PROPERTIES AND FOR A HAY BLOCK DELIBERATELY PLACED ABOVE THE CROWN OF THE CULVERT /AS IN THE ACTUAL CONSTRUCTION/ ARE COMPARED WITH THE RECORDED PRESSURES. IT IS CONCLUDED THAT GIVEN A PROPER DESCRIPTION OF THE MATERIAL PROPERTIES, IN PARTICULAR THE RATIO OF FILL HAY MODULUS, AN ACCURATE DISTRIBUTION OF BARREL PRESSURE MAY BE OBTAINED. /AUTHOR/

Brown, CB
California University, Berkeley, California Department Public Works,
California Division Highways Hpr, July 1966

ACKNOWLEDGMENT: Bureau of Public Roads /US/ (4165192 66)PB 173 359, 1C23021042, 1C63020558

3A 233761

DEVELOPMENT OF GUIDELINE FOR THE DESIGN OF SUBSURFACE DRAINAGE SYSTEMS FOR HIGHWAY PAVEMENT STRUCTURAL SECTIONS

THE REPORT PRESENTS RESULTS OF INTERVIEWS WITH STATE HIGHWAY DEPARTMENT PERSONNEL, FIELD RECONNAISSANCE OF PAVEMENTS IN 9 CASE STUDIES OF SELECTED PAVEMENTS IN THE FHWA REGIONS. PROBLEMS WITH EXISTING DRAINAGE DESIGN CONCEPTS AND CONSTRUCTION METHODS ARE POINTED OUT, SHOWING WHY MANY PAVE-

MENTS ARE SATURATED WITH WATER FOR LONG PERIODS OF TIME EACH YEAR. IT IS DEDUCED THAT THIS SATURATION CONTRIBUTES TO CONSIDERABLE SHORTENING OF PAVEMENT LIFE. A NEW METHOD OF DESIGN IS PRESENTED TO TAKE CARE OF THE INFILTRATION OF SURFACE WATER. INFLOW-OUTFLOW ANALYSES AND HIGHWAY GEOMETRICS ARE INCLUDED IN A PROCEDURE UTILIZING A TWO-LAYER GRADED FILTER TO RAPIDLY REMOVE ANY WATER ENTERING THE STRUCTURAL LAYERS. /FHWA/

Cedergren, HR Arman, JA O'Brien, KH
Cedergren, Ken O'Brien and Associates Final Rpt. FHWA-RD-73-14,
Feb. 1973, 198 pp
RESPONSIBLE INDIVIDUAL: Ring, GW (HRS-14)

Contract FH-11-7582

ACKNOWLEDGMENT: Federal Highway Administration

PB-231173/AS

3A 234099

HOLLAND

A NEW CONSTRUCTION CONCEPT WAS DEVELOPED PRIMARILY TO PROTECT CANALS AND OTHER WATERWAYS FROM SCOUR AND EROSION. IT INVOLVES PLACING DOUBLE WALLED CLOTH MATTRESS MATERIAL OVER THE BANK OR OTHER AREA TO BE PROTECTED. THE TWO LAYERS OF CLOTH, PREFERABLY NYLON, ARE WOVEN TOGETHER EVERY SIX OR EIGHT INCHES AT THE POINTS. MULTIPLE SECTIONS OF SUCH MATTRESS MAY BE JOINED TO COVER WIDE AREAS. WHEN PROPERLY POSITIONED AND SECURED, CEMENT MORTAR IS PUMPED INTO THE MATTRESS TO INFLATE IT SO IT RESEMBLES COBBLESTONE PAVING. THE SIZE OF THE COBBLES DEPENDS ON THE SPACING OF THE TACK POINTS. ONE SECTION IS PUMPED AT A TIME UNTIL THE SCHEME IS COMPLETED. THE SYSTEM CAN BE USED TO PAVE A STREAM BED BY STRETCHING THE MATERIAL FROM ONE BANK TO THE OTHER, EVEN WHERE STRONG CURRENTS EXIST. THIS DUTCH PROCESS IS BEING INTRODUCED INTO THE U. S. CONSTRUCTION INDUSTRY UNDER THE TRADE-MARK FABRIFORM. NEW APPLICATIONS SUCH AS PILE JACKETING, TUNNEL LINING, BEACH PROTECTION, SMALL DAM ENCASUREMENT, ETC. ARE BEING TESTED OR STUDIED.

Prepakt Reporter Apr. 1967

3A 234111

THE NEW AUSTRIAN TUNNELING METHOD

THE METHOD /AUSTRIAN PATENT 165573 OF 1948/ IS TO CONSTRUCT A TEMPORARY CONCRETE ROOF AND THE PERMANENT FLOOR AS THE TUNNEL IS BEING BORED. DEFORMATION MEASUREMENTS OF THE TEMPORARY ROOF SHOW THE STRENGTH OF STEEL REINFORCEMENT REQUIRED FOR THE PERMANENT LOADBEARING ROOF. THE USE OF SPRAYED CONCRETE PERMITS GREATER STABILITY BY INCLUDING THE MOUNTAIN IN THE LOADBEARING SYSTEM. CONSIDERABLY THINNER LAYERS OF CONCRETE ARE BEING USED THAN WITH TRADITIONAL METHODS. /AUTHOR/

Von, RABCEWICZ L Sattler, K *Bauingenieur /Germany/* 1965

3A 234135

ANALYSIS OF EMBANKMENT STRESSES AND DEFORMATIONS

THE FINITE ELEMENT METHOD IS APPLIED TO THE EVALUATION OF EMBANKMENT STRESSES AND DEFORMATIONS. CONSTRUCTION SEQUENCE PLAYS AN IMPORTANT PART IN THE DEFORMATIONS DEVELOPED IN EARTH EMBANKMENTS, AND IN INCREMENTAL CONSTRUCTION VERSION OF THE FINITE ELEMENT METHOD IS DESCRIBED WHICH ACCURATELY ACCOUNTS FOR THIS EFFECT. CALCULATIONS DEMONSTRATE THE INFLUENCE OF BASIC PARAMETERS SUCH AS MATERIAL PROPERTIES, SIZE, GEOMETRY ON THE STRESSES AND DEFORMATIONS DEVELOPED IN EMBANKMENTS, AND THE EFFECT OF FOUNDATION FLEXIBILITY ON THE EMBANK-

MENT. BECAUSE THE EARTH USED IN EMBANKMENTS IS NOT AN IDEAL ELASTIC MATERIAL, THE FINITE ELEMENT PROGRAM WAS MODIFIED TO TAKE INTO ACCOUNT MORE REALISTIC STRESS-STRAIN RELATIONSHIPS. THE SOIL CONSTITUTIVE RELATIONS WERE EXPRESSED IN TERMS OF THE BULK MODULUS AND THE DEFORMATION MODULUS, AND IT WAS ASSUMED THAT ONLY THE DEFORMATION MODULUS WOULD VARY WITH STRAIN. RESULTS OF AN ANALYSIS OF OTTER BROOK DAM, USING NONLINEAR PROPERTIES DEFINED BY TESTS OF THE DAM MATERIALS, WERE FOUND TO BE IN GOOD AGREEMENT WITH FIELD OBSERVATIONS OF DEFORMATIONS IN THIS STRUCTURE. /ASCE/

Clough, RW Woodward, RJ *Am Soc Civil Engr J Soil Mech Div* July 1967

3A 234209

DESIGN AND CONSTRUCTION OF A HORIZONTAL VISCOUS FLOW MODEL

THE HORIZONTAL VISCOUS FLOW MODEL WITH INFINITE AREAL EXTENT CAN BE USED FOR ALMOST ANY WELL FLOW PROBLEM WHETHER TWO-DIMENSIONAL OR THREE-DIMENSIONAL, STEADY OR NONSTEADY, SINGLE AQUIFER OR MULTIAQUIFER. THIS MODEL CAN ALSO BE USED IN THE FIELD OF SOIL MECHANICS FOR SUBSURFACE DRAINAGE PROBLEMS. THE DESIGN INCLUDES SCALE MODEL ANALYSIS AND THE APPLICATION OF CONFORMAL MAPPING TECHNIQUES IN ORDER TO SIMULATE AN IDEAL AQUIFER. CONSTRUCTION, CALIBRATION, AND TEST PROCEDURES FOR THE MODEL ARE DESCRIBED. THE APPARATUS HAS PROVED TO BE BOTH A VALUABLE RESEARCH TOOL AND AN EXCELLENT TEACHING AID.

Varrin, RD Fang, HY
Ground Water July 1967

3A 234235

GRAIN SIZE VS DOLLARS FOR DRAINAGE AGGREGATES

ADEQUATE SUBSURFACE DRAINAGE IS RECOGNIZED AS ONE OF THE MOST IMPORTANT FEATURES IN THE DESIGNING AND CONSTRUCTION OF MANY CIVIL ENGINEERING WORKS, INCLUDING EARTH DAMS, SPILLWAYS, RETAINING WALLS, HIGHWAYS AND AIRPORTS. MONEY ALLOTTED TO SUBSURFACE DRAINAGE USUALLY IS RETURNED MANY TIMES. HOWEVER, A TREND IN THE SELECTION OF TYPES OF AGGREGATES FOR SUBSURFACE DRAINAGE SYSTEMS HAS, IN SOME CASES, LED TO HIGHLY UNECONOMICAL DESIGNS. SEVERAL EXAMPLES ARE GIVEN. DESPITE THE LARGE SUM SPENT FOR SUBSURFACE DRAINAGE, THE STRUCTURES SUFFERED DAMAGE FROM WATER BECAUSE OF INADEQUATE DRAINAGE CAPACITY. FREQUENTLY THE SOLUTION IS FOUND IN THE USE OF GRADED FILTERS, A TYPE OF SANDWICH CONSTRUCTION THAT UTILIZES A CORE OF CLEANED, WASHED AND SCREENED AGGREGATE OF ONE SIZE WITHIN PROTECTING ENVELOPES OF FINER, SELECTED FILTER MATERIALS. WHEN COARSE ONE-SIZE AGGREGATES ARE USED IN DRAINAGE LAYERS, IT IS USUALLY NECESSARY TO PLACE A SEPARATE FINE FILTER LAYER AGAINST THE SOIL. FINE AND COARSE FILTER MATERIALS GENERALLY CAN BE PLACED IN LAYERS OF UNIFORM THICKNESS IF THE WORK IS PLANNED TO PREVENT EQUIPMENT OPERATIONS THAT WILL CAUSE RUTTING OR SHOVING OF THESE LAYERS. A COST COMPARISON TABLE IS PRESENTED AS EVIDENCE THAT FINE-GRAINED SINGLE-LAYER AGGREGATE DRAINS ARE EXTREMELY UNECONOMICAL WHEN USED FOR THE REMOVAL OF APPRECIABLE QUANTITIES OF GROUND WATER AND SEEPAGE. DRAINAGE SYSTEMS SHOULD ALWAYS BE DESIGNED USING MODERN CRITERIA FOR FILTER MATERIALS THAT WILL ASSURE PERMANENT, ADEQUATE WATER REMOVAL WITHOUT CLOGGING. ECONOMIC STUDIES INDICATE THE NEED FOR EVALUATING EACH SUBSURFACE DRAINAGE SYSTEM ON THE BASIS OF THE BENEFITS POSSIBLE IN RELATION TO THE AMOUNT OF MONEY SPENT.

Cedergren, HR *Civil Engineering Asce* Nov. 1967

3A 234267

MULTIPLE-SANDWICH METHOD OF SOFT-CLAY BANKING USING CARDBOARD WICKS AND QUICKLIME

THIS PAPER REPORTS BASIC EXPERIMENTS ON A NEW CONSTRUCTION METHOD FOR RIVER DYKES OR HIGHWAY EMBANKMENTS, USING SOFT ALLUVIAL CLAY OF HIGH WATER CONTENT. BY THIS METHOD, SANDWICHES (5CM THICK) CONSISTING OF CARDBOARD WICKS AND GRANULAR QUICKLIME ARE OVERLAID WITH A 60-70 CM CLAY LAYER. IT HAS PROVED FAIRLY SATISFACTORY IN PRACTICE. /AUTHOR/

Yamanouchi, T Miura, N *Israel Soc Soil Mechanics & Fdn Eng* Sept. 1967

3A 234407

UNDERGROUND CORROSION AND SALT INFILTRATION

THE MECHANISM OF SALT PENETRATION INTO THE SOIL AND THE POSSIBLE EFFECTS OF INFILTRATED SALTS ON UNDERGROUND CORROSION ARE DISCUSSED. SIZABLE QUANTITIES OF HIGHWAY DEICING SALTS ENTER THE SOIL ADJACENT TO HIGHWAYS. SALTS ARE MOVED THROUGH THE SOIL PRIMARILY BY THE MOVEMENT OF SOIL WATER, WITH DIFFUSION HAVING ONLY MINOR IMPORTANCE. THE RATE OF WATER AND SALT MOVEMENT DEPENDS ON THE SOIL PERMEABILITY. SALT PENETRATION IS RELATED TO UNDERGROUND TYPE CORROSION IN SEVERAL WAYS. INCREASED SALT CONCENTRATIONS REDUCE SOIL RESISTIVITY AND GENERALLY INCREASE THE CORROSIVENESS OF THE SOILS. THE NATURAL LEACHING PROCESS PRODUCES CONCENTRATION DIFFERENCES OVER NARROW DEPTHS WHICH CAN PRODUCE GALVANIC CELL CORROSION, THE IMPORTANCE OF WHICH WILL DEPEND ON THE STABILITY OF THE ANODE LOCATION. THESE EFFECTS ARE RELATED TO SOIL DRAINAGE. CONSTRUCTION PROCEDURES SHOULD BE CONTROLLED TO PROVIDE A UNIFORM AND WELL DRAINED SOIL AROUND PIPES.

Berthouex, PM Prior, GA *Journal Awwa* Mar. 1968

3A 234539

DISPERSION-FACTORS IN THE THICKNESS OF CARRIAGEWAY LAYERS

TO CONTROL THE THICKNESS OF CARRIAGEWAY LAYERS, A LIMITED NUMBER OF DESTRUCTIVE TESTS ARE CARRIED OUT, THE RESULTS OF WHICH ARE AFFECTED BY AN ACCIDENTAL ERROR DUE TO VARIOUS CAUSES OF DISPERSION. THESE CAUSES ARE IRREGULARITIES OF THE SURFACES DELIMITING THE LAYER STUDIED OR GEOMETRICAL FACTORS AFFECTING THE PARALLELISM OF THESE SURFACES. ANALYSIS OF THESE FACTORS SHOWS THE PRESENCE OF FOUR VARIABLES IN THE VARIANCE OF THICKNESS OF A LAYER. THE FIRST TWO VARIABLES ARE LOCAL UNDULATIONS IN THE SURFACES, THE THIRD IS LINKED WITH THE COVARIANCE OF THE UNDULATIONS, THE FOURTH TRANSLATES THE EFFECT OF THE NON-PARALLELISM OF THE SURFACES. THE NORMALITY OF THICKNESS DISTRIBUTION AND THE ACCURACY OF THE ANALYTICAL EXPRESSION OF VARIANCE WERE CONFIRMED BY MEANS OF THE STATISTICAL ANALYSIS OF 240 TOPOGRAPHICAL MEASUREMENTS CARRIED OUT BY THE C.R.R. IN 1963 ON ONE OF THE FIVE EXPERIMENTAL SECTIONS OF THE 223 R.N. THE RESULTS FROM THESE MEASUREMENTS CONCERNING THICKNESS OF SUB-BASE, OF BINDER AND OF ASPHALTIC CONCRETE ARE GIVEN FOR INFORMATION PURPOSES. THE AUTHOR CONCLUDES THAT THE REGULARITY OF THE THICKNESS OF A CARRIAGEWAY LAYER DEPENDS ONLY PARTLY ON THE CARE WITH WHICH THE LAYER WAS BUILT AND THAT THIS LAYER IS VERY SENSITIVE NOT ONLY TO THE EVENNESS OF SURFACE OF THE UNDERLYING LAYER BUT ALSO TO THE COVARIANCE OF UNDULATIONS IN THE TWO SURFACES AND TO THE LACK OF PARALLELISM WHICH CAN OCCUR BETWEEN THEM. /RRL/

Ganse, RV *Technique Routiere, Brussels /Belgium/* Dec. 1965

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 234610

ONE OF THE EFFECTIVE TECHNIQUES FOR THE UNDERGROUND CONSTRUCTION OF BEARINGS FOR STRUCTURES BUILT ON SOIL HAVING A LOW BEARING CAPACITY (IN RUSSIAN)

DETAILS ARE GIVEN OF A METHOD USED IN JAPAN FOR SINKING LARGE PRESTRESSED CONCRETE CAISSONS THROUGH SOFT SOIL. TO ILLUSTRATE THE TECHNIQUE, THE SINKING OF A CAISSON FOR A BREAKWATER IS DESCRIBED. THE METHOD CONSISTS IN SINKING THE LOWER PART OF THE CAISSON OPENED AT BOTH ENDS SO THAT ITS UPPER EDGE IS BELOW WATER LEVEL; THE UPPER SIDE IS THEN CLOSED, AND WATER PUMPED INSIDE THE CAISSON. THE PRESSURE OF THE WATER IS SUFFICIENT TO SINK THE CAISSON. /LCPC/RRL/

Savinov, OA *Osnovaniya Fund Mekh Gruntov /Ussr/* 67

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 234633

CONSTRUCTION OF THE UNDERGROUND VEYTAUX POWER PLANT BY MEANS OF ROCK ANCHORING RODS AND SHOTCRETE /IN FRENCH/

THE CONSTRUCTION METHODS USED FOR AND TESTS CARRIED OUT DURING THE INSTALLATION OF THE UNDERGROUND HYDROELECTRIC POWER PLANT ARE DESCRIBED. THE ROCK CONSISTED MAINLY OF LIMESTONE AND CLAY-SHALE, THE STRATIFICATION WAS SUBHORIZONTAL, STRATA WERE UNDULATING, AND THERE WERE SEVERAL VERTICAL DIACLASE NET WORKS. GROUND SUPPORT WAS CARRIED OUT BY MEANS OF ROCK ANCHORING RODS AND THE APPLICATION OF A SHOTCRETE LAYER PROJECTED ON THE SURFACE OF THE EXCAVATION. THIS VERY RAPID METHOD PREVENTED DISPLACEMENTS OF THE ROCK FROM OCCURRING DURING THE EXCAVATION. THE STATIC CALCULATION OF THE GROUND SUPPORT WAS DONE BY USING THE TALOBRE AND RABCEWICZ METHODS AND THE FINITE ELEMENT METHOD. BECAUSE OF THE EXISTING CRACKS, THE CALCULATION WAS MADE FOR AN ELASTIC RANGE, AND BY AN ITERATIVE METHOD ASSUMING THE TENSILE STRENGTH TO BE EQUAL TO NIL. THERE WAS A GOOD AGREEMENT BETWEEN THE DISPLACEMENT VALUES CALCULATED AND THOSE MEASURED IN THE EXCAVATION. TESTS CARRIED OUT ON A PHOTOELASTIC MODEL SHOW THAT THE RATIO BETWEEN THE LENGTH OF THE ANCHORAGE AND THE DISTANCE BETWEEN THE RODS MUST BE A MINIMUM OF 2 IN ORDER TO OBTAIN UNIFORM COMPRESSION FROM THE RODS. TESTS ALSO SHOW THAT STRESS DISTRIBUTION IN A CRACKED MEDIUM IS VERY DIFFERENT FROM THAT IN A HOMOGENEOUS CONTINUOUS MEDIUM. /LCPC/RRL/

Rescher, OJ *Bull Tech De La Suisse Romande /Switz/* July 1968

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 234742

FIELD AND LABORATORY BEHAVIOR OF A LIGHTLY OVERCONSOLIDATED CLAY

AN EXTENSIVE SERIES OF FLOOD LEVEES UP TO 10 FT HIGH IS BEING CONSTRUCTED IN LAUNCESTON, AUSTRALIA. THE LEVEES REST ON A SOFT CLAY AND A MAJOR FAILURE OCCURRED ON RAISING THE LEVEES TO A 7-FOOT HEIGHT. AN INVESTIGATION HAS BEEN MADE TO ANALYZE THE FAILURE AND RECOMMEND FUTURE CONSTRUCTION PROCEDURES. LABORATORY TESTING SHOWED THE SOIL TO BE LIGHTLY OVERCONSOLIDATED AND OBSERVATIONS ON A FULL SIZE INSTRUMENTED TEST LEVEE INDICATE THAT THE DEGREE OF OVERCONSOLIDATION, ALTHOUGH SMALL, INFLUENCES FIELD BEHAVIOR TO A MARKED EXTENT. TOTAL STRESS ANALYSES GAVE A FACTOR OF SAFETY AGAINST GENERAL SHEAR FAILURE OF 1.60, AND AN EFFECTIVE STRESS ANALYSIS GAVE SLIGHTLY BELOW UNITY ASSUMING THAT THE CONSOLIDATION INDEX INDICATES THAT CRITICAL STATE CONDITIONS MAY APPLY. A FOUR STAGE CONSTRUCTION PROCEDURE HAS BEEN RECOMMENDED ON THE

BASIS OF RESULTS FROM THE INVESTIGATION. /RRL/AUTHOR/

Parry, RH *Geotechnique /UK/* June 1968

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 235013

PILES AND PILE FOUNDATIONS /IN FRENCH/
PILE SYSTEMS ARE DESCRIBED. THE BEARING CAPACITY AND STABILITY OF PILES ARE DISCUSSED. NUMERICAL DATA AND EXAMPLES OF PRACTICAL APPLICATIONS ARE GIVEN. IT DEALS WITH WOODEN, METAL, CONCRETE AND REINFORCED AND PRESTRESSED CONCRETE PILES. CONSTRUCTION METHODS AND SITE EQUIPMENT ARE REVIEWED, STATIC AND DYNAMIC FORMULAE ARE PRESENTED, AND THE STABILITY OF GROUPS OF PILES IS ANALYZED. /LCPC/RRL/

Davilian, Z *Editions Eyrolles /France/* 1969

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 235022

DRILLING OF MOTORWAY TUNNELS IN VERY DIFFICULT ROCK /IN GERMAN/

A COMPARISON IS MADE BETWEEN TWO METHODS OF TUNNEL CONSTRUCTION USED FOR THE SERRA RIPOLI AND ROVINE TUNNELS IN THE MILAN-ROME-NAPLES MOTORWAY. BOTH METHODS WERE USED FOR THE SERRA RIPOLI TUNNEL, WHICH CONSISTS OF TWO PARALLEL TUBES; EACH TUBE WAS BUILT ACCORDING TO A DIFFERENT METHOD. THE CONSTRUCTION OF THE FIRST TUBE WAS CARRIED OUT ACCORDING TO THE STANDARD DRIFT METHOD AND TIMBERING. THE SECOND TUBE WAS DRIVEN IN HALF SECTION, AND A PRELIMINARY PROTECTIVE SHOTCRETE LINING WAS IMMEDIATELY APPLIED. LATER, METAL CENTERINGS COATED WITH SHOTCRETE WERE PLACED IN POSITION TO FORM A PRELIMINARY ARCH. THE OTHER CONSTRUCTION STAGES WERE SIMILAR TO THOSE OF THE STANDARD METHOD. THE USE OF SHOTCRETE RESULTED IN SAVINGS IN CONSTRUCTION COSTS AS THE THICKNESS OF THE TUNNEL LINING WAS REDUCED AND THE CONSTRUCTION SITE MECHANIZED. /LCPC(A)/RRL

Zanon, A

Geologie Und Bauwesen, Vienna /Austria/

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 235031

EMBANKMENTS ON COMPRESSIBLE SOILS /IN FRENCH/
THIS BIBLIOGRAPHY LISTS PUBLICATIONS CONCERNED WITH THE CONSTRUCTION OF EMBANKMENT ROADS BUILT ON VARIOUS TYPES OF COMPRESSIBLE SOIL (PEAT, SWAMP, MUD, CLAY, ETC). IT DEALS WITH (1) CONSTRUCTION, (2) STUDY OF SOIL IN-SITU AND IN THE LABORATORY (FULL-SCALE TESTS, PORE PRESSURE MEASUREMENTS, ODOMETER SHEAR TESTS, ETC) FROM THE POINT OF VIEW OF ITS COMPOSITION, MECHANICAL CHARACTERISTICS, BEHAVIOR (SETTLEMENT, CONSOLIDATION, ETC.) AND (3) CONSTRUCTION METHODS FOR THIS TYPE OF ROAD. /TRRL/

Lab Cent Ponts Chauss, Paris /France/ 1969, 2 pp, 183 Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 235047

DIFFICULTIES ENCOUNTERED DURING THE CONSTRUCTION OF THE FOUNDATIONS OF TWO STRUCTURES /IN FRENCH/
THE FOLLOWING FACTORS HAD TO BE TAKEN INTO ACCOUNT IN CONSTRUCTING WELL SUNK FOUNDATIONS IN LIMESTONE IN ASTERIES DU STAMPIEN: INCORRECT PREDICTION OF GROUND CONDITIONS, ADVANTAGES, DISADVANTAGES AND EFFECTIVENESS OF SHEATHING SYSTEMS, STOPPAGE OF THE SINKING OF EACH WELL BECAUSE OF

POSSIBLE LATERAL FRICTION, SUBSTANTIAL LOSSES OF CONCRETE IN THE LIMESTONE DISCONTINUITIES, AND DIFFICULTY OF ENSURING THE HOMOGENEITY OF THE PRESENCE OF LOOSE POCKETS OF CLAY AND SAND IN THE LIMESTONE. THEREFORE IT WAS NECESSARY TO CONDUCT MORE NUMEROUS AND DETAILED PRELIMINARY INVESTIGATIONS. RESULTS SHOWED THAT, ECONOMICALLY THE BEST SOLUTION WAS TO SINK A SMALL NUMBER OF LARGE, CREEP WELLS WHENEVER POSSIBLE. ATTENTION IS DRAWN TO THE IMPORTANCE OF USING VERY SPECIAL ELABORATE CONSTRUCTION METHODS FOR DEEP FOUNDATIONS BUILT UNDER WATER IN THIS TYPE OF SOIL. /LCPC/A/RRL/

Colliez, P *Bull Liaison Labs Routiers /France/* No. 50, Feb. 1971, pp 133-48, 10 Fig, 4 Phot

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 235057

DEEP FOUNDATIONS PART II

CONSTRUCTION DEFECTS AND EXAMPLES ARE GIVEN OF DRY CONCRETING, CONCRETING UNDER WATER, CONCRETING UNDER DRILLING MUD, SHALLOW DRILLED SHAFTS, AND CORROSION OF PILES BY THE SURROUNDING MEDIUM: WOODEN PILES, METAL PILES. /TRRL/

Logeais, L *Batir /France/* No. 3, Apr. 1971, pp 45-56, 10 Fig, 41 Phot

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 235082

EARTHWORKS WITH EXPLOSIVES BY MEANS OF THE OVERBURDEN DRILLING METHOD /IN FRENCH/

IN ORDER TO REDUCE TO A MINIMUM THE INCONVENIENCE CAUSED BY DRILLING IN THE VICINITY OF BUILDINGS DURING THE CONSTRUCTION OF THE PARIS-LYON MOTORWAY, IT WAS DECIDED TO USE THE OVERBURDEN DRILLING METHOD WHICH WAS DEVELOPED IN SWEDEN. DETAILS ARE GIVEN OF THE METHOD AND OF ITS MAIN APPLICATIONS: DRILLING AND BLASTING OF THE BEDROCK WITHOUT PRELIMINARY REMOVAL OF SOIL COVERING, OPENING OF TRENCHES, BLASTING UNDER WATER, MORTAR BLINDING, STRENGTHENING OF SHEET PILES BY INSTALLATION OF CABLES OR BARS, TIE RODS, MINERAL SITE INVESTIGATION, ETC. /TRRL/

Basset, C Roux, R *Bull Liaison Labs Routiers /France/* No. 53, June 1971, pp 7-9, 2 Fig, 1 Phot

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 235105

LOW-STRENGTH CLAYEY SOIL /IN RUSSIAN/

THIS PUBLICATION CONTAINS 76 OF THE 117 REPORTS PRESENTED AT THE FEDERAL CONFERENCE ON CONSTRUCTION PROBLEMS ENCOUNTERED WITH SATURATED, LOW-STRENGTH CLAYEY SOIL. THE REPORTS ARE CLASSIFIED INTO THREE SECTIONS AS FOLLOWS: (1) ENGINEERING GEOLOGY APPLIED TO SATURATED COMPRESSIBLE CLAYEY SOIL; (2) CALCULATIONS OF STRUCTURES RESTING ON COMPRESSIBLE SOIL, AND SHEARING STRENGTH, CREEP AND RHEOLOGY; AND (3) ANALYSIS OF SOME CASES AND CONSTRUCTION METHODS FOR STRUCTURES ON COMPRESSIBLE SOIL. /TRRL/

Tsytoich, NA

Aluste Institut /Ussr/ 1965, 420 pp, Figs, Tabs, Refs

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 235162

SOFT GROUND TUNNELING TECHNOLOGY IN GERMANY
DEVELOPMENTS IN SOFT GROUND TUNNEL CONSTRUCTION REPRESENTING THE LARGEST APPLICATION IN GERMANY ARE PRESENTED. THE PAPER DEALS WITH OPEN CONSTRUCTION, CLOSED (COVERED) CONSTRUCTION WITH SOME SPECIAL METHODS SUCH AS THOSE OF FREEZING AND TUNNELING UNDER PROTECTIVE PIPES, MACHINE-SHIELD

TUNNELLING AND WITH TUNNEL LININGS AND SEALS. THE DATA ARE BASED MAINLY ON PRACTICAL EXPERIENCE GAINED IN THE CONSTRUCTION OF UNDERGROUND RAILWAY TUNNELS. /RRL(A)/

Girnau, G *Technology and Potential of Tunnelling* June 1970

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 235214

THE UNDERGROUND ROUTINE OF URBAN HIGHWAYS
THE ADVANTAGES DERIVED BY THE COMMUNITY AND THE ROAD USER FROM THE CONSTRUCTION OF UNDERGROUND URBAN ROADS ARE DESCRIBED WITH REGARD TO COST, LAND LOSS, NOISE, VISUAL BARRIER, PEDESTRIAN BARRIER, COMMUNITY DIVISION, APPEARANCE, DRIVING COMFORT, ACCESS, AND VIEW. THE DEPTH OF TUNNELS, DESIGN OF ACCESS ROADS, TUNNEL SHAPE AND CONSTRUCTION METHODS, VENTILATION, LIGHTING AND SERVICES ARE DISCUSSED TOGETHER WITH THE FACILITIES OFFERED BY A CENTRAL CITY TERMINAL. /TRRL/

Marc, RC *Roads & Road Construction, London* /UK/ Vol. 49 No 578-9, Feb. 1971, pp 61-4, 1 Fig, 5 Phot

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 235229

TUNNELLING FOR URBAN HIGHWAYS
THIS PAPER DISCUSSES THE VARIOUS TUNNELLING METHODS, SUCH AS SUBMERGED TUBE CONSTRUCTION, CUT-AND-COVER- WORK, AND SUB-SURFACE BORING TECHNIQUES, AND DESCRIBES IN SOME DETAIL THE PROGRESS WHICH HAS BEEN MADE TO IMPROVE CONSTRUCTION METHODS ESPECIALLY IN THE PROVISION OF TUNNELING MACHINES WHICH ARE REDUCING THE DIRECT COST OF TUNNEL CONSTRUCTION. INDIRECT COSTS, SUCH AS EXCESSIVE LAND COSTS, DIVERSIONS OF SERVICES BOTH TEMPORARY AND PERMANENT, DISRUPTION TO TRAFFIC AND DISTURBANCE TO AN ESTABLISHED WAY OF LIFE ARE CONSIDERED. CONCLUSIONS ARE DRAWN RELATING TO THE VIABILITY OF TUNNELING FOR HIGHWAYS. /TRRL/

Tough, SG *Inst Hwy Engineers Journal, London* /UK/ Vol. 18 No. 6, June 1971, pp 21-7, 1 Tab, 3 Phot

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 235232

DESIGN AND CONSTRUCTION OF THE HONG KONG CROSS-HARBOR TUNNEL
THE DESIGN AND CONSTRUCTION OF THE HONG KONG CROSS-HARBOR TUNNEL ARE DESCRIBED. THE TUNNEL, WITH HEADROOM OF 16 FT HAS DUAL TWO-LANE CARRIAGEWAY, EACH 22 FT WIDE, WIDENING TO 215 FT ON THE KOWLOON SIDE FOR TOLL BOOTH LANES. THE SUBMERGED SECTION CONSISTS OF 15 UNITS, VARYING IN LENGTH FROM 324 TO 374 FT AND WEIGHING OVER 20,000 TONS, WHICH ARE OF TWIN STEEL TUBE CONSTRUCTION WITH A REINFORCED CONCRETE KEEL AND INTERIOR AND EXTERIOR LINING, AND BALLAST CONCRETE. WHEN COMPLETED, THE TUNNEL WITH ITS SUBMERGED SECTION LENGTH OF 5256 FT WILL BE THE LONGEST TWIN STEEL SUBMERGED TUNNEL IN THE WORLD. /RRL/

Innes, KW *Tunnels & Tunnelling* /UK/ July 1971

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 235233

TUNNELLING ON THE BRIXTON EXTENSION OF THE VICTORIA LINE
THE EXCAVATION AND CONSTRUCTION METHODS USED FOR THE 5.5 KM-LONG EXTENSION OF THE VICTORIA LINE FROM VICTORIA TO BRIXTON IN SOUTH-WEST LONDON IS DESCRIBED. THE CONSTRUCTION, WHICH COMPRISES TWIN

RUNNING TUNNELS, WAS CARRIED OUT USING BORED TUNNELLING METHODS; TOTAL COSTS AMOUNTED TO 12.5 M POUNDS. /TRRL/

Bubbers, BL *Tunnels & Tunnelling* /UK/ Vol. 3 No. 4, July 1971, pp 235-42, 5 Fig, 1 Phot, 4 Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 235234

UNDERGROUND MOTORWAYS FOR URBAN AREAS
THE CASE IS DISCUSSED FOR THE CONSTRUCTION OF URBAN MOTORWAYS BELOW GROUND LEVEL, AND THEIR ADVANTAGES ARE STRESSED: REDUCTION IN NOISE AND AIR POLLUTION, AND CREATION OF VALUABLE LAND SPACE THANKS TO RELATIVELY LOW INTRUSION ON THE URBAN ENVIRONMENT. THE GENERAL COMPARISON OF CONSTRUCTION COSTS IS DIFFICULT AS AMENITY VALUES, LAND AND REDEVELOPMENT COSTS, AND LOCAL SOIL CONDITIONS HAVE TO BE CONSIDERED. DEMAND WILL GROW IN THE FUTURE FOR MOTORWAY TUNNELS, AND PRIORITY SHOULD BE GIVEN TO RESEARCH INTO PROBLEMS OF TUNNEL DESIGN, STRUCTURAL LOADING, PLANT, MAINTENANCE AND CONSTRUCTION OPERATION REQUIREMENTS. /TRRL/

Lyons, DJ *Tunnels & Tunnelling* /UK/ Vol. 3 No. 4, July 1971, pp 277-8, 2 Fig, 2 Tab

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 235272

LIST OF PUBLICATIONS (1951-1970)
A LIST OF THE PAPERS, REPORTS AND TECHNICAL NOTES, PRODUCED BY THE PORT AND HARBOUR RESEARCH INSTITUTE SINCE 1951, IS PRESENTED GROUPED AS FOLLOWS: HYDRAULICS AND COASTAL ENGINEERING; SOIL MECHANICS AND FOUNDATION ENGINEERING; STRUCTURAL MECHANICS AND EARTHQUAKE ENGINEERING; MATERIALS TECHNOLOGY; DESIGNING; PORT PLANNING; DREDGING AND CONSTRUCTION EQUIPMENT; AIRPORT ENGINEERING. /RRL/

Transportation Ministry /Japan/ Apr. 1971, 86 pp

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 235365

FACTORS AFFECTING VERTICAL LOADS ON UNDERGROUND DUCTS DUE TO ARCHING
A THEORETICAL AND MATHEMATICAL ANALYSIS IS PRESENTED ON THE THEORY OF EARTH PRESSURE ON UNDERGROUND CONDUITS. NO DIFFERENTIATION IS MADE BETWEEN RIGID OR FLEXIBLE CONDUITS BECAUSE THE SHAPE OF THE CONDUIT IS NOT CONSIDERED A VARIABLE. THE MATHEMATICAL TREATMENT DEALS WITH THE PRESSURES ACTING IN THE PLANE PERPENDICULAR TO THE LONGITUDINAL AXIS OF THE CONDUIT. IT IS SHOWN THAT THE PRESSURE ON TOP OF BOTH COVERED-UP AND MINED-IN CONDUITS IS GOVERNED BY THE SAME MATHEMATICAL RELATIONS. HOWEVER, THE VALUES OF THE PHYSICAL FACTORS APPEARING IN THE THEORETICAL EXPRESSIONS DEPEND UPON THE GEOMETRY AND NATURE OF INSTALLATION, THE PHYSICAL PROPERTIES, AND THE INITIAL STATE OF THE MATERIALS, AS WELL AS ON THE CONSTRUCTION METHODS AND WORKMANSHIP EMPLOYED. A GOOD SOIL EXPLORATION OF THE SITE WHERE THE CONDUIT IS TO BE INSTALLED IS IMPERATIVE BECAUSE KNOWLEDGE OF THE PHYSICAL PROPERTIES OF THE SOILS INVOLVED IS NECESSARY. THE LOAD ON COVERED-UP CONDUITS BECOMES A MINIMUM IF THE CONDUIT SIDE SUPPORTING MATERIAL IS THOROUGHLY COMPACTED, THE DITCH DIRECTLY ABOVE THE CONDUIT IS MADE AS HIGH AS ECONOMICALLY FEASIBLE, AND THE DITCH IS FILLED WITH A COMPRESSIBLE, LOOSE MATERIAL. SINCE AN UNDERGROUND CONDUIT HAS THE TENDENCY TO SETTLE MORE IN THE MIDDLE THAN AT ITS ENDS, THE EARTH MASS WHICH IS ABOVE ITS MIDDLE

PORTION, WILL TEND TO BRACE ITSELF AGAINST THE END MASSES THEREBY INCREASING THE NORMAL PRESSURE AND THE LONGITUDINAL STRAINS AT THE ENDS AND DECREASING THE PRESSURE AT THE MIDDLE. THE EFFECTS OF SUCH ARCHING ACTION ARE CONSIDERED TO BE ESPECIALLY SIGNIFICANT IN THE CASE OF LONG CONDUITS INSTALLED UNDER HIGH FILLS.

Costes, NC *Highway Research Board Bulletin* 1956

3A 235575

MIXING-IN-PLACE SOIL AND PORTLAND CEMENT CONSTRUCTION METHODS CAN BE FOUND TO MIX PORTLAND CEMENT GROUT AND SOIL IN PLACE BELOW GROUND AT THE RATE OF 1,000 CU YD A DAY AT \$8 TO \$15 PER CU YARD. WHEN SUCH METHODS AND APPARATUS ARE DEVELOPED, THERE WILL BE WIDESPREAD APPLICATION IN THE FIELD OF UNDERGROUND CONSTRUCTION. AMONG THE MORE IMPORTANT APPLICATIONS MAY BE STABILIZING SAND DEPOSITS UNDER NUCLEAR POWER PLANTS IN EARTHQUAKE REGIONS. /ASCE/

Sherard, JL *Am Soc Civil Engr J Soil Mech Div* Nov. 1969

3A 235605

HYDRAULIC FILLS TO SUPPORT STRUCTURAL LOADS DATA ARE COMPILED BASED UPON A REVIEW OF THE LITERATURE, CONCERNING THE RELATIVE DENSITY, PENETRATION RESISTANCE, COMPRESSIBILITY AND RATE OF CONSOLIDATION. ONLY HYDRAULIC FILLS PLACED BY SLUICING THROUGH PIPES ARE CONSIDERED, AND EMPHASIS IS UPON PERFORMANCE UNDER ORDINARY DEAD AND LIVE LOADS. FILLS ARE CLASSIFIED ACCORDING TO THE NATURE OF THE BORROW MATERIAL: (1) FAIRLY CLEAN SAND, RESULTING IN A REASONABLY UNIFORM FILL OF MODERATE DENSITY; (2) SILTY OR CLAYEY SAND, FOR INHOMOGENEOUS FILL OF LARGE VOID RATIO; (3) STIFF COHESIVE SOIL, RESULTING IN A SKELETON OF CLAY BALLS RESULTING IN A LAMINATED NORMALLY CONSOLIDATED CLAY, THE CHARACTERISTICS OF EACH TYPE OF FILL ARE ILLUSTRATED BY A CASE STUDY. THE PLACEMENT AND ENGINEERING PROPERTIES OF THE MOST DESIRABLE TYPE OF FILL--THAT DERIVED FROM A FAIRLY CLEAN SAND--ARE CONSIDERED IN DETAIL. /ASCE/

Whitman, RV *Am Soc Civil Engr J Soil Mech* Jan. 1970

3A 235642

TUNNELS AND SUBWAYS ON THE SAN FRANCISCO BAY AREA RAPID TRANSIT SYSTEM APPROXIMATELY 20 MILES OF THE 75-MILE LONG SAN FRANCISCO BAY RAPID TRANSIT SYSTEM (BART) IS UNDERGROUND. FOUR MILES OF THIS ARE UNDERWATER TUBE, CONSTRUCTED BY SINKING STEEL AND CONCRETE UNITS INTO A TRENCH EXCAVATED IN THE MUDS OF THE BAY FLOOR. OF THE REMAINING 16 MILES, 4 MILES ARE IN MEDIUM SOFT ROCK, 6 MILES IN SOFT GROUND, AND 6 MILES ARE CUT-AND-COVER CONSTRUCTION. TWO MAJOR ACTIVE FAULTS, THE SAN ANDREAS AND THE HAYWARD FAULTS PASS THROUGH THE AREA. THE SAN ANDREAS FAULT IS NOT CROSSED BY THE BART SYSTEM. THE BERKELEY HILLS TUNNEL PENETRATES THE HAYWARD FAULT AT RIGHT ANGLES. THE HAYWARD FAULT RUNS NORTH-SOUTH ON THE EAST SIDE OF THE BAY. MOVEMENT ALONG THIS FAULT IS OF THE ORDER OF 1/8 INCH PER YEAR. THE ROCK IN THE AREA IS HETEROGENEOUS CONSISTING OF SANDSTONES, SILTSTONES, SHALES, AND CONGLOMERATE, WITH VOLCANIC INTRUSIONS. THE BERKELEY HILLS TUNNEL CONSISTS OF TWIN BORES EACH 3 MILES LONG, AND OVERSIZED TO PERMIT A SEISMIC CREEP OR LOCAL SHEAR OF 2 FT HORIZONTALLY AND 1 FT VERTICALLY. TWO MAJOR CONSIDERATIONS INFLUENCE THE HORIZONTAL ALIGNMENT: (1) THE NEED TO KEEP THE TUNNEL UNDER THE STREETS AS FAR AS POSSIBLE IN ORDER TO MINIMIZE THE COST OF EASEMENTS AND RIGHT-OF-WAY, AND (2) THE NEED FOR FLAT RADII TO

PERMIT THE NORMAL MAXIMUM SYSTEM SPEED OF 70 MILES PER HOUR. IN MOST PARTS OF THE SYSTEM, A MINIMUM RADIUS OF 1500 FT WAS SET DOWN. ALTERNATIVE DETAILED DESIGNS OF TUNNEL LINERS FOR THE SOFT GROUND WERE PREPARED FOR UTILIZING CAST IRON, DUCTILE IRON, FABRICATED STEEL, AND FOR THE SHALLOWER TUNNELS, PRECAST CONCRETE. ADJACENT STRUCTURES WERE UNDERPINNED DURING CONSTRUCTION. HOWEVER, SUBWAYS INTERFERED WITH EXISTING FOOTINGS. EXCAVATION METHODS HAVE VARIED WIDELY BETWEEN CONTRACTS, AND INCLUDED THREE DIFFERENT TYPES OF MOLE, SEVERAL HAND-MINING SHIELDS, AND CONVENTIONAL ROCK BLASTING. TWO OF THE MOLES ARE SOFT GROUND MACHINES WHOSE DESIGN WAS AFFECTED BY THE SPECIFICATIONS OF THE CONTRACT ON WHICH THEY WERE USED. OF THE TWO ROCK TUNNELS, THE LONGER BERKELEY HILLS TUNNEL WAS EXCAVATED USING CONVENTIONAL DRILL AND SHOOT METHODS, WITH A TWO-TIER JUMBO. THE SHORTER TUNNEL IN SAN FRANCISCO USED A JAVA MOLE WHICH UTILIZES TUNGSTEN CARBIDE INSERT CUTTERS WHICH UNDERCUT THE FACE REMOVING CHIPS OF ROCK. STEEL TUNNEL LININGS WERE CAST IN ROCK TUNNELS IN A CONVENTIONAL MANNER, USING FORMS WITH TWO HINGES TRAVELING ON RAILS. FOR SOFT GROUND TUNNELS, CONTRACTORS WERE GIVEN TWO ALTERNATIVE METHODS OF FILLING THE VOID FORMED BY THE SHIELD BETWEEN THE LINING AND THE GROUND. MOST OF THE TUNNELS ARE BELOW THE GROUNDWATER TABLE. ACTUAL SETTLEMENTS OCCURRING DURING THE BART CONSTRUCTION HAVE BEEN LESS THAN EXPECTED. TUNNELLING COSTS AND PROGRESS RATES ARE PRESENTED.

Thon, JG Amos, MJ *Tunnels & Tunnelling /UK/* Jan. 1970

3A 235645

HILL BUILT OVER TUNNEL A TUNNEL WAS BUILT AND CONSTRUCTED TO ACCOMMODATE THE NEW YORK, NEW HAVEN AND HARTFORD RAILROAD LINE NEAR BERLIN, CONNECTICUT. A HILL WAS BUILT OVER AND AROUND THE TUNNEL TO ACCOMMODATE THE SUBGRADE FOR RELOCATION OF STATE ROUTE 72 WHERE IT CROSSES THE TRACK AT AN ANGLE OF 74 DEGREES. A HINGED ARCH WAS USED WITH NEOPRENE AS A WATERPROOFING MEMBRANE, A SEAL, AND AS A BEARING MATERIAL. THE ARCH TUNNEL WAS CONSTRUCTED OF PRECAST, POST-TENSIONED UNITS. THE ARCH UNITS WERE DESIGNED TO BE LIFTED INTO POSITION AND SET INTO TEN-FOOT-WIDE FOUNDATIONS EXTENDING THE LENGTH OF THE TUNNEL THAT WERE NOTCHED TO ACCOMMODATE THE LEGS OF THE ARCH. NEOPRENE BEARINGS U-SHAPED AND FITTED TO THE BASE OF THE ARCH UNITS AT THE CASTING YARD DEVELOP THE HINGE ACTION. AREAS OF THE JOINT ABOVE AND BELOW THE PAD ARE FILLED WITH CLOSED CELL NEOPRENE SPONGE. LENGTHS OF NEOPRENE SHEET WERE USED TO WATERPROOF PARALLEL JOINTS BETWEEN ARCH UNITS.

Tunnels & Tunnelling /UK/ Jan. 1970

3A 235688

SOME DESIGN CONSIDERATIONS IN THE SELECTION OF UNDERGROUND SUPPORT SYSTEMS GUIDELINES FOR THE DESIGN OF SUPPORTS FOR UNDERGROUND OPENINGS IN BOTH SOIL AND ROCK ARE PRESENTED AND DISCUSSED FOR SEVERAL SPECIFIC SITUATIONS. THE DESIGN AND CONSTRUCTION OF BOTH SHAFTS AND TUNNELS ARE EXAMINED. THE PROBLEMS THAT MAY OCCUR BECAUSE OF UNUSUAL OR VARIABLE GEOLOGIC CONDITIONS ARE OUTLINED AND THE EFFECTS OF THESE GEOLOGIC ANOMALIES ON THE CONSTRUCTION SCHEME ARE INDICATED. SUPPORT SYSTEMS AND CONSTRUCTION METHODS WHICH CAN BE EASILY MODIFIED TO ADAPT TO VARIABLE CONDITIONS AND REQUIREMENTS ARE ALSO DISCUSSED. THE COST OF TUNNEL SUPPORT SYSTEMS IS EVALUATED AND COMPARED TO THE TOTAL COST OF THE

TUNNEL. THE COST RELATIONSHIPS ARE ILLUSTRATED BY NUMEROUS DETAILED COST ESTIMATES OF TUNNELS IN BOTH SOIL AND ROCK. FINALLY, THE PROBLEMS OF GROUND MOVEMENTS AROUND SOFT GROUND TUNNELS ARE DISCUSSED AND METHODS FOR PREDICTING THE MAGNITUDE OF SETTLEMENT OVER SOFT GROUND TUNNELS ARE PRESENTED. /AUTHOR/

Peck, RB
Illinois University, Urbana Nov. 1969

CFSTI PB190 443, 1P63211125

3A 235836

TWO DIFFERENT EXCAVATING METHODS APPLIED TO NIHONZAKA TUNNEL OF TOKYO-NAGOYA EXPRESSWAY
THE NIHONZAKA TUNNEL, IN TWIN TUBES, IS OVER 2,000 M. IN LENGTH. CONSTRUCTION WAS INITIATED AT BOTH PORTALS USING TWO DIFFERENT METHODS. SIDE WALL PILOTS FOLLOWED BY FULL SECTION DRIVING WAS ADOPTED FOR THE EAST, WHILE THE DRIVING OF THE HALF WAS APPLIED FOR THE WEST. BASALT PREVAILED EXCEPT FOR SOME CONGLOMERATE ROCK. THE TWO METHODS WERE COMPARED IN RELATION TO: (1) CONSTRUCTION PROCEDURE, (2) EQUIPMENT, (3) ACTUAL PROGRESS SCHEDULE AND CYCLE TIME, (4) DRILLING HOLES, BLASTING, AND OVER EXCAVATION, (5) HAULING OF EXCAVATED MATERIAL, (6) INSTALLATION OF STEEL SUPPORTS, AND (7) ARCH LINING. ALTHOUGH THE METHODS WERE SIMILAR IN GEOLOGICAL CONDITIONS, NAMELY, WATER LEAKAGE CONDITION THE SAFETY AND PROGRESS SCHEDULE SHOWED THAT BOTH METHODS HAD DISTINCT ADVANTAGES AND DISADVANTAGES. IN EAST PROJECT, THE HEIGHT OF THE FULL SECTION-EXCAVATION IS ABOUT 9 M. AND IN THE WEST PROJECT THE HEIGHT IS AS LOW AS 5.5 M. IN THE WEST, DURING EXCAVATION, MORE TENSION WAS REQUIRED WHEN THERE WAS WATER LEAKAGE. THE WEST PROVED TO BE SUPERIOR TO THE EAST IN A PROGRESS SCHEDULE SINCE THE RATE OF EXCAVATION IS ABOUT THE SAME FOR PILOT DRIVING, EXTENDING EXCAVATION FOR FULL SECTION-DRIVING, AND UPPER HALF-EXCAVATION, WHILE THE LOWER HALF-EXCAVATION SHOWED PROGRESS.

Hachiya, Y Tajima, T *Japan Road Association Annual Reports* 1969

3A 236348

NEW CONCEPTS FOR PIPELINE EXCAVATION IN ROCK
BECAUSE OF A COMBINATION OF MUNICIPAL INDEBTEDNESS AND LOCAL ROCK CONDITIONS, A TOWN IN OREGON THAT WAS REQUIRED TO INSTALL A SEWER CONTRACTED WITH AN ENGINEERING FIRM TO STUDY THE FEASIBILITY OF APPLYING NEW TECHNOLOGY TO THE PROBLEM. TWO FINDINGS EMERGED THAT MAY BE OF INTEREST TO OTHER CITIES: (1) UNORTHODOX SEWER SYSTEMS SUCH AS VACUUM AND COMMUNITY PRESSURE SYSTEMS WERE FOUND TO BE DEVELOPED TO SUCH AN EXTENT THAT THEY CAN PROBABLY BE DESIGNED WITHOUT MUCH FURTHER RESEARCH. (2) MACHINES AVAILABLE FOR ROCK EXCAVATION IN FIELDS OTHER THAN SEWER CONSTRUCTION SHOW CONSIDERABLE PROMISE. INVESTIGATION IS NEEDED TO DETERMINE WHETHER USE OF ROCK EXCAVATION EQUIPMENT MAY BE AS PRACTICAL AS CONVENTIONAL DRILLING AND BLASTING. NEW TECHNOLOGY APPLICABLE TO SEWER CONSTRUCTION IS REVIEWED IN THE FOLLOWING AREAS: RIPPING, DIGGING, TRENCHING, AUGERING, HYDRAULIC BREAKING, VIBRATORY DRIVING, ROTARY DRILLING, PERCUSSIVE DRILLING, AND JETTING. THE ENGINEERING FIRM IS NOW INVESTIGATING THE COSTS OF THESE VARIOUS APPROACHES.

Taylor, WA Clark, LK *Public Works* Sept. 1971

3A 236364

SOIL MECHANICS SECTION
RESEARCH ON THE MECHANICS OF SOILS AND EARTH STRUCTURES INCLUDE: (1) STUDIES ON CONSOLIDATION OF SOFT

CLAY, ORGANIC SOIL, PARTIALLY SATURATED SOIL AND IMPROVEMENT OF SOFT GROUND; (2) INVESTIGATIONS OF DYNAMIC PROPERTIES OF SOIL SUBJECTED TO EARTHQUAKES OR REPEATED TRAFFIC LOAD; (3) INVESTIGATION OF DESIGN AND CONSTRUCTION METHODS FOR UNDERGROUND STRUCTURES SUCH AS CULVERTS AND PIPE-LINES INSTALLED UNDER THE GROUND; (4) STUDIES ON STABILITY OF EARTH STRUCTURES SUCH AS LEVEES AND HIGHWAY EMBANKMENTS SUBJECTED TO SEISMIC FORCE OR SEEPAGE FORCE; AND (5) STUDIES ON DEFORMATION CHARACTERISTICS AND STRENGTH OF ROCK MATERIAL FOR DESIGNING EARTH AND ROCK FILL DAMS.

Public Works Res Inst, Cm /Japan/ Sept. 1971, pp 20-1, 2 Fig, 3 Phot

3A 236421

TUNNELING SYSTEMS AND TECHNOLOGY
THE REPORT EXAMINES STATE-OF-THE-ART IN TUNNELING SYSTEMS AND TECHNOLOGIES, WITH AN EMPHASIS ON PROMISING AREAS FOR FUTURE RESEARCH AND DEVELOPMENT PROJECTS. THE AUTHORS FOCUS PRINCIPALLY ON MACHINE BORING METHODS FOR TUNNEL CONSTRUCTION WHERE NEAR-TERM AUTOMATION HAS PROVIDED SUBSTANTIALLY INCREASED PRODUCTIVITY OVER MANUAL LABOR. THE EVOLUTION OF TUNNELING METHODOLOGY IS BRIEFLY TRACED. THE REPORT NOTES THAT SUPPORT OPERATIONS REPRESENT THE MAJOR PROBLEM FOR TUNNEL CONSTRUCTION AND THE PRINCIPAL OBSTACLE TO OPTIMIZED PRODUCTIVITY. THE AUTHORS EXAMINE PRIORITIES OF SUPPORT OPERATIONS. THE REPORT CONCLUDES THAT EACH OPERATION POSES TIME AND SPACE REQUIREMENTS WHICH ULTIMATELY CAUSE SUPPORT OPERATIONS TO LAG BEHIND MAXIMUM BORING CAPACITY. THE PERFORMANCE OF PRESENT TUNNELING SYSTEMS IS EXAMINED WITH REFERENCE TO ALTERNATIVE BORING MACHINES OPERATING IN DIFFERENT SUBSURFACE CONDITIONS. IT IS ESTIMATED THAT THE CURRENT RATE FOR COMPLETING AN AVERAGE LINED TUNNEL AVERAGES ONLY SEVEN TO FIFTEEN PERCENT OF THE RATED ADVANCE CAPABILITY OF MACHINE TECHNOLOGY. THE AUTHORS ALSO DISCUSS CURRENT TUNNEL APPLICATIONS TO A VARIETY OF SERVICES, INCLUDING SUBSURFACE URBAN TRANSPORTATION, PENETRATION OF PHYSICAL BARRIERS TO HIGH SPEED INTERCITY TRANSPORTATION, & STORAGE AND TRANSPORT OF NATURAL RESOURCES. THE REPORT CONCLUDES WITH AN OVERVIEW OF POTENTIAL RESEARCH AND DEVELOPMENT TO IMPROVE CURRENT TUNNELING TECHNOLOGY. THE ANALYSIS EMPHASIZES IMPROVED SUPPORT SYSTEMS AND PROJECTS A SEVENFOLD INCREASE IN TOTAL TUNNEL MILEAGE GIVEN POTENTIAL GROWTH IN SUPPORT TECHNOLOGY. IN ADDITION, THE AUTHORS RECOMMEND THAT FUTURE DEVELOPMENT PROGRAMS BE COORDINATED AMONG THE VARIOUS ASPECTS OF TUNNEL CONSTRUCTION TO ENSURE COMPATIBILITY AMONG NEW SYSTEMS. /UMTA/

North American Rockwell Corporation Dec. 1967

ACKNOWLEDGMENT: UMTA

3A 236428

SOFT GROUND TUNNELING SYSTEMS STUDY-PART 1: TECHNICAL DISCUSSION

THE PURPOSE OF THIS STUDY IS TO DEVELOP CONCEPTS FOR SOFT GROUND TUNNELING SYSTEMS WHICH WOULD BE CAPABLE OF OPERATING IN WEAK AND WET STRATA, BUT WITHOUT THE USE OF COMPRESSED AIR AS A WORKING ENVIRONMENT. SEVERAL TYPES OF MECHANICAL EXCAVATORS ARE USED IN SOILS WHICH HAVE MEDIUM-TO-GOOD OPEN CUT STABILITY. MOST OF THESE EXCAVATORS ARE COMPRISED OF A SERIES OF CUTTERS OR SCRAPERS MOUNTED ON A WHEEL OR DISK CUTTERHEAD. THE CUTTERHEAD IS ROUTED WHILE BEING JACKED AGAINST THE SOIL FACE, RIPPING OR GOUGING THE SOIL LOOSE. A NEW MEMCO MACHINE, BEING EMPLOYED IN THE SAUGUS TUNNEL IN CALIFORNIA, USES A DIFFERENT CONCEPT. RATHER THAN A

ROTATING WHEEL ARRANGEMENT, A 1-1 1/2 YEAR RIPPER BUCKET IS EMPLOYED. THE BUCKET CAN BE TURNED AND MOVED IN ANY DIRECTION TO BREAK OUT MATERIAL FROM THE FACE, IT IS WORKED IN AN UPRIGHT POSITION (LIKE A BACKHOE) TO PULL LOOSE MATERIAL ONTO AN INCLINED MUCKING CONVEYOR. THE MACHINE CAN BE FITTED WITH A RIPPER TOOTH WHEN CONDITIONS AT THE HEADING REQUIRE IT. THE PROBLEMS OF ENVIRONMENTAL CONTROL ENCOUNTERED IN UNDERGROUND EXCAVATION FOR TUNNELING, MINING, OR OTHER CONSTRUCTION ARE ESSENTIALLY THE SAME: GASES, DUST, HEAT HUMIDITY, EXCESSIVE NOISE, VIBRATION, LACK OF ADEQUATE LIGHT, AND THE NEED FOR PROTECTIVE CLOTHING AGAINST HAZARDS. THE USE OF BULKHEADS, INSTALLED IN THE SHIELD OF TUNNELING MACHINES IMMEDIATELY BEHIND THE CUTTERHEAD TO ISOLATE THE TUNNEL FROM WATER-SATURATED SOILS, IS BELIEVED TO HOLD CONSIDERABLE PROMISE. MEMCO DEVELOPED A MACHINE UTILIZING THE BULKHEAD PRINCIPLE AND HAS BEEN EMPLOYING IT SUCCESSFULLY ON A TUNNELING PROJECT IN SOUTH AMERICA. WITH THIS MACHINE, MUCK IS TRANSPORTED TO AND THROUGH THE BULKHEAD, NEAR THE TOP, ON A CONVEYOR BELT SYSTEM. IT HAS NOT YET ENCOUNTERED A CONDITION WHERE WATER FLOW THROUGH THE SOIL HAS BEEN SUFFICIENT TO COMPLETELY FLOOD THE AREA IN FRONT OF THE BULKHEAD, AND WILL HAVE TO BE MODIFIED TO HANDLE THIS CONDITION. /UMTA/

lit Research Institute, Jacobs Associates, Mining Equip Manuf Corp Oct. 1968

ACKNOWLEDGMENT: UMTA

3A 236463

MOBILE RIVER TUNNEL

COMPLETION OF THE MOBILE (ALA.) RIVER TUNNEL, SCHEDULED FOR LATE 1972, PROVIDES A VITAL LINK IN INTERSTATE-10. THE STEEL, TWIN-TUBE SECTIONS ARE APPROXIMATELY 40 FEET DEEP BY 80 FEET WIDE AND ARE 346 FEET LONG. TWIN CYLINDRICAL TUBES 36 FEET 9 INCHES IN DIAMETER PROVIDE SEPARATE WATERTIGHT ENCLOSURES FOR THE ROADWAY AND AIR DUCT FOR EACH TUBE. AN OUTER OPEN-TOPPED OCTAGONAL STEEL FORM PLATE RETAINS THE BALLAST CONCRETE WHICH IS POURED AROUND AND BETWEEN THE CYLINDRICAL TUBES TEMPORARY STEEL BULKHEADS CLOSE THE TUBE ENDS TO CONTROL BUOYANCY WHILE THE SECTIONS ARE AFLOAT AND DURING SINKING AND JOINING OPERATIONS. SEVEN TUBE SECTIONS ARE REQUIRED. THE TUNNEL LENGTH IS 3,000 FEET PORTAL TO PORTAL. CURVED RAMPS APPROXIMATELY 715 FEET LONG AT EACH END MAKE THE TOTAL LENGTH APPROXIMATELY 4,430 FEET. THE TUNNEL LENGTH COMPRISES (FROM WEST TO EAST) 200 FEET OF CAST-IN PLACE CONCRETE ARCH SECTION, 50 FEET OF VENTILATION STRUCTURE, 26.5 FEET OF TRANSITION SECTION, 2,422 FEET OF PREFABRICATED SECTIONS SUNK IN A TRENCH DREDGED TO PROFILE (SEVEN SECTIONS), 26.5 FEET OF TRANSITION SECTION, 50 FEET OF VENTILATION STRUCTURE, AND 225 FEET OF CAST-IN-PLACE CONCRETE ARCH SECTION. TANGENT GRADES OF 5.25 PERCENT (WEST) AND 5.05 PERCENT (EAST) ARE CONNECTED BY A VERTICAL SAG CURVE OF 900-FOOT LENGTH WITH THE STEEL TUBE SECTIONS FABRICATED TO FIT THE PROFILE. A MINIMUM COVER OF 5 FEET IS PROVIDED UNDER THE SHIP CHANNEL (600 FEET WIDE BY 40 FEET DEEP, ALLOWING 2 FEET FOR OVERDREDGING. AT THE LOW POINT, THE TOP OF THE TUNNEL AND THE ROADWAY ARE, RESPECTIVELY, 57 FEET AND 83.5 FEET BELOW THE RIVER SURFACE. DETAILS OF CONSTRUCTION ARE GIVEN.

Roberson, BL *Military Engineer* Vol. 64 No. 422, Dec. 1972, pp 424-8, 5 Phot

3A 236568

OFF SHORE SHAFT CONSTRUCTION IN THE NORTH SEA

A METHOD OF CONSTRUCTION IN WHICH THE DRILLING AND ALSO THE LINING OF THE SHAFT WOULD BE COMPLETE IN

SEQUENCE FROM AN EIGHT LEGGED WORK BARGE IS DETAILED, AND THE COOLING SYSTEM CONSTRUCTION CONTRACT IS DESCRIBED. DIAGRAMS ILLUSTRATE THE LOCATION OF THE SHAFTS AND CYLINDRICAL CASING UNIT FOR PERMANENT SHAFT LINING. THE STEPS IN CONSTRUCTION ARE REVIEWED. THE UPPER PART OF THE HOLE WOULD BE PROTECTED DURING DRILLING BY A PILEDIVEN CONDUCTOR CASING EXTENDING INTO THE FIRM CLAY LAYERS OF THE SEA BED AND PROJECTING ABOVE SEA LEVEL INTO A GUIDE FRAME ATTACHED TO THE SIDE OF THE WORK BARGE. DRILLING WAS PERFORMED BY A ROTARY DRILL DRIVEN BY A BORING TABLE SECURED TO A CANTILEVER STRUCTURE FIXED TO THE BARGE. THE CONSTRUCTION METHOD HINGED ON THE OPERATION OF LOWERING AND GROUTING A SEALED CYLINDRICAL CASING INTO A PRE-DRILLED HOLE, THE DRILLING PLATFORM AND ITS LOCATION, SHAFT EXCAVATION, PREPARATION AND POSITIONING OF THE SHAFT CASING AND THE GROUTING OF THE SHAFT CASING ARE DESCRIBED IN DETAIL. COMMENTS ARE MADE ON THE PROGRAM AND PERFORMANCE, AND DIFFICULTIES ENCOUNTERED ARE DISCUSSED.

Adamson, JN *N Am Rapid Excav & Tunnelling Conf Proc* Vol. 2 June 1972, pp 915-29, 8 Fig

3A 236577

CONSTRUCTION PROCEDURES AND EQUIPMENT FOR DROP SHAFTS METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

THE PROBLEMS OF RAISE BORING IN THE CHICAGO AREA ARE DISCUSSED. THE DIMENSIONS OF THE FIVE HOLES TO BE BORED ARE GIVEN. THE PILOT HOLE WOULD BE 12.25" DIAMETER, AND THE DRILL STEEL, 10" HIGH-STRENGTH STEEL. STUDY LED TO THE CONCLUSION THAT IF THE STEEL COULD STAND THE TORQUE AND TENSION, AND THE HYDRAULICS COULD SUPPLY SUFFICIENT THRUST, THEN THE STABILITY OF THE WHOLE WOULD BE BEST ON A ONE-PASS SYSTEM. THE DRILL STEEL, WITH SUFFICIENT INLINE STABILIZERS, WOULD HAVE A CONSTANT GUIDE IN THE PILOT HOLE WHICH WOULD ALLOW A MAXIMUM OF 1.125 INCH HORIZONTAL MOVEMENT. SPECIAL PRECAUTIONS WERE TAKEN TO SURVEY VERY ACCURATELY THE POSITION OF THE RAISE DRILL AND TO PREENGINEER ITS ALIGNMENT. THE CONTRACT ALLOWED FOR 0.5 PERCENT DEVIATION WHICH WOULD BE ABOUT ONE FOOT. CONCERN FOR ACCURACY WAS SPECIALLY HIGH. THE REPORT HIGHLIGHTS AREAS OF CONCERN. A SPECIAL METHOD OF TRANSPORTATION HAD TO BE DEVELOPED TO CARRY EACH HEAD THROUGH THE TUNNEL. THE BUILDING OF MODELS IS ADVISED. THE SPECIAL FRAME FOR TRANSPORTING THE HEAD WAS SLUNG BETWEEN A MUCK TRUCK AND A MUCK LOADER FOR THE JOURNEY THROUGH THE TUNNEL. HYDRAULIC JACKS AND RIGGING CONNECTED TO ANCHOR BOLTS PRE-DRIVEN INTO THE ROCK ARCHES, WERE USED TO MANIPULATE THE HEAD IN THE CONFINED SPACES, AND FINALLY TO POSITION IT UNDER DRILL STEEL. RETRACTION AND ROTATION PROCEDURES ARE OUTLINED. PROBLEMS ENCOUNTERED IN EXPERIENCE LED TO DEVELOPMENT OF PRECAUTIONARY MEASURES. THESE INCLUDE SUCH AREAS AS VALVE SYSTEMS, HANDLING DRILL STEEL, FOUNDATIONS ON WHICH THE RAISE DRILL IS PLACED AND CONTROL OF WATER. BLASTING OF ROCK SUPPORT RINGS, EQUIPMENT FOR GROUTING, AND TOOLS FOR WORKING INSIDE EACH DROP SHAFT ARE DESCRIBED. THE CONSTRUCTION OF THE CONCRETE LINER AND MUCK STORAGE AND HANDLING ARE REVIEWED. CONCLUSIONS DRAWN FROM PRACTICAL EXPERIENCE ARE PRESENTED. IT IS URGED THAT SPECIAL ATTENTION BE PAID TO THE SAFETY AND SECURITY OF CONSTRUCTION PERSONNEL.

Diponio, J Lynch, J *N Am Rapid Excav & Tunnelling Conf Proc* Vol. 2 June 1972, pp 1077-88

3A 236809

THE NAPLES TANGENTIAL ROAD. THE GROTTOS TRaversed BY THE VOMERO TUNNEL

AN ILLUSTRATED ARTICLE DESCRIBES THE METHODS USED IN THE CONSTRUCTION OF THE TWIN VOMERO TUNNELS (PART OF THE NAPLES EAST/WEST TANGENTIAL MOTORWAY) THROUGH TWO HIGH ALTITUDE GROTTOS. DETAILS ARE GIVEN OF THE REMOVAL OF WEAK MATERIAL AND THE STRENGTHENING OF THE CAVITIES, THE TOTAL VOLUMES OF WHICH EXCEEDED 100,000 CUBIC METRES. /TRRL/

Moneta, F *Autostrade /Italy/* Vol. 14 No. 6, June 1972, pp 4-18, 17 Fig, 15 Phot

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/IRRD 202 872, 2C63235555

3A 236815

MINI ROCK MOLE BIDS FOR SMALL BORE MARKET

A DESCRIPTION IS PRESENTED OF A SMALL NON-CIRCULAR ROCK TUNNEL BORING MACHINE, THE "MINI-FULLFACER" DEVELOPED BY ATLAS COPCO, AND DESIGNED FOR SHORT DRIVES (50-1000 METRES) AND SHALLOW DEPTHS. ESTIMATES OF COSTS OF OPERATION ARE GIVEN. /TRRL/

Cottrill, A
New Civil Engineer /UK/ Vol. 4 Aug. 1972, pp 30-1, 4 Fig, 5 Phot

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/IRRD 202 880, 2C63235571

3A 236841

A REVIEW OF STRUCTURAL DIAPHRAGM WALLS

THE PAPER DESCRIBES THE SLURRY TRENCH TECHNIQUE OF EXCAVATION AND SUBSEQUENT DIAPHRAGM WALL INSTALLATION. IT ALSO DETAILS SITE PROCEDURES DEVELOPED AS THE RESULT OF SPECIALIST CONTRACTURAL EXPERIENCE. THE MAIN ADVANTAGES OF THE TECHNIQUE ARE THE LACK OF DISTURBANCE OF THE GROUND OR ADJACENT STRUCTURES DURING EXCAVATION, THE ABILITY TO OPERATE IN GROUND CONDITIONS WHERE THE NECESSITY FOR COMPLICATED AND COSTLY EXCAVATION SUPPORT WOULD OTHERWISE RENDER WALL CONSTRUCTION IMPOSSIBLE, AND THE DEPTH AND SPEED OF CONSTRUCTION. THE REVIEW EXAMINES THE DESIGN OF STRUCTURAL DIAPHRAGM WALLS AND THE ADVANTAGES AND DISADVANTAGES OF THE PROCESS. IT FURTHER CONSIDERS THE PROPERTIES OF BENTONITE, THE THEORY OF TRENCH STABILITY AND PRELIMINARY CONSTRUCTION PROCEDURES AND DESCRIBES THE PANEL EXCAVATION AND CONSTRUCTION OF THE WALL. AN APPENDIX ILLUSTRATES SOME OF THE MORE INTERESTING AND UNUSUAL STRUCTURAL DIAPHRAGM WALL CONTRACTS COMPLETED AROUND THE WORLD. /TRRL/

Andrews, DC
Commonw Scient Indus Res Org /Austral/ Conf Paper Vol. 173 20 pp, 10 Fig, 1 Tab, 13 Phot 16, Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/IRRD 206 965, 2C63235947

3A 236859

SPRAYED CONCRETE IN HARD ROCK TUNNELS

THE USE OF CONCRETE SPRAYING TO GIVE TEMPORARY ROCK SUPPORT IN TUNNEL CONSTRUCTION IS DISCUSSED. THE SPRAYED LINING RESTRAINS LOOSENING OF THE EXPOSED ROCK AFTER BLASTING OPERATIONS SO THAT LOADS ARE CARRIED BY THE ROCK ARCH INSTEAD OF BY A SUPPORTING STRUCTURE. BRIEF DETAILS ARE ALSO GIVEN OF THE USE OF CONCRETE SPRAYING WITH VARIOUS REINFORCING SYSTEMS AND ALSO THE COST OF SUCH TECHNIQUES COMPARED WITH OTHER METHODS. /TRRL/

Garrod, AD Hetherington, JS *Tunnels & Tunnelling /UK/* Vol. 5 N 1973, pp 473-9, 7 Fig, 2 Tab, 2 Phot, 2 Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/IRRD 206 698, 2C63236284

3A 236860

EXCAVATING AND LINING THE SONNENBERG TUNNEL

DETAILS ARE GIVEN OF METHODS USED FOR THE CONSTRUCTION OF THE SONNENBERG TUNNEL WHICH CONSIST OF TWO INTER-CONNECTED 2-LANE TUBES RUNNING BETWEEN THE SENTI FORK AND THE GROSSHOF JUNCTION, A DISTANCE OF ABOUT 1.53M, ON THE N2 NATIONSTRASSE IN SWITZERLAND. BECAUSE OF THE DENSITY OF THE SURROUNDING BOULTUP AREA, IT WAS DECIDED TO DRIVE THE TUNNEL MECHANICALLY USING A NEW TYPE OF DRILLING EQUIPMENT WHICH IS ALMOST NOISELESS AND VIBRATION-FREE. USING THE EQUIPMENT, A PILOT TUNNEL OF 3.5M, DIAMETER IS DRILLED ON THE TUNNEL CENTRE AND THEN ENLARGED IN TWO STAGES. THE TWO ELECTRO-HYDRAULIC MACHINES ALTHOUGH COMBINED IN ONE UNIT, OPERATE SEPARATELY. DETAILS ARE ALSO GIVEN OF METHODS USED TO SEAL THE TUNNEL TUBES USING PVC-FOIL INSULATION. THE TUNNEL IS EXPECTED TO BE IN USE BY THE END OF 1975. /TRRL/

Bensch, E *Tunnels & Tunnelling /UK/* Vol. 5 N No. 5, Sept. 1973, pp 443-51, 4 Fig, 1 Tab, 6 Phot

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/IRRD 206 699, 2C63236285

3A 236861

FOUNDATION OF A TUNNEL BY THE SAND-FLOW SYSTEM

THE ARTICLE DESCRIBES MODEL TESTS TO DEMONSTRATE THE SAND-FLOW SYSTEM, A TECHNIQUE DEVELOPED FOR FORMING THE FOUNDATION OF A SUNKEN TUNNEL FOR THE PROPOSED CROSSING OF THE RIVER WESTERSCHELDT IN THE NETHERLANDS. IN THIS SYSTEM, ORIFICES IN THE BOTTOM OF PREFORMED TUNNEL ELEMENTS ARE MIXTURE OF SAND-WATER IS THEN FORCED UNDER THE TEMPORARILY SUPPORTED TUNNEL ELEMENTS WHICH LIE IN A DREDGED TRENCH. THE SEDIMENTATIONS GRADUALLY BUILD UP AND COMPLETELY FILL THE SPACE BETWEEN THE TUNNEL SECTION AND THE SIDES OF THE TRENCH. /TRRL/

Griffioen, A Vanffioen, AL *Tunnels & Tunnelling /UK/* Vol. 5 N No. 4, 1973, pp 354-63, 12 Fig, 11 Phot

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/IRRD 206 696, 2C63236286

3A 236890

PRAGUE METRO CONSTRUCTION PROCEEDS THROUGH DIFFICULT GEOLOGICAL CONDITIONS

A RECONSTRUCTION SCHEME DESIGNED TO MEET THE GROWTH OF MASS TRANSPORTATION IN PRAGUE IS DESCRIBED. WITHIN THIS SCHEME AN UNDERGROUND RAILWAY SYSTEM WILL BE DEVELOPED ALONG FOUR MAIN ROUTES AND WILL BE SUPPLEMENTED BY BUS AND TRAMWAY SERVICES. THE TOTAL LENGTH OF THE NETWORK WILL BE 92.7 KM, HAVING A TOTAL OF 104 STATIONS, OF WHICH 26 KM WILL RUN ON THE SURFACE, 39 KM WILL BE EXCAVATED AT A SHALLOW DEPTH OF 10-14 M, WHILE 27.7 KM WILL BE TUNNELLED DEEP UNDER THE CENTER OF THE CITY. GENERAL DETAILS ARE GIVEN OF PROPOSED TUNNELLING METHODS, EQUIPMENT, ROLLING STOCK, AND SIGNALLING EQUIPMENT. /TRRL/

Tunnels & Tunnelling /UK/ Vol. 4 No. 1, pp 63-5, 1 Fig

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 237037

TUNNELS FOR ROADS AND MOTORWAYS

THE PAPER USES THREE EXAMPLES OF ROAD TUNNEL CONSTRUCTION IN BRITAIN TO SHOW HOW WIDE VARIATIONS IN TUNNELING COST DEPEND UPON GROUND CONDITIONS. THE EXAMPLES USED ARE THE GREAT CHARLES STREET TUNNEL,

BIRMINGHAM, THE HEATHROW AIRPORT CARGO TUNNEL AND THE CLYDE TUNNEL. THE PRINCIPLES TO BE CONSIDERED IN TUNNEL PLANNING AND CONSTRUCTION ARE OUTLINED IN ORDER TO OBTAIN THE MOST SATISFACTORY SOLUTION FOR THE LEAST COST. THE RELATIVE COSTS OF BORED TUNNELS COMPARED WITH THOSE OF CUT-AND-COVER METHODS OF CONSTRUCTION ARE BRIEFLY MENTIONED.

Wood, AM

Quarterly J of Engineering /UK/ Vol. 5 No. 1, 1972, pp 111-26, 4 Fig, 3 Tab, 20 Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 237045

BORED COMPACTION PILES

THE DESIGN OF BORED COMPACTION PILES, THEIR METHOD OF CONSTRUCTION AND THE TYPE OF EQUIPMENT REQUIRED FOR THEIR CONSTRUCTION, ARE DESCRIBED. DETAILS ARE GIVEN OF THE ADVANTAGES OF THIS TYPE OF PILE IN WHICH REINFORCEMENT IS DRIVEN INTO FRESHLY PLACED CONCRETE AND THE SURROUNDING SOIL. SAFE LOADS ARE GIVEN FOR 3M. BORED COMPACTION PILES IN SANDY SOIL. /TRRL/

Indian Concrete Journal Vol. 46 No. 7, July 1972, pp 278-80, 2 Tab, 2 Phot, 1 Ref

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 237152

CAUSES OF SETTLEMENT IN RELATION TO THE CONSTRUCTION METHODS USED FOR UNDERGROUND TUNNELS

THIS ARTICLE ANALYSES THE CAUSES OF COLLAPSE INSIDE A TUNNEL AND OF SURFACE SETTLEMENT DUE TO UNDERGROUND EXCAVATIONS, AND IS BASED ON FIELD EXPERIENCE IN THE SHIELD DRIVEN CONSTRUCTION OF A SECTION OF THE BUDAPEST UNDERGROUND RAILWAY, WHICH PASSES THROUGH THE TOWN CENTER. /TRRL/

Le Strade /Italy/ Apr. 1972, pp 232-7, 4 Fig, 1 Tab

ACKNOWLEDGMENT: Transport & Road Research Lab /UK/

3A 237183

THE ROLE OF SOIL ENGINEERING IN ECONOMIC DEVELOPMENT IN ASIA OPEN FORUM

PANELISTS PRESENTED THEIR VIEWS ON VARIOUS ASPECTS OF SOIL ENGINEERING IN ASIA. THE CONTRACTOR'S POINT OF VIEW IS OUTLINED AND THE IMPORTANCE OF USING APPROPRIATE CONSTRUCTION METHODS FOR THE PREVAILING CONDITIONS ESPECIALLY SOFT SUB SOIL CONDITIONS IS STRESSED. FOUNDATION DESIGN AND THE NEED FOR ADEQUATE PRELIMINARY SITE INVESTIGATIONS SUCH AS SOIL SAMPLING, AND LABORATORY AND IN-SITU TESTING ARE INVESTIGATED. EXAMPLES ARE GIVEN OF THE ROLE PLAYED BY ENGINEERING GEOLOGY IN PROJECTS IN TURKEY, PAKISTAN, THAILAND AND LAOS. PRACTICES ADOPTED IN ASIAN COUNTRIES ARE OUTLINED TOGETHER WITH THE THREE FUNDAMENTAL DIFFICULTIES ENCOUNTERED IN ASIA, E. G. SCARCITY OF SOIL ENGINEERS, LACK OF SOIL MECHANICS TRAINING AMONG SOIL ENGINEERS AND POOR LABORATORY FACILITIES IN SOUTH EAST ASIA. THE ECONOMIC ASPECTS OF SOIL ENGINEERING ARE EXAMINED. /TRRL/

Brand, EW Fourth Asian Regional Conf Proc Conf Paper Vol. 2 July 1972, pp 206-14

3A 237276

ENGINEERING SITE INVESTIGATIONS IN PERMAFROST AREAS

MOST ENGINEERING PROBLEMS IN PERMAFROST AREAS ARE CAUSED BY THAWING OF PERENNIALY FROZEN GROUND WHICH CONTAINS LARGE QUANTITIES OF ICE. SUCH ICE

SEGREGATION IS MOST SERIOUS IN FINE GRAINED SOILS. THE PAPER DESCRIBES THE SITE INVESTIGATION PROCEDURE TO OBTAIN THE INFORMATION NEEDED FOR DESIGN AND CONSTRUCTION IN THESE CONDITIONS. THE FIRST PHASE CONSISTS OF PRELIMINARY OFFICE STUDIES OF AVAILABLE RECORDS AND AIRPHOTOS AND PLANNING THE FIELD OPERATION WITH ITS PROBLEMS OF ACCESS AND COMMUNICATIONS. THE SECOND PHASE IS FIELD INVESTIGATIONS INCLUDING A GENERAL EXPLORATORY SURVEY FOLLOWED BY DETAILED INVESTIGATION. THE FINAL STAGE PROVIDES FOR CONTINUING OBSERVATIONS AND THE PREPARATION OF REPORTS. THE NEED FOR RECORDING AND EXCHANGING ALL OBSERVATIONS, EXPERIENCES AND CONDITIONS ENCOUNTERED IN THE NORTH IS NEEDED IF GENERAL KNOWLEDGE IS TO BE INCREASED. /CGRA/

Johnston, GH Nrc Div Bldg Res Tech Papers /Can/ Oct. 1966

ACKNOWLEDGMENT: Canadian Good Roads Association

3A 237385

PROTECTIVE STRUCTURES AND COMPONENTS

THIS COMPILATION OF ABSTRACTS IS BASED ON SOVIET AND SATELLITE OPEN SOURCES PUBLISHED IN 1966. IT IS THE 19TH REPORT IN A SERIES ON PROTECTIVE STRUCTURES AND COMPONENTS AND WAS PREPARED IN RESPONSE TO THE FOLLOWING AREAS OF INTEREST: /1/ OPERATIONAL EMPLOYMENT AND PHILOSOPHY, /2/ MISSILE OR SPACE VEHICLE, /3/ FACILITIES, /4/ TRANSPORTATION, /5/ LAUNCH SITE, /6/ GROUND SUPPORT EQUIPMENT, /7/ NATURAL ENVIRONMENT CONDITIONS /SITE AND FACILITIES/, /8/ PERSONNEL, /9/ PACKAGING, PRESERVATION, AND STORAGE. THIS REPORT CONTAINS MATERIALS RELEVANT TO TOPICS 3, 4, 5 AND 9. THERE ARE 16 ENTRIES IN TOPIC 3, 5 ENTRIES IN TOPIC 4, 3 ENTRIES IN TOPIC 5, AND 1 ENTRY IN TOPIC 9. THE REPORT INCLUDES DATA CONCERNING THE STORAGE OF PETROLEUM PRODUCTS IN PERMAFROST, THE EQUIPMENT AND MACHINES USED ON CONSTRUCTION OF ROADS AND EARTHWORKS IN PERMAFROST AND FROZEN SOILS, THE LAYING OF PIPELINES IN PERMAFROST AREAS, THE ELECTRIC WARMING OF FROZEN SOIL, NEW GAS AND OIL PIPELINES, NEW ROADS AND RAILWAYS, ROADS, RAILROADS, AND WATER VEHICLE TRANSPORTATION, CRAWLER CRANES, AND THE DEVELOPMENT OF CONTAINERIZED AND PACKAGED SHIPMENTS IN VOLUME AND TECHNIQUES. APPENDED TO THE TEXT ARE 29 PHOTOGRAPHS AND DIAGRAMS. THESE ITEMS ARE CITED IN THE FOREGOING ENTRIES. A BIBLIOGRAPHY, COMPRISING 25 ENTRIES, IS INCLUDED AT THE END OF THE REPORT. /CFSTI/

Library of Congress Nov. 1966

ACKNOWLEDGMENT: Clearinghouse Fed Sci & Tech Info AD646 390 \$3.00, 3C64085550

3A 237635

BARK AS FILLER-AND LIGHT FILL MATERIAL IN ROAD EMBANKMENTS /IN NORWEGIAN/

BARK WAS USED AS CONSTRUCTION MATERIAL ON A NEW MOTORWAY AT VINTERBRU NEAR OSLO. THE PROBLEM OF OBTAINING BARK IN SUFFICIENT QUANTITIES DURING THE CONSTRUCTION PERIOD IS DISCUSSED. THE EFFICIENCY OF DIFFERENT TYPES OF CONSTRUCTION MACHINERY IN HANDLING THE BARK BOTH REGARDING VOLUME CAPACITIES AND TRACTION CONDITIONS DURING THE LOADING, HAULING AND UNLOADING STAGES IS THEN MENTIONED. METHODS EMPLOYED IN PLACING AND COMPACTING THE BARK ARE DESCRIBED. IMPROVED LOAD SPREADING EFFECT IS OBTAINED BY A 20-40 CM LAYER OF BARK ON SOFT MATERIALS WITH LOW BEARING CAPACITY. FURTHER RESEARCH IS NEEDED ON THE USE OF BARK IN ROAD CONSTRUCTION, BUT EXPERIENCE INDICATES THAT IT CAN BE EASILY HANDLED EVEN IN WET CONDITIONS DURING RAINY PERIODS BY ORDINARY CONSTRUCTION MACHINERY. /SVV/RRL/

Klem, I H Klem, G S Teknisk Ukeblad, Oslo /Norway/ Feb. 1970

ACKNOWLEDGMENT: Road Research Laboratory /UK/

3A 237721

ORGANIC CATIONIC CHEMICALS AS STABILIZING AGENTS FOR IOWA LOESS

THIS PAPER PRESENTS THE RESULTS OF PRELIMINARY EVALUATION STUDIES OF A NUMBER OF ORGANIC CATIONIC CHEMICALS AS STABILIZING AGENTS FOR IOWA LOESS. THE LOESS RANGES TEXTURALLY FROM SILTY LOAM TO SILTY CLAY. AN UNCONFINED COMPRESSION TEST IS USED FOR RATING THE CHEMICALS. IN THIS TEST, THE PRINCIPAL CRITERIA OF STABILITY ARE COMPRESSIVE STRENGTH, MOISTURE ABSORPTION, AND SWELLING AFTER 24 HOURS IMMERSION IN WATER. THE EFFECTS OF THE CHEMICALS ON AIR-DRY STRENGTH AND SHRINKAGE DURING AIR DRYING ARE ALSO CONSIDERED IN EVALUATING THE BENEFITS TO STABILITY. THOUGH OF A PRELIMINARY NATURE, THE INVESTIGATION DEMONSTRATES THE SUPERIORITY OF SEVERAL OF THE NINETEEN CATIONIC CHEMICALS USED. CHEMICALS DESIGNATED BY THE TRADE NAMES ARQUAD 2HT, ARQUAD 2S, ARMEEN RESIDUE, ARMAC T, CRUDE AMINE, AND ARMEEN RESIDUE ARQUAD, ARE CONSIDERED PARTICULARLY WORTHY OF FURTHER STUDY. THESE CHEMICALS IN AMOUNTS RANGING FROM 0.08 TO LESS THAN 1.0 PERCENT BY DRY WEIGHT OF THE SOIL SUBSTANTIALLY IMPROVE THE STABILITY OF LOESS. USED IN SUCH AMOUNTS, THE COST OF THE CHEMICALS PER SQUARE YARD OF BASE COURSE SIX INCHES THICK RANGES FROM ABOUT \$0.14 TO \$1.13, WHICH IS ECONOMICALLY FEASIBLE FOR HIGHWAY CONSTRUCTION. IT IS BELIEVED THAT CONVENTIONAL HIGHWAY CONSTRUCTION EQUIPMENT AND PROCEDURES COULD BE USED FOR THE PROCESSING OF SOIL WITH ORGANIC CATIONIC CHEMICALS. THE MOST PRACTICAL METHOD OF APPLYING THE CHEMICALS TO THE SOIL IS AS SOLUTIONS OR DISPERSIONS IN WATER, AND A SOLUTION OR DISPERSION WOULD BE ADDED TO THE SOIL IN THE AMOUNT NECESSARY FOR COMPACTION TO NEAR STANDARD PROCTOR DENSITY. IN THE CONCENTRATIONS USED, THE VISCOSITY OF THE SOLUTION OR DISPERSION IS LOW ENOUGH TO PERMIT SPRAYING. FIELD EXPERIMENTATION WILL BE NECESSARY TO EVALUATE MORE FULLY THE EFFECTIVENESS OF THE CHEMICALS. /AUTHOR/

Hoover, JM Davidson, DT *Highway Research Board Bulletin* 1956

3A 237742

INSULATED TEST ROAD-STATE ROAD 26

THE REQUISITE PLANNING FOR AN EXPERIMENTAL SECTION OF INDIANA HIGHWAY, INCORPORATING FOAM-PLASTIC INSULATING LAYERS TO ATTENUATE FROST PENETRATION, WAS DEVELOPED. WITH THE HELP OF INDIANA STATE HIGHWAY OFFICIALS, A FLEXIBLE PAVEMENT CONSTRUCTION WAS SELECTED, WITHIN WHICH THE PROPOSED FIELD INSTALLATION WOULD BE LOCATED. TWO INSULATED SECTIONS AND ONE NON-INSULATED SECTION COMPRISE THE TEST INSTALLATION. SELECTION OF THE INSULATION THICKNESSES TO BE USED WAS BASED ON THE RESULTS OF A COMPUTER ANALYSIS DEVELOPED AT PURDUE UNIVERSITY. THIS PROGRAM, UNDER THE CONDITION OF ONE-DIMENSIONAL HEAT FLOW BY CONDUCTION, PREDICTS THE DISTRIBUTION OF TEMPERATURE WITH TIME THROUGHOUT A LAYERED MEDIUM. INPUT DATA UTILIZED WERE BASED ON CLIMATIC RECORDS FOR THE AREA IN WHICH THE SITE IS LOCATED AND ON ESTIMATED THERMAL PROPERTIES OF THE COMPONENT LAYERS OF THE PROPOSED HIGHWAY CROSS-SECTION. METHODS OF EVALUATING THE THERMAL AND STRUCTURAL PERFORMANCE OF THE INSULATED AND NON-INSULATED SECTIONS WERE RECOMMENDED. THERMAL PERFORMANCE IS TO BE EVALUATED BY MEANS OF THERMISTORS STRATEGICALLY PLACED IN EACH OF THE THREE SECTIONS AND STRUCTURAL PERFORMANCE BY MEANS OF BENKELMAN BEAM TESTS. SPECIAL CONSTRUCTION PROCEDURES WERE RECOMMENDED FOR THE FIELD INSTALLATION, DUE TO THE EXPERIMENTAL NATURE OF THE PROJECT. /AUTHOR/

Stulgis, RP

Purdue & Ind State Hwy Comm Jhrp July 1968

3A 237775

BASES AND FOUNDATIONS ON FROZEN SOIL

CONTENTS: GENERAL INFORMATION ON FROZEN SOILS PHYSICO-MECHANICAL PROCESSES IN FREEZING SOILS PHYSICAL PROPERTIES OF FROZEN SOILS MECHANICAL PROPERTIES OF FROZEN SOILS PROPERTIES OF FROZEN SOILS ON THAWING METHODS OF CONSTRUCTION ON FROZEN SOILS AND ENGINEERING PREPARATION OF THE SITE PRINCIPLES OF FOUNDATION DESIGN BY THE METHOD OF RETAINING THE FROZEN CONDITION OF BASE SOILS FOUNDATION DESIGN METHODS WHICH CONSIDER THAWING OF FROZEN BASE SOILS PRINCIPLES OF FOUNDATION DESIGN TO RESIST FROST-HEAVING SPECIAL FEATURES OF FOUNDATION CONSTRUCTION AND MAINTENANCE OF STRUCTURES ERECTED ON FROZEN SOILS

Tsytoovich, NA *Highway Research Board Special Reports* 1960

3A 237785

SEALED TUBE KEEPS FROST FROZEN TO HOLD BUILDINGS
A HEAT TRANSFER SYSTEM CONSISTING OF TWO TUBES AND AN ANTIFREEZE SOLUTION ENCLOSED WITHIN A LARGER HERMETICALLY SEALED STEEL SHELL MAY POSSIBLY OVERCOME THE PROBLEMS OF BUILDING IN PERMAFROST. THE THERMOPILE IS BURIED IN THE GROUND FOR PART OF ITS LENGTH TO PREVENT THAWING OF PERMAFROST. SIX TO EIGHT TUBES, EACH 13 FT. LONG BY 6 IN. IN DIAMETER, WOULD BE NEEDED TO KEEP THE SOIL FROZEN AROUND THE AVERAGE SIZE HOUSE IN FAIRBANKS AND SIMILAR LATITUDES. ONE THERMOPILE CONTAINS TWO CHEMICALLY INERT PLASTIC INNER TUBES, EACH RUNNING FROM END TO CENTER ABOUT HALF THE LENGTH OF THE UNIT. THE STEEL SHELL IS BUILT AROUND THE TUBES, FILLED WITH A SPECIAL LIQUID CHEMICAL AND THEN SEALED AT BOTH ENDS. THE TUBES ARE PLACED UPRIGHT IN THE GROUND WITH 25% TO 30% OF THEIR LENGTH ABOVE THE GROUND'S SURFACE. BEST PERFORMANCE IS OBTAINED BY PLACING THE TUBES IN EARLY FALL. THE TUBES ARE NOT DRIVEN INTO THE GROUND, BUT PLACED IN A HOLE IN WHICH A MIXTURE OF SAND AND GRAVEL IS THEN PACKED AROUND THEM. THREE STEEL TUBES, 20 FT. LONG AND 6 IN. IN DIAMETER HAVE BEEN INSTALLED TO STABILIZE A RAILROAD BRIDGE BUILT IN 1947 THAT HAD STARTED TO SHIFT AS PERMAFROST THAWED. IT IS SUGGESTED THAT THERMOPILES CONSTRUCTED EVERY 40 TO 50 FT. ALONG PIPELINE ROUTES WILL SUPPORT THE LINE AND KEEP THE GROUND FROM THAWING.

Engineering News-record July 1969

3A 238030

SUBGRADE INSULATION FOR FROST HEAVE CONTROL: SUMMARY OF SECOND AND THIRD WINTER'S PERFORMANCE

THIS REPORT DISCUSSES THE SECOND AND THIRD WINTER FOLLOWUP OF OBSERVATIONS ON TWO ROADWAY TEST INSTALLATIONS NEAR ANCHORAGE, ALASKA, WHERE EXTRUDED, EXPANDED, POLYSTYRENE INSULATION BOARDS AND FOAMED-IN PLACE URETHANE WERE USED AS SUBGRADE INSULATION LAYERS TO PREVENT FROST HEAVING. FROST PENETRATION DEPTHS AND SURFACE ELEVATION CHANGES WERE MEASURED PERIODICALLY IN BOTH INSULATED AND ADJACENT UNINSULATED SECTIONS UNDER THIS STUDY. SOME DATA WERE ALSO OBTAINED ON FROST PENETRATION NEAR THE EDGES OF THE INSULATION LAYER. RELATIVE PERFORMANCE OF THE TWO INSULATION LAYERS IS COMPARED ON THE BASIS OF TEMPERATURE DIFFERENTIAL DATA. A NUMBER OF CONCLUSIONS ARE PRESENTED RELATING TO DESIGN AND PERFORMANCE OF INSULATED ROADWAYS UNDER CLIMATIC CONDITIONS SIMILAR TO PROJECT AREA, WHICH HAD A DESIGN AIR FREEZING INDEX OF 2500 TO 3000 DEGREES F-DAYS AND A MEAN ANNUAL AIR TEMPERATURE OF 36 DEGREES F. /AUTHOR/

Alaska Department Highways July 1971

3A 238066

HIGHWAY CONSTRUCTION ON SOILS OF THE TYPE

"MASSAPE" /IN PORTUGUESE/

SPECIFIC METHODS OF PAVING IN THE RECONCAVO BAHIANO ARE DISCUSSED WITH REGARD TO THE SOIL PROPERTIES THERE. SPECIFIC STUDIES OF SOILS AND ECONOMIC SOLUTIONS FOR THE PAVEMENTS ARE PRESENTED. /RRI/

Monteiro, R

Fed Dist Hwy Dpt, Salvador /Braz/

ACKNOWLEDGMENT: Road Research Institute /Brazil/

3A 238116

PILLARS AND PILES IN THE GROUND FROST PROBLEMS

PILLARS, PILES AND POLES ARE USED FOR MANY PURPOSES: POWER-AND TELEPHONE-LINES, POLES-HOUSES ON FARMS, FOUNDATIONS FOR HOUSES, BRIDGES, ROADS ETC. FREEZING AND THAWING OF THE GROUND HAS HARMFUL INFLUENCE ON THE USEFULNESS AND QUALITY OF SUCH CONSTRUCTIONS. ADFREEZING OF THE SOIL TO THE SURFACE OF THE CONSTRUCTIONS, ALLOWS UPLIFT FORCES FROM THE GROWING OF THE ICE LENSES IN THE FREEZING GROUND TO BE TRANSMITTED TO THE PILLARS, PILES AND POLES. THERE HAS BEEN SOME RESEARCH IN THIS FIELD AIMING AT FINDING THE SIZE OF THE ADFREEZING STRENGTH AND ACCOMPANYING UPLIFT FORCES. THE WORK HAS BEEN DONE IN CANADA, JAPAN, USSR AND NORWAY. SOME EXAMPLES ARE MENTIONED IN THIS ARTICLE, BUT THEY VARY SO MUCH AND ARE FOUND UNDER SUCH VARYING EXPERIMENTAL CONDITIONS THAT THEY ARE NOT YET SUITABLE FOR PRACTICAL USE. THEY GIVE, HOWEVER, A USEFUL IDEA ABOUT THE PHENOMENON. THE GROWTH OF ICE LENSES DURING FREEZING GIVES AN ACCUMULATION OF WATER IN CERTAIN LAYERS IN THE SOIL. WHEN THE ICE THAWS THE RESULT CAN BE A SATURATION OF THE GROUND GREAT ENOUGH TO SPOIL THE BEARING CAPACITY OF THE SOIL. THE UPLIFT FORCES DURING FREEZING DESTROYS STONE-LOCKS AND WEDGES INSERTED IN THE GROUND TO KEEP THE CONSTRUCTION IN PLACE. A HOUSE ON PILLARS ABOVE THE GROUND, CHANGES THE WIND CONDITIONS NEAR THE GROUND AND PREVENTS NATURAL ACCUMULATION OF SNOW UNDER IT. THE FREEZING OF THE SOIL WILL REACH DOWN TO OTHER AND MORE VARYING DEPTHS THAN BEFORE THE HOUSE WAS BUILT. PILLAR AND PILE FOUNDATIONS ARE MORE SENSITIVE TO VARIATIONS IN AMOUNTS OF FROST-HEAVE AND FORCES THAN CONTINUOUS FOUNDATION WALLS. VARIATIONS IN HEAVING HEIGHTS ALONG A WALL WILL BE MORE DANGEROUS WHEN THEY ARE ACTING ON UNCONTINUOUS PILLARS, THAN ON A CONTINUOUS CONCRETE FOUNDATION WALL. VARYING EXPERIENCES REGARDING THE PROBLEMS AND THE WAY OF HANDLING THEM ARE DISCUSSED. TWO APPROXIMATIVE FORMULAS FOR CALCULATING THE ADFREEZING FORCE (BY DALMATOV AND VIALOV) ARE MENTIONED.

Herje, JR

Royal Norwegian Council Sci & Ind Res No. 8, Dec. 1972, pp 49-50

3A 238117

FROST INSULATION OF PIPE TRENCHES

CONTINUING EXPERIMENTS IN THE AREA OF FROST INSULATION OF PIPE TRENCHES IS DESCRIBED AND THE CONCLUSIONS DRAWN ARE PRESENTED. THE TEST PROCEDURE CONSISTED OF INSULATING 3 OF 4 ADJACENT AREAS WHILE THE LAST SERVED FOR REFERENCE. POLYSTYRENE SHEETS (STYROFOAM) OF 0.05 M. THICKNESS AND 30 KG/CUBIC METER WERE USED AS INSULATION AND LAID IN TWO LAYERS WITH STAGGERED JOINTS. THE TOTAL THICKNESS OF THE INSULATION WAS 0.1M. A LAYER OF SAND 0.05M. WAS LAID UNDER THE INSULATION. THE COVER OVER THE INSULATING LAYER OF THE 3 TEST AREAS WERE 0.1 M., 0.3 M., AND 0.5 M. THICK RESPECTIVELY. VERTICAL INSULATION WAS

PLACED BETWEEN THE AREAS AND AT THEIR ENDS. THE TEST AREA AND ABOUT 3 M AROUND IT WAS KEPT CLEAR OF SNOW. IN ORDER TO INVESTIGATE THE EFFECT OF HEAT GIVEN OUT BY A WATER PIPE, A HEATING CABLE WAS PLACED UNDER THE INSULATING SHEETS. RESULTS INDICATE THAT A 1.5M. WIDE LAYER OF INSULATION IS GREATLY EFFECTIVE AND FROST PENETRATION WAS REDUCED CONSIDERABLY. IT IS ALSO SHOWN THAT THE RELATIVELY NARROW LAYER OF INSULATION MUST NOT BE LAID TOO SHALLOW IN THE TRENCH. THE INSULATING LAYER VERY EFFECTIVELY REDUCES THE HEAT LOSS FROM A WATER PIPE. IN THE CALCULATION OF RESULTS, CONDITIONS HAVE BEEN REGARDED AS STATIONARY, EXTREME SUBSURFACE TEMPERATURES WERE USED, AND A LINER TEMPERATURE DISTRIBUTION FROM THE SURFACE DOWN TO THE LIMIT OF FROST PENETRATION WAS ASSUMED. CONDITIONS ARISING FROM THESE ASSUMPTIONS ARE REVIEWED. THE RESULTS ARE DISCUSSED, RECOMMENDATIONS ARE MADE, AND THE DIRECTION OF FUTURE RESEARCH IS INDICATED.

Gundersen, P

Royal Norwegian Council Sci & Ind Res No. 8, Dec. 1972, pp 60-2, 5 Ref

3A 238118

WINTER-CONSTRUCTION

WHEN CONSTRUCTING DURING WINTER, THE STRUCTURES HAVE TO BE PROTECTED FROM DAMAGES DUE TO FREEZING OF THE SUBSOILS. AS METHODS OF PREVENTING FROST-DAMAGES DURING THE CONSTRUCTION PHASE, THIS PAPER POINTS OUT: 1. REPLACING FROST-SUSCEPTIBLE WITH NON-FROST-SUSCEPTIBLE SOIL. 2. REDUCING TEMPERATURE EXPOSURE ON GROUND AND STRUCTURES BY COVERING WITH THERMAL INSULATION MATERIALS. 3. COMPENSATING THE HEAT LOSSES TO THE AIR BY ARTIFICIAL HEAT SUPPLY. IT IS INDICATED THAT A SNOW-LAYER ACTS AS INSULATION, BUT ONE MAY HARDLY TAKE THIS INTO ACCOUNT WHEN PLANNING FROST PROTECTION. TO DEMONSTRATE THE EFFECT OF POSSIBLE MEANS OF PROTECTION, TEMPERATURE DISTRIBUTIONS ARE COMPUTED IN 8 CASES. AS CLIMATE, THE WINTER 1965/66 SNOW-FREE IN OSLO, IS USED. THE IMPORTANCE OF KEEPING THE FROST-PROTECTION INTACT WHILE CONSTRUCTING IS SHOWN. SOME PRACTICAL MEANS OF PROTECTION ARE OUTLINED: THAWING OF FROZEN SOIL HAS OFTEN BEEN DONE TO FACILITATE EXCAVATION IN WINTER. HOWEVER, ENERGY MAY BE SAVED BY INSULATING THE SURFACE IN ORDER TO MAKE USE OF HEAT STORED IN THE GROUND. EXCAVATED AREAS HAVE TO BE COVERED WITH INSULATION AS SOON AS POSSIBLE TO PREVENT FREEZING OF THE SUBSOIL. THIS IS OF PARTICULAR IMPORTANCE WHERE FOUNDATIONS ARE TO BE CONSTRUCTED LATER IN THE WINTER. WHEN POSSIBLE, IT IS FAVORABLE TO EXCAVATE AND DO FOUNDATION WORKS PRIOR TO THE FROST PERIOD AND THEN PROVIDE FOR EFFECTIVE COVERING UNTIL THE REMAINING WORKS CAN BE DONE. BASEMET WALLS HAVE TO BE PROTECTED BOTH AGAINST HORIZONTAL HEAVE FORCES AND FREEZING OF THE SUBSOIL. USUALLY IT IS NECESSARY TO INSULATE THE BASEMENT FLOOR. CONCRETE-STRUCTURES IN SOIL ACT AS COLDBRIDGES WHEN UPPER PARTS ARE EXPOSED TO THE OUTDOOR AIR. THIS EFFECT MAY BE ELIMINATED BY COVERING OR SUPPLYING HEAT TO THE CRITICAL ZONES. SLABS-ON-GROUND MAY BE PROTECTED BY MEANS OF AN INSULATING COVER AND IF NECESSARY, COMBINED WITH HEAT SUPPLY. TO MAINTAIN THE INSULATION PROPERTY ONE MUST TAKE CARE TO AVOID MECHANICAL AND MOISTURE DAMAGES ON A COVER. AN EXAMPLE SHOWS A SOLUTION WHERE THE FLOOR INSULATION ACTS AS FROST PROTECTION DURING THE CONSTRUCTION PERIOD. IN THIS CASE ONE MAY EASILY PROTECT THE INSULATION FROM DAMAGES. A COVERING OF THE WHOLE BUILDING SITE WITH A HEATED TENT HAS NOT YET BEEN USED IN NORWAY. BY MEANS OF SUCH A COVERING ONE MAY PREVENT FROST DAMAGES ON THE FOUNDATIONS AND CONSTRUCTION MAY BE DONE IN FAVORABLE CLIMATE CONDITIONS. IT IS POINTED OUT THAT CHOICE OF MEANS

HAVE TO BE ADAPTED TO THE SITE-CLIMATE AND THAT PRACTICAL EXPERIENCE ALWAYS WILL HAVE TO BE AN IMPORTANT FACTOR WHEN CHOOSING SUITABLE PROTECTION MEANS.

Thue, JV

Royal Norwegian Council Sci & Ind Res No. 8, Dec. 1972, pp 68

3A 238135

CONSTRUCTION OF AN UNATTENDED SEISMOLOGICAL OBSERVATORY (USO) IN PERMAFROST

THE CONSTRUCTION OF A LARGE DIAMETER CASED BOREHOLE AND SURFACE INSTRUMENT SHELTER FOR THE INSTALLATION OF A HIGH RESOLUTION, LONG TERM RECORDING SEISMOGRAPH IN MARGINAL PERMAFROST 15 MILES WEST OF FAIRBANKS, ALASKA, IS DESCRIBED. PERMAFROST EXTENDED TO A DEPTH OF 123 FT AND CONSISTED OF FROZEN SILT, PEAT AND SANDY SMALL GRAVEL AND WAS UNDERLAIN BY A THAWED GRAVEL AQUIFER. THE FIRST 48 FT OF 16-IN. HOLE WAS DRILLED WITH A TRUCK-MOUNTED AUGER. A FAILING 1500 MOUNTED ON A TRACKED TRAILER WAS MODIFIED TO ACCOMMODATE A 4-IN.-ID KELLY, SWIVEL AND DRILL PIPE SO THAT COMPRESSED AIR IN REVERSE CIRCULATION COULD BE USED FOR CUTTINGS REMOVAL. AIR WAS CIRCULATED BY EITHER PRESSURIZING THE ANNULUS THROUGH A ROTATING SEAL OR BY AN AIR EDUCTOR (INJECTOR). THESE SYSTEMS WERE USED TO COMPLETE THE HOLE TO 92 FT. ALTHOUGH CONSIDERABLE DIFFICULTY WAS ENCOUNTERED, DRILLING RATES OF 10 FT/HR WERE MEASURED WHEN USING COMPRESSED AIR CHILLED TO BELOW 20 DEG F, SHROUDED BITS TO PROVIDE ADEQUATE BOTTOM HOLE CLEANING AND EITHER THE EDUCTOR OR THE PRESSURIZED ANNULUS. THE LATTER IS PREFERRED SINCE COMPRESSED AIR REQUIREMENTS ARE MUCH LESS. ELEVEN AND THREE QUARTER IN. O.D. CASING WITH FLUSH, STEP-THREADED JOINTS WAS SET USING A SOIL-WATER-SNOW SLURRY AS GROUT. FORTY THERMOCUPLES WERE INSTALLED IN THE FILL PLACED OVER THE CASING AND IN THE GROUND BENEATH TO MONITOR THERMAL BEHAVIOR. DATA FROM THESE ARE DISCUSSED. FIVE THERMISTORS ATTACHED TO THE BOREHOLE PACKAGE YIELDED DATA ON THE GROUND BENEATH TO MONITOR THERMAL BEHAVIOR. DATA FROM THESE ARE DISCUSSED. FIVE THERMISTORS ATTACHED TO THE BOREHOLE PACKAGE YIELDED DATA ON THE GROUND TEMPERATURE AT THE 80 TO 85-FT DEPTH INTERVAL. USING THESE DATA, THE PERMAFROST THICKNESS OBTAINED BY EXPLORATORY DRILLING, AND THE MEAN ANNUAL AIR TEMPERATURE, THE GROUND TEMPERATURE PROFILE AT DEPTH IS ESTIMATED. THIS ANALYSIS YIELDS A GROUND TEMPERATURE OF ABOUT -1.7 DEG C FOR A DEPTH OF FIFTY FEET (MINIMUM DEPTH OF ZERO ANNUAL AMPLITUDE). IT IS CONCLUDED THAT RAPID CONSTRUCTION OF SIMILAR INSTALLATIONS IN PERMAFROST REGIONS IS FEASIBLE, BUT WOULD PRESENT FORMIDABLE LOGISTICAL PROBLEMS. DRILLING "BIG HOLES WITH LITTLE RIGS" IN ALMOST ANY FROZEN SOIL OR ROCK ALSO APPEARS FEASIBLE. HOWEVER, CONSIDERABLE DEVELOPMENT WORK WILL BE REQUIRED ON THIS AND OTHER ASPECTS OF THE PROBLEM BEFORE 100% SUCCESS CAN BE GUARANTEED FOR EACH HOLE STARTED, CONSIDERING THE ORIGINAL LIMITATIONS ARBITRARILY SET ON THE PROBLEM; I.E., CONSTRUCTION IN UNFRIENDLY COUNTRIES, IN ONE WEEK'S TIME, WITH AIR TRANSPORTABLE EQUIPMENT.

Lange, GR *Crrrel Special Reports, Army Dept /US/ Spec Rept* No. 113, Feb. 1973, 38 pp, 40 Fig, 2 Tab

3A 238140

ALASKA BUILDS HIGHWAY OVER MUSKEG AND PERMAFROST

CONSTRUCTION TECHNIQUES IN MUSKEG AND PERMAFROST AREAS ARE DESCRIBED. IN MUSKEG AREAS, AN OLDER TECHNIQUE IN WHICH A DRAGLINE REMOVED ORGANIC MATERIAL WAS FOUND TO BE SATISFACTORY FOR SHALLOW

DEPOSITS BUT WAS UNECONOMICAL FOR MUSKEG DEPTHS IN EXCESS OF 5 TO 6 FT. THE ROLLING SURCHARGE METHOD OF STABILIZATION IS SIMPLE AND CONSISTENT WITH HIGH PRODUCTIVITY CONSTRUCTION. THE PROCEDURE IS BEGUN BY BULLDOZING THE EMBANKMENT SURCHARGE INTO THE MUSKEG AREA FROM ONE SIDE. HAULING UNITS BRING ADDITIONAL MATERIAL TO THE TRAILING EDGE OF THE SURCHARGE. BULLDOZERS CONTINUALLY MOVE MATERIAL FROM BACK OF THE SURCHARGE TO THE LEADING EDGE AND PUSH IT AHEAD INTO THE MARSH. THE USE OF THE DRAGLINE WHERE THE UPPER LAYERS OF THE MUSKEG MATERIAL ARE TOO FIBROUS OR STIFF IS DESCRIBED. A SURCHARGE HEIGHT OF ABOUT 5 FT. IS USED AS A STARTING POINT. THE HEIGHT IS VARIED UP OR DOWN DURING CONSTRUCTION. PERMAFROST CONDITIONS ARE DESCRIBED AND THE TASK OF PREDICTING THE BEHAVIOR OF THE THAWED PERMAFROST AND THE RATE AND DEPTH OF POST-CONSTRUCTION THAW IS DISCUSSED. SINCE THE DEGRADATION OF THE PERMAFROST CANNOT BE PREVENTED, A DESIGN CRITERION HAS BEEN ESTABLISHED IN WHICH THE RATE OF THAW AND SUBSEQUENT SETTLEMENT IS HELD TO TOLERABLE LIMITS. THAW REDUCING METHODS ARE OUTLINED. CLEARING AND REMOVAL OF ORGANIC DEBRIS IS REQUIRED IN CONTRACT SPECIFICATIONS. THE INSULATING PROPERTIES OF PEATS AND MOSSES, THE MAINTENANCE OF EMBANKMENT HEIGHTS FROM 4 TO 6 FT., THE BACKFILLING WITH GRANULAR MATERIALS OF EXCAVATIONS FROM 3 TO 5 FT., AND THE DRAINING OF FLOWING WATER FROM THE HIGHWAY AREA ARE ALL DESCRIBED.

Becker, JC *Civil Engineering Asce* Vol. 42 No. 7, July 1972, pp 75-7, 2 Fig, 2 Phot

3A 238688

QUALITY CONTROL IN HIGHWAY CONSTRUCTION PROGRAMS

EACH OF THE PARTIES IN HIGHWAY CONSTRUCTION ENGINEERING PROJECTS HAS RESPONSIBILITIES TO THOSE WITH WHOM HE HAS AN IMMEDIATE AND DIRECT CONTRACTUAL RELATIONSHIP. THESE RESPONSIBILITIES ARE DETERMINED PRIMARILY BY THE TERMS OF PARTIES' WRITTEN CONTRACTS. THE MATTER OF ASSURING THAT CONSTRUCTION IS PERFORMED ACCORDING TO ACCEPTABLE STANDARDS OF QUALITY IS CUSTOMARILY COVERED BY CONTRACT AND CERTAIN DOCTRINES OF LAW. THE IMPORTANCE IS DISCUSSED OF SPECIFICATIONS IN HIGHWAY PROJECTS AND IN QUALITY CONTROL. THE CRITERIA OF QUALITY IS DISCUSSED IN RELATION TO: THE CONCEPT OF EQUALITY AND TRADE PRACTICES. QUALITY CONTROL MUST DEPEND UPON CONTRACT PROVISION FOR STORAGE AND HANDLING OF MATERIALS, INSPECTION PROCEDURE, AND ADJUSTMENT PROCEDURES. THE CONTRACT LAW THAT HIGHWAY DEPARTMENTS AND CONSTRUCTION CONTRACTORS ARE CONCERNED WITH IS LARGELY ADMINISTRATIVE LAW. CONTRACT ADMINISTRATION IS OFTEN DEFEATED BY THE STATE'S PROCEDURES FOR QUALITY CONTROL WHICH ARE UNREALISTIC, OR THE CONCEPT OF PRIVACY OF CONTRACT. TO IMPROVE CONTRACT ADMINISTRATION, THERE MUST BE SOME NEW AND SEARCHING STUDY OF THE LEGAL FRAMEWORK OF THIS FUNCTION, AND A THOROUGH ANALYSIS OF THE FACTORS THAT AFFECT IT AND THE PUBLIC POLICIES IT SERVES.

Dunbar, DW *Highway Research Record, Hwy Res Board* 1969

3A 239960

EARTHMOVERS POLLUTE LITTLE BUT FACE EMISSION STANDARDS

THE DIESEL IS CONSIDERED THE PREDOMINANT ENGINE USED IN CONSTRUCTION EQUIPMENT. SMOKE REGULATIONS, WHICH ARE IN EFFECT OR PENDING, ARE DISCUSSED TO POINT OUT THE INDUSTRY IS SUBJECT TO CONTROLS. AN ESTIMATE OF THE AMOUNT OF HYDROCARBONS, CARBON MONOXIDE, AND OXIDES OF NITROGEN EMITTED BY EARTH-

MOVING EQUIPMENT IS MADE TO EVALUATE THE AIR POLLUTION WHICH MAY BE ATTRIBUTED TO THE INDUSTRY. SUBSTANTIAL EFFORT TO REDUCE EMISSIONS IS SUGGESTED. /AUTHOR/

Henderson, RD *Sae Journal, Soc Automotive Engr* May 1970

3A 240027

SOUND MEASUREMENTS ON BUILDING MACHINES /IN GERMAN/

THE NOISE OF MORE THAN 200 MACHINES USED IN BUILDING AND ROAD CONSTRUCTION WORK HAS BEEN MEASURED UNDER UNIFORM CONDITIONS. THE RESULTS SHOW THE DISTRIBUTION OF LEVELS FOR VARIOUS TYPES OF MACHINES. IN SOME CASES, SIMPLE NOISE REDUCTION MEASURES WERE EVALUATED. /AUTHOR/

Rathe, EJ 1970

3A 240053

NOISE FROM COMPRESSORS AND PNEUMATIC EQUIPMENT TEST CODES FOR THE MEASUREMENT OF THE NOISE FROM PORTABLE COMPRESSORS, ROCK DRILLS AND PAVING BREAKERS ARE DISCUSSED. NOISE LEVELS FOR SUCH EQUIPMENT ARE REPORTED, AND NOISE CRITERIA FOR CONSTRUCTION WORKS WITH RESPECT TO ANNOYANCE ARE ANNOTATED. AN APPENDIX QUOTES NORWEGIAN PROPOSALS ON TESTS CODES FOR THE MEASUREMENT OF NOISE FROM COMPRESSORS AND PNEUMATIC EQUIPMENT. DISTRIBUTORS AND CONTRACTORS WANT THE NOISE LIMITS RELATED TO THE INDIVIDUAL UNIT; HOWEVER, IT IS BELIEVED THAT THE BEST RESULTS WILL BE OBTAINED IF THE LIMITS ARE DIRECTLY RELATED TO THE ANNOYING NOISE. /AUTHOR/

Dirdal, B Gjaevenes, K *Applied Acoustics /UK/* Jan. 1971

3A 241787

DATA COLLECTION AND ANALYSIS REPORT-TRACK AND ROADBED INVESTIGATIONS FOR TEST TRACK PROGRAM OF SAN FRANCISCO BAY AREA RAPID TRANSIT DISTRICT THE RESULTS OF DATA COLLECTION AND ANALYSIS OF TRACK AND ROADBED CONSTRUCTION TECHNIQUES ARE REPORTED. THE COMPONENTS FOR LABORATORY TESTING AND INSTALLATION IN A 4.5 MILE TEST TRACK TO BE CONSTRUCTED FOR THE SAN FRANCISCO BAY AREA RAPID TRANSIT DISTRICT ARE DESCRIBED. THE INVESTIGATIONS AND RECOMMENDATIONS COVERED ARE LIMITED TO THE AREA BETWEEN THE TOP OF RAIL AND BOTTOM OF BALLAST. THE FINDINGS AND RECOMMENDATIONS REGARDING LABORATORY AND FIELD TESTING OF NEW OR MODIFIED CONCEPTS FOR RAIL, RAIL FASTENERS, RAIL PADS, TIES, AND SEVERAL TYPES OF ROADBED ARE PRESENTED. ECONOMIC COMPARISONS OF CAPITAL AND OPERATING AND MAINTENANCE COSTS ARE INCLUDED FOR THE RECOMMENDED SECTIONS. CONSTRUCTION METHODS FOR NEW TYPES OF ROADBED ARE OUTLINED, AS WELL AS MAINTENANCE OF WAY REQUIREMENTS FOR PERSONNEL AND EQUIPMENT. EXTENSIVE LABORATORY TESTS ARE RECOMMENDED IN CERTAIN AREAS TO ACCELERATE ACCEPTANCE OR REJECTION OF CERTAIN FACILITIES BEFORE THEY ARE INSTALLED IN TRACK; IN ADDITION, MORE LABORATORY TESTING IS RECOMMENDED IN CERTAIN AREAS FOR THE ACCUMULATION OF DATA TO BE FURTHER SUPPLEMENTED BY IN-TRACK TESTING. /UMTA/

Kaiser Engineers May 1964

ACKNOWLEDGMENT: UMTA

3A 260091

COMPOSITE ACTION WITHOUT SHEAR CONNECTORS

In order to develop composite action in a beam with the flange embedded in the deck slab, sufficient natural bond friction forces must exist between the flange and concrete to transfer the horizontal shearing forces. The

methods are discussed and the results are presented of a series of tests that were conducted to determine if natural bond forces are adequate. Details are given of the test specimens which were hybrid castellated steel beams. To evaluate composite action, instrumentation was provided to measure slip between the concrete and steel, deflection of the composite beam, and strains in the beam and concrete slab. The loading condition, and the test procedure are described, and the slip measurement results are set forth. Load deflection characteristics, stress distribution, horizontal shear stress and repeated loads are other aspects covered. Conclusions based on the test results are presented.

Watson, J (Mulach Steel Corporation); O'Neil, R Barnoff, RM (Pennsylvania State University, University Park); Mead, E (Mulach Steel Corporation) *Engineering Journal* Vol. 11 No. 2, 1974, pp 29-33, 10 Fig., 8 Ref.

3A 260123

PAVEMENT CRUSHED, REUSED TO STRENGTHEN RUNWAY BASE

A badly cracked pavement at Orange Municipal Airport in Orange, Massachusetts was recently reconstructed by reconstituting the existing pavement and a portion of the existing base by pulverizing and mixing them with a travelling hammer mill. The reclaimed mixture of old pavement and base was used as a stabilized base of improved gradation characteristics which was overlaid with a new bituminous concrete surface course. Cobbles (6 to 12 inches) which frost had migrated from the subgrade into the base course were also crushed during this process to a 2 inch maximum size, and no wasting of materials was necessary. This method of reconstruction was about 15 percent less expensive than removing and wasting the old pavement, upgrading the existing base with imported aggregate and paving. A thin pavement overlay would probably experience about 80 percent reflection of old underlying cracks within 3 to 5 years, and there would be no opportunity to improve the base course or relieve the frost heaving of cobbles. /Author/

Briggs, RC (Edwards and Kelcey, Incorporated) *ASCE Civil Engineering* Vol. 43 No. 4, Apr. 1973, pp 82-84, 1 Fig., 1 Tab., 2 Phot.

3A 260235

NOISE CONTROL AND CIVIL ENGINEERING

The report explains noise nomenclature, describes tools and mathematical models for reducing noise on engineering projects, and makes recommendations for revising engineering education. The various Federal, State and local regulations related to noise are reviewed. Future construction planning will have to take into account noise control in scheduling and deployment of construction equipment. The Environment Protection Agency's (EPA) document 'Noise from Construction Equipment and Operations, Building Equipment and Home Appliances' (dealing with construction noise), describes a model which predicts noise from various types of construction projects. On the basis of field interviews, EPA calculated "usage factors" for each piece of equipment. An average noise level for each phase of each job was calculated and tabulated. Tables are also presented of the various types of equipment that can be quieted, the degree of quieting and the cost of quieting. Options for compliance open to construction planners are listed. Important aspects of traffic noise are identified: noise levels rise 9 dBA each time the average speed is doubled; for a constant average speed, doubling the number of vehicles per hour increases average noise by 3 dBA; stop and go traffic introduces higher peak levels and often lower averages; smooth but slow traffic has a low average and low peaks. A mathematical model is described which was used to device various methods of decreasing sound emission levels from a mixture of different types of vehicles, different speeds, different volumes and different emission characteristics. Ways of handling problems dealing with traffic noise abatement are outlined. The need is indicated for education of the civil engineer to help him cope with problems of noise control and reduction. Topics that should be included in an elementary acoustics course are listed.

Krokosky, EM Dym, CL (Carnegie-Mellon University) *ASCE Civil Engineering* Vol. 44 No. 5, May 1974, pp 45-49, 3 Tab.

3A 260354

ILLUSTRATED TERMINOLOGY FOR CONCRETE VIBRATORS

The German, English, French, Italian, Dutch and Swedish terminology for components fo internal poker vibrators, external vibrators, concrete compactors incorporating flotation units, surface vibrators, concrete surface

finishers, and special compacting machines is given and illustrated. /TRRL/
Committee for European Construction Equipment RD Rpt. 1971, 54 pp, 29 Fig.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 203021)

3A 260400

THE UNDERGROUND RAILWAY IN VIENNA [Die Wiener U-Bahn]

The author reports on the planning and construction of the underground railway in Vienna. Construction methods used include the following: The open-pit method, for which a description is given of jointing of slurry trench walls with precast concrete for depths greater than 20 m and supporting of the freestanding slurry trench walls and access shafts by means of soil anchors, steel frames or sections of plate beams; and the closed construction method, for which a description is given of the fully automatic shield, settlements of the soil above the shield and the main causes of this, the provision of a safety wall in front of St. Stephen's Cathedral, and the construction of a drilled pile wall by means of a low-vibration worm drill. /TRRL/ [German]

Ellinger, M *Zement und Beton* Vol. 1972 No. 65, Dec. 1972, pp 9-18, 12 Fig., 7 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 301118)

3A 260435

WATER USED TO PRELOAD UNSTABLE SUBSOILS

During the construction of an 1100 acre containerport development at Elizabeth, New Jersey, the Port Authority of New York and New Jersey found the following circumstances favored the use of water rather than sand for surcharge: the lack of area to dispose of sand surcharge; the increased cost to purchase additional fill; the ready availability of sand for dikes and water for surcharge; the shorter construction period. The steps to construct, fill, maintain and empty the water surcharge site of two lakes, 44 acres and 19 acres, are fully described. Problems such as seagulls, wind and cold weather during the construction and preload periods are detailed together with the solutions. Field observations were required to monitor the performance of the water preload and dand dike stability. A brief cost estimate of the project, together with photographs and illustrations are also provided.

Tozzoli, AJ York, DL (Port Authority of New York and New Jersey) *ASCE Civil Engineering* Vol. 43 No. 8, Aug. 1973, pp 56-59, 2 Fig., 2 Phot.

3A 260445

MEMBRANE ENCAPSULATED SOIL LAYERS (MESL) FOR ROAD CONSTRUCTION IN COLD REGIONS

The possible use is examined of membranes to encapsulate frost susceptible soils, compacted at water contents below optimum, to inhibit frost action by maintaining the water content at a low level. Laboratory test data are presented to show the effects of soil type and compaction conditions on the potential field performance of such encapsulated soils. The three soils tested in the laboratory are: a moderately plastic clay from Ellsworth, S.D.; a sandy silt; from Hannover, N.H.; and lean clay from Elmendorf, Alaska. Soils similar to those tested will also be utilized in field trials subjected to freezing and thawing. The results of the unfrozen water content determinations, and freezing tests on the Ellsworth clay are described and discussed. The Ellsworth clay seems ideally suited to use in membrane encapsulated soil layers (MESL) in a frost area. The behavior of Hannover silt in a brief test program was very different. CBR values for unsoaked samples of Hannover silt decrease much more rapidly with increasing water content on the wet side of optimum than values for Ellsworth clay. On the dry side of optimum, the CBR of the silt is essentially constant. Freezing tests, post thaw strength and possible chemical treatment are also considered. Investigations indicate Elmendorf clay is less plastic (PI=18) and of more uniform particle size than the Ellsworth clay (PI=25). Freezing point depression tests suggest that a significant percentage of the soil water may remain unfrozen at temperatures only a few degrees below zero deg. C. Freezing tests, lime treatment and placement requirements related to Elmendorf clay are also considered.

This paper was presented during the Symposium on Frost Action on Roads held in Oslo, Norway, 1-3 October, 1973.

Quinn, WF Carbee, D Johnson, TC (Cold Regions Research and Engineering Laboratory) Organization for Economic Cooperation and Devel Conf Paper 1973, pp 417-438, 12 Fig., Tabs., Refs.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 214595)

3A 260447

PAVEMENT DESIGN IN COLD AREAS

A replacement method is described which is based on the CBR design, and the use of insulation in road construction. The subgrade bearing capacity during the thawing period was investigated and design CBR value has been set up for each group of soil characters. The pavement depth and the replacement depth was compared and the larger is taken for the determination of pavement structures. The field CBR tests on subgrade, frost prevention layers and 30 cm thick layer of frost prevention layers above the surface of subgrade, are reported and discussed. Since Roads in Hokkaido show large freezing depth, a replacement depth of roads should be 80 percent of the deepest frost penetration in existing gravel roads. This corresponds to about 70 percent of the frost penetration in the roads which are replaced to full depth with nonfrost grained materials. A frost damage correcting measure is outlined. When the pavement depth (above) is smaller than the standard replacement depth, frost-susceptible materials shall be filled below the subbase course for such a depth of difference. The minimum depth of frost preventing layer shall be 15 cm. The qualities required of replacement materials are listed. Care is urged in the selection of insulating material and the use is noted of extruded polystyrene board on subgrade soil. However, quantitative studies of its' effect on frost action were not performed.

This paper was presented during the Symposium on Frost Action on Roads held in Oslo, Norway, 1-3 October, 1973.

Kono, F Takahashi, T Kubo, H Hiraoka, H (Hokkaido Development Bureau, Japan)

Organization for Economic Cooperation and Devel Conf Paper 1973, pp 161-173, 6 Fig., 7 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 214611)

3A 260471

POLYSTYRENE FOAM IS COMPETITIVE, LIGHTWEIGHT FILL

Shortly after construction, the abutments of a Michigan bridge began to move toward the river. The problem was caused by the fact that the approach roads to the bridge were of earthfill (125 lbs/cu ft), creating large forces against bridge piers and abutments. After examining several possible solutions, the best solution was considered to be the use of polystyrene foam (3 lbs/cu ft) as fill. It weighs much less than sand or very soft clay, minimizing the amount of excavation. It also has long-term durability and won't absorb much moisture. Ease of placement, immediate availability, and comparatively low cost were also factors in its favor. The construction procedures utilized are briefly discussed in this article.

Coleman, TA (Michigan Department of State Highways & Transp) *ASCE Civil Engineering* Vol. 44 No. 2, Feb. 1974, pp 68-69, 2 Fig., 3 Phot.

3A 260476

FALSEWORK FAILURES: CAN THEY BE PREVENTED?

Several falsework failures which have made news headlines have caused concern as to the adequacy of falsework checking procedures. Although billed as "Bridge Collapses," eight instances in which falsework has failed in California in recent years are analyzed and in all cases it is shown that the failure was strictly falsework and not the finished bridge structure. The question of what can be done to prevent falsework collapses is raised and some suggestions are made of ways to improve the quality of this temporary structure which traditionally has been the responsibility of the contractor. The State recognizes its responsibility to the traveling public and new procedures are outlined to improve falsework quality. /AUTHOR/

Elliott, AL *ASCE Civil Engineering* Vol. 43 N No. 0, Nov. 1973, pp 74-76, 4 Phot

3A 260486

IMPACT OF METRICATION ON THE CONSTRUCTION INDUSTRY

A thorough discussion is presented concerning the desirability of national metrication and the present status of this important matter. Metrication alternatives are considered, leading to the conclusion that nothing short of complete and genuine metrication can provide the maximum benefit. A necessary point of beginning for metrication of the construction industry as a whole is the familiarization of large numbers of people with the metric system. It is additionally determined that metrication of the construction industry must necessarily proceed simultaneously within each of its four elements: design; material and equipment production; contractors; and labor. The ramifications of metrication as they apply to each of these four areas are discussed and specific problem areas are identified.

Engineering Issues

Clough, RH *ASCE Journal of Professional Activities* Vol. 100 No. EI3, Proc. Paper 10646, July 1974, pp 225-234

3A 260656

UNDERWATER CONCRETE FORMING TIME SLASHED

Dramatic reductions in both time and manpower requirements for forming concrete structures underwater are possible because of a unique fiberglass form. The forms are manufactured by filament winding fiberglass and resin and are made in standard lengths of 60 feet and in diameters from two to 12 feet and even larger. The cylindrical forms are split lengthwise so that they can be spread open and slipped around a piling and allowed to snap shut. The fiberglass angle bars are lugged together to form a spillproof closure. If left in place, these forms provide protection against corrosion.

Dixie Contractor Vol. 49 No. 4, July 1974, p 28

3A 260780

RAIL TUNNEL IN ROCK SPEEDS B.C. TRAINS

The article describes the construction of the 4568 Ft. long, 16 ft. wide and 24 ft. 6 in. high railway tunnel being blasted through granite-like granodiorite rock at Nelson Creek, West Vancouver, Canada. If the preliminary rock survey, showing solid, uniform rock formation is correct, no steel lining and only occasional concrete grouting will be necessary. /TRRL/

Tunnels and Tunnelling Vol. 4 No. 6, Nov. 1972, pp 547, 1 Fig., 1 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 204099)

3A 260896

FROST PROTECTION OF EXISTING ROADS BY A TOP INSULATING LAYER [Frostbeskyttelse av Eksisterende Veger Med Toppløseringsmetoden]

It has been calculated that some 35000 km (22000 miles) of the Norwegian road network requires strengthening in order to comply with the standards set up for 8 ton axle load. A new method of protecting existing roads from frost and at the same time strengthening them is described for a 3.6 km (2.2 miles) long stretch. The method uses boards of insulating materials of high compressive strength placed directly on top of the existing road with a thin layer-8 cm (3 1/4")-of asphaltic gravel on top of the boards. constructional details are given in some detail as it is of great importance that this thin addition to the existing road behaves as uniformly as possible. Deflection measurements with the benkelman beam do not indicate any great differences before and after construction, and both the total deflection and radius of curvature are within the limits generally accepted for a normal standard road. Temperature-gauges are placed immediately above and below the insulating boards and 1 m (3' 4") below the boards. Air temperature and relative humidity, rainfall and cloud conditions will be observed twice daily in order to gather data about the relation between the above parameters and formation of ice on the road surface. /TRRL/ [Norwegian/English]

Borg, JVN (Committee on Frost Action in Soils, Norway) *Frost i Jord* No. 9, Mar. 1973, pp 7-19, 6 Fig., 5 Phot., 1 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 206069)

3A 260951

CALCULATION OF LATERAL THRUST ON TUNNEL WALLS [Calcolodelle Spinte Laterali Sulle Pareti in Gallerie]

This study of the underground railway system in Prague, Czechoslovakia, analyzes the working stress conditions of an underground railway tunnel. Design criteria and tolerance limits for earth pressures in soft and compact ground are discussed. Construction techniques preliminary to tunnel drilling are outlined for various ground conditions. /TRRL/ [Italian]

Straka, J *Strade* No. 11, 1973, pp 649-654, 7 Fig., 1 Tab.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 208731)

3A 261075

SIMPLIFIED MUFFLER SHELL CONSTRUCTION

The inventor describes a simplified means for attaching the outer shell of the muffler to the inner tube. The technique involves forming the ends of the shell in a manner which reduces the diameter progressively. Two enlarged sections are then formed on the inner tube on each side of the point where it meets the outer shell. The configuration may then be spot welded at this point.--GJS

Patent filed 11 August 1970.

Straw, EG (Tenneco Incorporated)
Department of Commerce

PURCHASE FROM: United States Patent Office 2021 Jefferson Davis Highway, Arlington, Virginia, 22202 Repr PC

3,523,590

3A 261274

AN ANALYSIS OF NOISE CONDITIONS PRESENT IN COMMERCIAL AND MILITARY VEHICLES

A noise survey was conducted to determine whether hazardous noise conditions exist within construction, farms, or military vehicles. A check was also made on the basic modes of public transportation: plane, railroad, bus, taxi, and private automobiles. Extreme noise conditions were found in much of the construction and farm equipment. The military design vehicles also showed some situations of extreme noise. The public transportation modes were generally free from any extreme noise conditions. (Author)

Sponsored by the Army.

Elliott, JE
Texas A&M University 1971, 63 pp

ACKNOWLEDGMENT: National Aeronautics and Space Administration (N73-12754)

PURCHASE FROM: National Technical Information Service 5285 Port Royal Road, Springfield, Virginia, 22151 Repr PC, Microfiche
N73-12754, AD-747685

3A 261499

BIBLIOGRAPHY ON WINTER CONSTRUCTION, 1967-1971
No Abstract.

Kaplar, CW Metrish, RM
Cold Regions Research and Engineering Laboratory Special Report 204, Apr. 1974, 77 pp, 746 Ref.

3A 261505

UPHILL HAUL-SCRAPERS VERSUS BOTTOM DUMPS WHICH ARE THE BEST?

A comparison is made of various haulage systems to determine which is the most efficient. The systems considered are the pushloaded scraper (PLS), twin-engined pushloaded scrapers (TEPLS) and top loaded bottom dump haulers (TLBDH). The material to be handled is a sand-silt-clay mixture. Areas compared are the characteristics of the machines, controlling cycle times, production and costs. The PLS, with the exception of the top loaded rear dump hauler, is closest to the "all material and all length of haul" concept. It shows lower unit cost in upgrade haulage than does the TLBDH up to plus 140 feet difference in elevation.

Church, HK *Roads and Streets* Vol. 116 No. 9, Sept. 1973, 4 pp, 3 Fig., 1 Phot.

3A 261591

REINFORCED EARTH WALL ALLOWS ROAD WIDENING IN TIDAL ESTUARY

The building is described of a reinforced earth (RE) wall (in a marine environment) in which the technique utilizes the friction of soil against buried metal strips to form a unified structural wall. It was designed so as to resist hydraulic forces and resist corrosion from the saltwater. The structure which includes a facing of interlocking concrete panels, consists of a wall which is 1,100 ft long and 28 ft (maximum) high. Details are given of the preparatory work. A non reinforced concrete footing is stepped across the site to provide true line and grade for the 861 panels that face the wall on the side of a creek. The interlocking precast concrete panels are described which are linked by a series of corrosion-resistance 0.75 in. aluminum magnesium alloy dowels cast into the panels. The spaces between the panels are filled to prevent backfill material from washing through the joints. Horizontal joints are filled with cork and vertical gaps are sealed with a filter material. The structural integrity of the RE wall is provided by metal strips imbedded in lifts of compacted earth fill. Strips which are imbedded at right angles to the wall face are on 19.5 and 30.0-in. centers behind the concrete facing. They attach to tabs cast into the panels with 0.5-in. bolts. Vertical spacing of the 14-, 23-, and 28-ft-long strips is 7.5 in. near the top and bottom of the fill and 30 in. in between. The 44,000 cu. yd. of fill is placed in 6 to 9-in. lifts which are then rolled.

Engineering News-Record Vol. 193 No. 7, Aug. 1974, p 40, 2 Phot.

3A 261635

ACCURACY OF EQUILIBRIUM SLOPE STABILITY ANALYSIS

The discussant of this paper described studies performed in an attempt to develop a simple method for predicting embankment deformation. The limit-equilibrium safety factors of compacted embankments were compared with the "actual" safety factors determined rigorously using the stress-strain relationships and the equations of compatibility of deformations. The mathematical simulation of embankments included compaction stresses and stage construction. The hyperbolic stress-strain representation proposed by Kondner was adopted with parameters selected to fit experimental results from actual consolidated undrained triaxial tests in clayey soil. Fourteen embankments were analyzed under end-of-construction condition, their "actual" safety factors being between 1.0 and 1.5 and their slope angles ranging from 1 (horizontal) on 1 (vertical) to 3 (horizontal) on 1 (vertical). For each embankment, contours of equal major principal strain (epsilon) were determined and the potential failure line was defined as the locus of epsilon (max). In every case this locus could be reasonably approximated by a circular arc. The "actual" safety factor is defined as the mean value of a ratio (given). A graph of the conventional safety factors versus the "actual" ones shows the former is always lower than the latter. The difference is as large as 30 percent and is dependent on the safety factor and on the slope angle.

Discussion of Proc. Paper 10097 by Stephen G. Wright, Fred H. Kulhawy, and James M. Duncan, published in October 1973

Resendiz, D (Mexico City University) *ASCE Journal of the Geotechnical Engineering Div* Vol. 100 No. GT8, Proc Paper 10695, Aug. 1974, pp 967-970, 3 Fig., 7 Ref., 1 App.

3A 261755

COMPUTER SIMULATION APPLIED TO SLIPFORM PAVING

A computer simulation model called SFPSIM has been developed in the SIMSCRIPT 11.5 language which attempts to incorporate the main interactions that can occur during typical paving operations. The computer analysis enables the determination of the optimum number of trucks to employ for any batch plant location and their scheduling. A diagram is presented of the typical slipform paving operation. Time lapse photography equipment was used to collect typical time data for the components. Pictures were taken at a rate of one frame every 4 seconds. The duration of each job operation was determined by counting the number of frames in which that operation occurred and multiplying by 4 seconds. Typical frequency distributions were thus obtained of the times required to service a truck at the wash-out area, load at the plant and unload at the paver. Stop watch readings while riding the truck yielded the truck speeds for each part of the cycle. The time distributions were fed into the simulation. Frequency distributions for the time between equipment failures and the downtimes expected at each failure were also incorporated into the program. A diagram is presented of the flow chart of the logic used in the computer program

which is designed to be flexible enough to model almost any normal slipform project. Some of the parameters that may be specified are listed. The types of questions that may be answered are illustrated by examination of selected results for a typical pavement 21,600 ft long, 9 in. thick, 24 ft wide, dual lane.

Willenbrock, JH (Pennsylvania State University) *Roads and Streets* Vol. 116 No. 6, June 1973, pp 144-146, 3 Fig.

3A 261768

GROUND FREEZING TECHNIQUES AT SALERNO

The article describes the construction of the Santa Lucia Tunnel, under Salerno, and considers the use of soil freezing in one tunnel section in detail. A geological section of ground under Salerno is shown; four types of strata present are volcanic, alluvial deposits, and dolomite (tectonic and non-tectonic in origin). Tunnelling difficulties caused by water are discussed. Water and soil cave-ins from the face were stopped by injection. A hydrological study was prepared. Preference of soil freezing over other techniques is discussed. Low temperature brine circulating in freeze pipes causes water in the voids to freeze, giving sealing and stabilization of the soil. The arrangement of freeze pipes is shown. Frost penetration and mechanical properties of frozen soil are considered. The freeze wall conditions of design and their practical realization are given. The construction method of calottes with a preliminary lining of steel beams and reinforced gunnite was adopted. Relevant construction data are listed. No settlement of structures on the surface occurred where soil freezing was applied, and the method was cheaper and safer than the chemical injection method. /TRRL/

Braun, B Macchi, A *Tunnels and Tunnelling* Vol. 6 No. 2, Apr. 1974, pp 81-89, 4 Fig.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 209603)

3A 261894

THE USE OF GAP GRADED MIXES IN ASPHALT OVERLAY

A type of gap graded mix intermediate between continuously graded asphalt concrete and a high sand content gap graded rolled asphalt has been used in the Natal asphalt overlay programme with good results. A full scale overlay experiment at Umbumbulu, trial sections at Tugela and a survey of some 150 miles of overlay already completed are described and their performance evaluated. The mix used appears to give good performance in layers thinner than called for in terms of current design methods. Explanations are given for its apparently superior flexibility and crack resistance over the more traditional asphalt concrete. Indirect tensile strength tests have been undertaken, which indicate a high tensile strength for this mix in the temperature ranges experienced in Natal. Economics of stage construction are possible because of the good performance of thin (less than 4") layers of gap graded mix even over old distressed pavements of high deflection levels. /AUTHOR/

Presented at the Third International Conference on the Structural Design of Asphalt Pavements, Grosvenor House, Park Lane, London, England, Sept. 11-15, 1972.

Knight, K (Natal University); Groth, P (Natal Roads Department); Akeroyd, FML (Mobil Oil Southern Africa Pty, Limited) *International Conf Struct Design Asph Pvmnts (3rd) Proceeding* Vol. 1 Sept. 1972, pp 1178-87, 6 Fig., 4 Tab., 15 Ref., Apps.

3A 261998

WELL FOUNDATIONS FOR ROAD BRIDGES

The paper discusses the design and method of construction of well foundations for road bridges. A single large diameter circular well is preferred to groups of smaller circular wells for ease of sinking and shuttering. It is recommended that careful consideration be given to the following loading combinations: (1) breaking force and seismic force, (2) seismic force and high flood, (3) seismic force on maximum live loads, and (4) live load surcharge. /TRRL/

Saxena, RK *Indian Roads Congress Journal* Vol. 34 No. 2, Dec. 1971, pp 391-435, 15 Fig., 2 Tab., 6 Phot., 7 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 201631)

3A 262079

TECHNICAL INFORMATION BULLETIN SP-39

Canadian research projects pertaining to the effect of low and high temperatures on properties of concrete, are outlined and discussed in 10 papers included in a Symposium publication, "Behavior of Concrete Under Temperature Extremes." The effect of temperature and age on the thermal expansion and modulus of elasticity of concrete for the temperatures between 100 and 150 degrees F are discussed in one paper. The effect of vacuum processing on the strength of concrete and the pulse velocity at 0 degrees F, after initial standard curing for various periods of time, is also reported. Field curing during winter and protection against freezing are covered in another paper. Other aspects covered in the papers presented here, include results from field-cured cylinders and drill cores taken from large column and slab specimens exposed during winter, the winter curing of concrete, the effect of temperature on air-entrained concrete, the behavior of lightweight concrete exposed to high temperature and the fire endurance of concrete masonry walls.

McFarland, HC

American Concrete Institute Bulletin SP-39, Sept. 1973, 3 pp

3A 262678

PRESPLITTING

Presplitting is defined and the experience of the California Division of Highways with the use of the technique is reported on metamorphic rock. The application of the technique was successful and increased future use is anticipated. The factors which contributed to obtaining satisfactory results are discussed and an analysis of costs is made. Specifications are discussed and the proposed specifications for the California Division of Highways are presented. /FHWA/

Smith, T McCauley, ML Mearns, R

California Department of Public Works, (19203 762503 632955) Intrm. Rpt. No. 1, Jan. 1971, 37 pp

Contract F-8-7

ACKNOWLEDGMENT: Federal Highway Administration (P-0056), California Department of Transportation

PURCHASE FROM: NTIS Repr. PC, Microfiche

PB-199352

3A 262777

AN APPROACH TO PHI SUB U EQUALS ZERO ANALYSIS FOR STAGE CONSTRUCTION

A method is presented for estimating the gain in the undrained strength of the subsoil due to dissipation of pore pressure under the sustained first-stage loading or preload during embankment construction. Results of the theoretical consideration are summarized in an equation which, when used in determining the increase in undrained strength, makes it possible to analyze the stability of stage construction by the phi sub u equals zero method.

Gangopadhyay, CR Som, N (Jadavpur University) *ASCE Journal of the Geotechnical Engineering Div Tech. Note* Vol. 100 No. GT6, Proc Paper 10597, June 1974, pp 699-703, 2 Fig., 1 Tab., 7 Ref., 1 App.

3A 262895

THE EFFECT OF HIGHWAYS UPON THE ENVIRONMENT

Community concern about the environmental effects of highway developments is reviewed, the opinions of professional environmentalists are discussed and steps taken to limit detrimental environmental effects are outlined. Legislation is now being enacted in some states to limit permissible noise level of each vehicle which operates on the highway. Congress is expressing interest in vehicle and construction equipment noise, and Federal legislation may be enacted. In highway location and design, the engineer must give consideration to the problems associated with highway noise. Some design-technique recommendations are proposed. Concern for soil erosion has prompted the issuance of Federal guidelines for minimizing soil erosion from highway construction. Emphasis must be placed on practical measures to eliminate soil erosion and the resultant stream or lake siltation. These measures must be incorporated in every highway project. Fitting the highway to the natural and cultural features should be the concern of every highway engineer. A highway must be located and designed such that it forms a tie between areas on either side of the highway. Attention is being

given to location of highways along natural boundaries of ecosystems and to the continuation of established wildlife trails across highway right-of-way. Preservation and conservation of lands and historic sites is another recognized goal in highway programs.

Twentieth Annual Meeting held at University of Arizona, April 15-16, 1971.

Wells, RI (Environment Development Division (FHA)) *Arizona Conf Roads & Streets Proc* 1971, pp 1-4

3A 263035

TRANSVERSE JOINT CONSTRUCTION AND SEALING PRACTICES 1968-1972

Since March 1968, transverse contraction joints in New York State have been constructed 5/8-in. wide with beveled edges, and sealed with 1-1/4-in. wide performed polychloroprene compression sealers. This study was initiated to evaluate this new system, and to investigate three laboratory tests that may more accurately predict field performance of sealers. This interim report evaluates joint construction and sealing methods, as well as field performance for the first 3 to 4 years. During 1968 and 1969, 10 construction projects throughout the state were selected for observation. On each, a test section of approximately 30 consecutive joints was established where successive stages of construction and sealing could be observed. The various methods, materials, and types of equipment used are evaluated. In addition, 12 other projects were selected in 1969 and 1970 for observation of sealer performance. Quarterly evaluation surveys have been conducted to determine long-term performance. After service of up to 4 years, the joints are performing satisfactorily and no sealers have failed. Some fines have begun to collect between the sides of the sealer and the joint faces, but none have worked their way to the bottom of joint grooves. /FHWA/

Prepared in cooperation with the U.S. Department of Transportation, Federal Highway Administration, under the study "Constructing and Sealing Transverse Joints."

Carlson, RD

New York State Department of Transportation Intrm Rpt. Mar. 1974, 58 pp

SSN 57-1

ACKNOWLEDGMENT: Federal Highway Administration (S-0225)

PURCHASE FROM: NTIS Repr. PC, Microfiche

PB-232557/AS

3A 263104

ORGANIZATION OF A COUNTY BRIDGE RENEWAL PROGRAMME

The procedure for planning and organizing a county bridge renewal program is examined and recommendations made for inspection, determination of priorities and arranging for the work to be spread over a period of years. Standardization of design and construction methods are commented on, and also the maintenance and strengthening of existing structures to ensure a sustained renewal rate designed to provide an even flow of work on design and construction. Attention is drawn to the importance of co-ordination at National Roads Board level with a view to the full employment of available forces on renewal and, where possible, extending the life of existing structures. /Author/

Proceedings of Roading Symposium, 1971, held at Victoria University of Wellington, 17-19 August 1971.

Coles, JS (Patangata County Council); Scott, BE (Rijkswaterstaat, Netherlands); Martin, PP *ASCE Journal of Soil Mechanics & Foundations Div Proceeding* Vol. 2 1972, pp 631-642, 22 Ref.

3A 263111

MODERN DESIGN AND CONSTRUCTION TECHNIQUES FOR CONCRETE ROAD PAVEMENTS

The primary purpose of this paper is to present facts concerning the up-to-date design criteria and construction techniques utilized in rigid portland cement concrete road pavements. As concrete pavements are at present not being utilized in the national roading program, this paper by necessity describes overseas trends and practices but particular reference is made to the application of these techniques to New Zealand roading conditions. The paper presents information on fatigue design methods for plain and reinforced concrete pavements, joint technology subgrade, support

criteria, and construction methods emphasizing current slip-form paving equipment and practice. Roading Engineers in New Zealand are now becoming aware of the need for providing durable, heavy-duty pavements for the rapidly increasing volume and weight of traffic. Concrete pavements can play their part in satisfying this need. /AUTHOR/

Proceedings of Roading Symposium, 1971, held at Victoria University of Wellington, 17-19 August, 1971.

Ralston, J (New Zealand Portland Cement Association)
National Roads Board, New Zealand Proceeding Vol. 1 1972, pp 411-426, 13 Fig., 7 Tab., 17 Ref.

3A 263167

THE EFFECT OF TRAFFIC ON BRIDGE DECK CRACKING

This paper summarizes a study of the effects of construction practices and traffic on bridge deck crackings. This was the second phase of a 2-phase research project. Factors related to the growth of cracks, particularly the influence of traffic and the resulting vibrations were also studied and reported. Observation of the construction of a bridge deck and the following stages of the life of the deck were made on two separate sets of bridges. The investigation included measurements of depth of cover and deck thicknesses and also the determination of the location amount of cracking on the bridges. Observations were also recorded of bridges subjected to construction traffic.

Held at University Center at the University of Tennessee, Knoxville on April 13th and 14th, 1972

Goodpasture, DW *Tennessee Highway Conference Proceedings (54th)*
Bulletin Number 39, Jan. 1973, pp 49-68

3A 263491

SURCHARGES MINIMIZE POST-CONSTRUCTION SETTLEMENT

The benefits of surcharges and waiting periods in highway construction are predicted by the application of the principles of soil mechanics. The use of these methods of construction minimizes the amount of detrimental settlement subsequent to paving. Time-consolidation data are used to determine the length of waiting periods. Unconfined and quick-undrained triaxial compression test results are used to determine the safe height of embankments. Berms permit construction to greater heights. Time studies and consolidated quick-undrained triaxial compression test data can be used to determine the increase in strength compatible with controlled rate of loading, but interpretation of test data and engineering judgment are significant factors. Comparison of field measurements and calculations based on test data indicate that the predictions of amount of settlement are somewhat more reliable than the predictions of the rate of settlement.

Kleiman, WF (California Division of Highways)
Engineering Geological & Soil Engineering Symp Proceeding 1966, p 10

3A 263540

ASPHALT CONSERVATION

Two methods are suggested for asphalt conservation. The first involves mix selection. It is estimated that by selecting blends that use lesser volumes of asphalt, a reduction in asphalt demand by as much as 10 percent can be achieved. This does not mean "cutting out asphalt resulting in a leaner mix." It just means selecting a mix that at optimum asphalt required a lesser volume of asphalt. Since asphalt mixes normally average 5 percent asphalt, a 10 percent reduction would be 10 lbs., which at an average of 67 dollars/ton would result in a 34-cent reduction per ton of mix. The second method of conservation is by stage construction with additional overlay applied for full design thickness when needed.

Foster, CR *Paving Forum* 1974, pp 10-11, 3 Tab.

3A 263619

COST ANALYSIS OF LIME-TREATED SOILS

A street improvement program was developed about ten years ago in Gridley, California, to reduce long term maintenance costs and provide streets throughout the city with adequate drainage, curb and gutter, base course and asphalt concrete surface course. Investigation showed lime stabilization to be the best method of base construction. Addition of approximately 4 percent lime increased the R value of the native soil from between 8 and 30 to a value of 80. All the work is done under force account and engineering is provided by the city. A construction crew of four men

formerly assigned to maintenance of soil and sand streets, handles each job. This article covers the construction procedure, cost records, cost comparison and annual cost savings.

Williams, WP (Gridley, City of, California) *Western Construction* Vol. 41
No. 6, June 1966, pp 114-115, 1 Tab.

3A 263648

EVALUATION OF EXPERIMENTAL STABILIZED SOIL BASE CONSTRUCTION, WEBSTER COUNTY, IOWA

This paper presents a portion of the results of an experimental stabilized soil road base program initiated by the Iowa State Highway Commission and the Webster County Engineer's Office. The 8.058-mi long site chosen is typical of the Clarion-Nicollet-Webster soil association area materials found in hundreds of miles of farm-to-market roads in the north-central third of Iowa. The Webster series, a black, heavy-textured, poorly drained clayey soil, dominates. Variable thickness base sections were constructed by using the in-place soil materials stabilized with Type I portland cement, lime, limefly ash and a combination of lime and portland cement. The surface course was a double bituminous armor coat using 3/8-in. crushed stone chips. The experimental features of the project were divided into two primary objectives, both directly related: (a) evaluation of conventional construction procedures, existing construction-inspection specifications and techniques, and recommendations for establishment and/or changes to each of the above areas; and (b) evaluation of the constructed material by field and laboratory tests for determination of stability requirements in the development of design criteria for low-cost stabilized soil base roads. This paper deals principally with the area of the first objective. Presented are an evaluation of the construction techniques, gradation specifications preceding introduction of the stabilizing agent(s); discussion of use of lime as a pretreating agent for reduction of plasticity and increase of friability, comparison of laboratory and field standard Proctor moisture-density relationships, in-place field density determinations using oil density and standard Proctor penetrometer methods, and variation of unconfined compressive strength of 7-day moist-cure specimens with variations in moisture and density. /Author/

In Highway Research Record No. 92, "Lime Stabilization", 1965, pp 21-42. Presented at 43rd Annual Meeting of Highway Research Board, 13-17 January 1964.

Hoover, JM (Iowa State University) *Highway Research Record* No. 92, 1965, pp 21-42, 8 Fig., 10 Tab., 10 Ref.

3A 263811

SITE CONTROL TESTS AND THE CONSTRUCTION OF ENBANKMENTS USING PULVERISED FUEL ASH FROM LAGOONS

From experience of practical handling on site and a series of laboratory tests, the authors give a general description pulverised fuel ash from lagoons and some of its properties-the variability of which are stressed. Methods used in the control and construction of pulverised fuel ash embankments on the A1 improvement works near Wetherby are described and, in the light of this, the need for rapid site control tests is indicated. Based largely on research at the Department of Transportation at Birmingham University, proposals are made to meet the requirements of such tests.

Elks, AD Redman, JT *Surveyor - Public Authority Technology* July 1965, pp 36-40, 6 Fig., 10 Phot., 4 Ref.

3A 263813

EMBANKMENTS ON COMPRESSIBLE SOILS

The authors give a rather complete theoretical treatment of the problem, in which attention is paid to equilibrium and settlement. The practical part of the publication however is less elaborated; different methods to overcome construction difficulties are described, but the authors do not point out why and when these should be applied.

Karst, H Bourges, F De Nie, FC *Annales de l'Institut Tech du Batiment Travaux Pub* N. 203, Nov. 1964, pp 1361-84

ACKNOWLEDGMENT: Applied Mechanics Reviews

3A 263942

COLD WEATHER LIME STABILIZATION

In recent years, lime stabilization of poor quality subgrade soils to upgrade quality or provide acceptable subbase material has increased in popularity

as a construction alternative. However, in many situations, specifications relative to cutoff dates for lime stabilization construction have rendered the alternative unfeasible. Previous studies have revealed that soil-lime mixtures cured prior to subjection to freeze-thaw conditions undergo autogenous healing that resulted in continued strength gain. The purpose of this study was not to evaluate the ramifications of autogenous healing of soil-lime mixtures but to evaluate the behavior of soil-lime mixtures subjected to cold weather stabilization. The basic premise involved in this study was that soil-lime mixtures subjected to freeze-thaw conditions immediately after compaction would not undergo pazzolanic reactions until favorable curing conditions were attained. Soil-lime reaction that would not occur during cold weather treatment would then be renewed under favorable conditions to produce latent strength gains. The scope of this study involved the investigation of the behavior of only one soil subjected to cold weather lime stabilization. The selected soil was evaluated at only one lime content, which was established as the stabilization lime content for that soil.

Rosen, WJ Marks, BD (Tennessee University, Knoxville) *Transportation Research Record* No. 501, 1974, pp 25-41, 6 Fig., 6 Ref.

PURCHASE FROM: TRB Orig. PC

3A 263982

TESTS ON MODEL BRIDGE BEAMS IN PRECAST TO IN SITU CONCRETE CONSTRUCTION

This report describes and gives results of two phases of model testing carried out on elements of a viaduct forming part of the proposed M11 London-Cambridge motorway. The results of the tests showed the design proposals for the section considered to be adequate, and that some economies might be achieved by dispensing with the tapering of the end-blocks of the precast beams. (A)

Sturrock, RD

Cement and Concrete Association, (7210-0926-3) Tech Rept No. 424, Report No 42.488, Jan. 1974, 17 pp, 19 Fig., 10 Phot., 3 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 209242)

3A 263999

FIRST FOUR-LANE DEMOUNTABLE FLYOVER

This article describes Britain's first four-lane demountable flyover, which is part of the London-Tilbury trunk road-the A 13. The flyway carries four lanes in a simple 44 ft wide carriageway and is 1084 ft. long. It consists of eighteen 36ft spans, four 18 ft anchor spans and two 63 ft spans. The 104 deck units, of composite steel and reinforced concrete, are supported on 3-leg portal trestles. Owing to lack of space the deck was constructed in two halves. Because of difficulties in maintaining adequate skid resistance to the concrete panels on previous flyways, 1 1/4" of hot rolled asphalt surfacing has been used. Joints between the deck units were polysulphide sealed. Construction details of the widening of the bridge over the Barking-Dagenham dock railway line are included. /TRRL/

Highways and Road Construction Vol. 42 No. 1773, 1974, p 23, 1 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 209886)

3A 264002

EXPANDED TUNNEL LININGS

Information on all known types of expanded tunnel linings from 1920 to date is given. The longitudinal and cross sections of eleven linings are shown in conjunction with a description of their construction and method of expansion. Practical usage is indicated when applicable. The design of segments making up a ring should be simple and robust. Although expanded tunnel linings have been used only for self-supporting ground their use is predicted for ground which is not self-supporting. /TRRL/

Donavan, HJ *Tunnels and Tunnelling* Vol. 6 No. 2, Apr. 1974, pp 46-53, Figs.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 209601)

3A 264284

PRECOMPRESSION FOR SUPPORT OF SHALLOW FOUNDATIONS

A survey of the state-of-the-art of professional practice in controlling foundation settlements by precompression concludes that the use of this method for the support of shallow foundations is a relatively new, useful, and flexible tool for the soils engineer. Methods for accomplishing precompression and means for accelerating it post-construction primary consolidation and for reducing post-construction secondary compression. The scope of the use of the method and suggested areas for future use and study are presented. /Author/

Aldrich, HP (Haley and Aldrich, Incorporated) *ASCE Journal of Soil Mechanics & Foundations Div* Vol. 91 No. 5M2, Mar. 1965, pp 5-20, 3 Fig.

3A 264291

PILE AND PIER FOUNDATIONS

In the design of pile and pier foundations the construction procedures play a significant and often dominant part in determining the extent of settlement that may occur. Settlements are examined under two simplified categories; (1) those that occur although adequate knowledge already exists for their prevention, and (2) those that occur for reasons inadequately understood. Because the first category is much the larger it is examined in most detail. Illustrations of excessive settlements caused by lack of knowledge of soil mechanics and of construction practices on the part of the designer are presented. The designer must be aware of the construction problems involved in his choice of foundation and transmit this awareness to the inspector. Examples of outdated knowledge and misconceptions still in use are given. Among the problems still requiring further investigation are (1) increase of point load with time of a pile passing through a compressible cohesive soil to embedment in a stiffer material, (2) estimation of settlements of long friction piles in cohesive soils of uniform or of stratified character, and (3) influence of the size of the pile group or foundation as a whole on the magnitude of settlement. /Author/

Peck, RB (Illinois University, Urbana) *ASCE Journal of Soil Mechanics & Foundations Div* Vol. 91 No. 5M2, Mar. 1965, pp 33-38

3A 264392

STABILIZED BASE IN MUNICIPAL STREET CONSTRUCTION

The use of a stabilized base applied in a single lift of 5-inch compacted thickness has enabled Woodbridge Township to construct better streets in less time and at lower cost on the unstable soils in the area. Construction method, mix design, etc. are given, as well as the results of tests made on the newly constructed pavements.

Beagle, CW (Woodbridge, Township of, New Jersey) *Public Works* Vol. 95 No. 1, Jan. 1964, pp 64-66, 5 Phot.

3A 264402

MEASURED PORE PRESSURES USED FOR THE CONTROL OF TWO-STAGE CONSTRUCTION OF AN EMBANKMENT

Because of soft foundation soil it was necessary to use two-stage construction for a double-track railway embankment varying in height from 21 to 33 feet. Effective stress methods of analysis were used and piezometers were installed in the foundation soil to indicate the pore pressures. Pore pressures measured during the first-stage loading indicated that the second stage could be added to complete the embankment about a year after the first stage. Measurements of pore pressures continued during the second stage loading so that a continuing check on stability could be maintained. The embankment was successfully completed. /Author/

DeLory, FA (Toronto University); Gass, AA (Golder (HQ) and Associates, Limited); Wong, WW (Canadian National Railways) *Canadian Geotechnical Journal* Vol. 2 No. 3, Aug. 1965, pp 216-233, 7 Fig., 2 Tab., 12 Ref.

3A 264505

SURFACE POPOUTS: HOW ARE THEY AFFECTED BY JOB CONDITIONS?

This report is the result of a joint industry study of construction techniques and their influence on surface popouts caused by alkali-silica reaction. The investigation used large sized slabs to determine how various job conditions, subsoils, concrete mixes, and surface treatments influence the formation of popouts. Although Southern California materials were used in this study,

such popouts are relatively commonplace in slabs-on-grade in other parts of the United States.

Campbell, RH Harding, W Misenhimer, E Nicholson, LP *American Concrete Institute, Journal of Proceeding* Vol. 71 No. 6, June 1974, pp 284-288, 4 Fig., 2 Tab., 1 Ref.

3A 264571

VIBRATIONS DURING CONSTRUCTION OPERATIONS

The subject of earth vibrations related to construction operations is examined in perspective. Comparison of conventional demolition methods versus demolition by explosives is considered. Graphical data are presented illustrating the relative intensities of vibration from various construction equipment and sources. Finally these vibration intensities are compared to damage criteria and normal human evaluation criteria.

Wiss, JF (Wiss, Janney, Elstner and Associates, Incorp) *ASCE Journal of the Construction Division* Vol. 100 No. C03, Proc. Paper 10798, Sept. 1974, pp 239-246, 6 Fig., 1 Ref., 2 App.

3A 264576

TIED-BACK EXCAVATIONS IN LOS ANGELES AREA

Based upon experience, the use of tied-back shoring to restrain a vertical excavation is a feasible and practical alternative to internal bracing. However to properly restrain the excavation with minimal movements of the embankment, certain design and construction procedures should be observed. The overall stability of the embankment is of the utmost importance. The use of active earth pressures in the design of shoring has proved to be satisfactory. Anchor capacities may be estimated on a theoretical basis. In designing the shoring system, proper attention should be given to resisting the downward component of the anchor load. Adjacent to streets or existing structures, the shoring should be monitored. The success of a shoring job depends to a great measure on the experience of the shoring contractor and quality of workmanship.

Maljian, PA Van Beveren, JL (Crandall (LeRoy) and Associates) *ASCE Journal of the Construction Division* Vol. 100 No. C03, Proc. Paper 10791, Sept. 1974, pp 337-356, 19 Fig., 2 Ref., 1 App.

3A 264610

DEVELOPMENT OF COLD WEATHER PAVING SPECIFICATIONS

Cold weather paving specifications were developed from work by Corlew and Dickson who used a computer solution to predict the cooling rate of bituminous concrete. Virginia had previously used a minimum atmospheric temperature as a criterion; however, it was evident that other factors had a significant effect on the cooling of bituminous concrete, so the computer solution was considered as a possible basis for new specifications. Although the solution had been checked by field measurements, it was decided to obtain further verification by plotting cooling curves for freshly placed hot mix. The curves were developed by measuring the cooling rates of bituminous mats of varying thicknesses under a variety of weather conditions. The field measurements verified the computer solution, and it was used to develop new cold weather paving specifications. The first specifications, put into effect in 1970, was written in tabular form using the laydown temperature and mat thickness as criteria. This specification has been modified and now appears in the form of a simple nomograph. /Author/

Maupin, GW, Jr (Highway Research Council) *Journal of Testing and Evaluation* Vol. 1 No. 6, Nov. 1973, pp 510-512, 4 Fig., 2 Ref., 2 App.

3A 264673

A TILL COFFERDAM IN THE ST. LAWRENCE RIVER

This paper deals with the design, construction, and performance of a drydock in the St. Lawrence River enclosed by a till dyke dumped in water. Alternative designs and methods of selecting a suitable till are discussed. Construction procedures are described along with the installation of a two-stage wellpoint system to intercept seepage through the riverbed beneath the dyke. Particular emphasis is placed upon the methods of control and observations taken both during and after construction. It is concluded that a till dyke dumped in water can form a stable and impermeable mass; however, care must be taken to apply any surcharge slowly to allow time for the dissipation of pore pressures in the underwater till.

Sutcliffe, FH (General Engineering Company Limited) *Canadian Geotechnical Journal* Vol. 2 No. 3, Aug. 1965, pp 261-273, 5 Fig., 1 Tab.

3A 264755

UNDERWATER CONSTRUCTION. DRILLING AND BLASTING. EXPLOSIVES HANDLING IS A SPECIALTY

The special equipment, skills and knowledge required to drill blastholes and load explosives underwater are reviewed. Detonating fuel or submarine electric detonators should be used to fire charges. The depth of the drill hole below grade is of primary importance in subaqueous blasting operations. Special precautions are described in the drilling through loose sand and muck to overlying rock. A non-sparking metal loading tube extending from the large deck to the bottom of the drilled hole should be used to load all charges. Alternative methods for blasting in the wet, and submarine blasting are outlined as well as several methods (mudcapping, snakehole blasting, blockhole blasting) employed to shelter underwater formations. The excavation of trenches and canals, the cutting off of underwater timber piling, and the removal of submerged obstacles are also discussed.

Construction Methods and Equipment Vol. 56 No. 10, Oct. 1974, pp 49-51, 3 Phot.

3A 264799

POLYMER CONCRETE-REINFORCED CONCRETE BEAMS

Composite beams consisting of reinforced concrete and a layer or cap of polyester concrete in the region of high compressive stress are tested and evaluated. The creep characteristics of polyester concrete were evaluated using 1000 hr creep tests, and the effect of sustained load on the ultimate compressive strength was also determined. Composite beams which were 6x6.5x64 in. (15.2x16.5x162.6 cm) were fabricated by capping precast reinforced concrete beams with a layer of fibrous polyester concrete of various given thicknesses. The composite beams were subjected to third-point loads on a simply supported length of 57 in. (145 cm). Load-deflection behavior and ultimate strength were determined for various combinations of reinforcement and depth of fibrous polyester concrete cap. Experimental and analytical results indicate that the fibrous polyester concrete composite beams are performance and material cost effective relative to reinforced concrete beams with the same percentage to tensile reinforcement. /ACI/

These abstracts are brief summaries of all ACI technical material published outside of these proceedings and are indexed in the Annual Proceedings Index. Number SP 40-14.

Lott, J Naus, D Howdyshell, P *American Concrete Institute, Journal of Proceeding* Vol. 70 No. 11, Nov. 1973, p 767

3A 264849

DATA ON THE USE OF EXPLOSIVES [Algunos Conceptos en el Uso de Explosivos.]

Explosives commonly used in civil engineering are reviewed and their specifications for use are cited. A study is made of detonating agents and pressure or shock waves. Specifications are given for calculating the quantity of explosives required for a given operation. /TRRL/ [Spanish]

Delupi, R *Vialidad* No. 6, Oct. 1971, pp 3-7, 2 Fig., 1 Phot., 3 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 101019)

3A 264886

RECONDITIONING HIGH-VOLUME FREEWAYS IN URBAN AREAS

Current practices in freeway rehabilitation are recorded that have been successfully used to overcome some of the problems that are associated with such projects. Planning and programming processes are described step-by-step, important design considerations are noted, and construction management practices inclusive of traffic control are described. Many unfulfilled needs for improving the urban freeway rehabilitation process are identified. Rehabilitation program planning is usually preceded by an inspection using sufficiency rating systems or other quantifiable values for project selection. Project objectives are defined in terms of the types of repairs and/or improvements to be made and the intended service life. Both program planning and definition of objectives recognize the constraints of environmental considerations in all urban highway projects. Air and noise pollution, waste disposal, and energy and resource utilization are considered

and evaluated in the project planning phase. If the impact of the project on urban traffic plans is to be controlled, the rehabilitation project must include a comprehensive public information program. The project design for an urban area must accommodate overhead structure clearances, retention of drainage features, limitations of work area, curing time restrictions, deadload restrictions on structures, and a cost-versus-service life elevation. Typical pavement rehabilitation projects have included leveling courses of bituminous concrete, varying in thickness from 2 to 5 in. Successful strip-surfacing in each wheelpath (where rutting has occurred) is described as well as slip-form paving of thin bonded concrete resurfacing. Alternative traffic controls for rehabilitation work sites are reviewed and the importance of construction management is emphasized. Design characteristics for new or rebuilt freeways are considered that are intended to provide maintainability. Conclusions and recommendations based on the study are presented.

Transportation Research Board NCHRP Reports 1974, 56 pp, Figs., Tabs., 5 App.

PURCHASE FROM: TRB Orig. PC

3A 264889

PROCEEDINGS OF WORKSHOP ON CUT-AND-COVER TUNNELING: PRECAST AND CAST-IN-PLACE DIAPHRAGM WALLS CONSTRUCTED USING SLURRY TRENCH TECHNIQUES

Various aspects of the design, construction and performance of traditional sheeting systems are reviewed, and recently developed technology for precast and cast-in-place diaphragm walls constructed using slurry trench techniques are examined. An overview is presented of support systems for cut-and-cover tunneling and the cost of cut-and-cover subway construction is discussed. The main advantages of diaphragm walls are listed. The elements of diaphragm wall design are detailed, particularly, water tightness and ground movements associated with excavation. A discussion of contracting for underground systems stresses innovation, competition, and awareness of the uncertainties and risks. The operations involved in the construction of a slurry wall and the applications of the prefabricated panel slurry wall are reviewed, as well as their future outlook. Geotechnical perspectives in underground metro systems are discussed.

This workshop was sponsored jointly by the Office of the Secretary of Transportation and the Federal Highway Administration.

D'Appolonia, DJ D'Appolonia, E Namy, D
ECI-Soletanche, Incorporated Final Rpt. FHWA-RD-74-57, Jan. 1974,
190 pp, Figs., 3 Ref.

RESPONSIBLE INDIVIDUAL: Majtenyi, SI

PURCHASE FROM: NTIS Repr. PC, Microfiche

PB-238043

3A 264984

NICE STUDY SESSION ON MOTORWAYS. WATERPROOFING LAYERS IN PAVEMENTS [Giornate Autostradali di Nizza. I Manti Stradali di Impermeabilizzazione]
WATERPROOFING LAYERS USED IN ROAD CONSTRUCTION IN FRANCE ARE GENERALLY OF THREE TYPES: MASTIC ASPHALT, RESINS (NOTABLY PITCH-RESIN MIXTURES), AND PREFABRICATED MULTI LAYERS. ADHESION, HARDENING, TENSILE, AND DURABILITY TESTS ON THESE MATERIALS ARE BRIEFLY DESCRIBED, AND EXAMPLES ARE GIVEN OF THEIR USE ON PAVEMENTS AND HIGHWAY STRUCTURE. [Italian]

Hossard, C (Agenzia per la Borgogna Della Scetavroute) *Autostrade* Vol. 15 No. 9, Sept. 1973, pp 29-31

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 209857)

3A 264987

HUMBER BRIDGE SLIPS INTO SHAPE
THE SLIPFORMING PROCESS FOR BUILDING THE SUPPORT TOWERS OF THE WORLD'S LARGEST SPAN ON THE HUMBER BRIDGE IS DESCRIBED. DETAILS OF THE 2.2 KM. LONG BRIDGE, WITH A MAIN SPAN OF 1410M, ARE INCLUDED. INSTEAD OF CONVENTIONAL STEEL, REINFORCED CONCRETE IS USED FOR THE TWO MAIN SUSPENSION TOWERS, WHICH RISE AT THE AVERAGE RATE OF 100MM/HOUR TO A

HEIGHT OF 160M. CONSTRUCTION OF THE SLIDING FORMWORK STRUCTURE AND ITS OPERATION ARE DESCRIBED. EACH TOWER LEG HAS A CRANE AND 24 HYDRAULIC CLIMBING JACKS. THE LEGS ARE SLIPFORMED SIMULTANEOUSLY AND THEY HAVE KEPT TO WITHIN 15 MM OF THE DESIGN SPECIFICATION. MOST OF THE CONCRETE IS TAKEN UP THROUGH THE LEG CORES IN SKIPS CONTROLLED BY AN ELECTRIC ROPE-GUIDED HOIST. POKER VIBRATORS WORK THE CONCRETE MIX AND EXTERNAL SURFACES ARE GIVEN A BRUSHED FINISH. CONSTRUCTION DETAILS AFTER THE COMPLETION OF THE TOWERS ARE OUTLINED.

Patey, DR *Container News* Vol. 258 No. 4938, Apr. 1974, pp 28-30, 6 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 209873)

3A 265001

CONSTRUCTION METHOD BY FORMWORK CONCRETING CYCLES AND LAUNCHING CYCLES [Procede de construction par cycles de betonage en coffrage fixe et cycles de poussage.]

After a brief history of the "Taktchiebverfahren" (alter-ate concreting and launching) construction method, a study is presented of the technique, based on examples of box-girder bridges already built: concreting area (and more particularly fixed metal formwork), forelip, sliding bearings, and launching devices. Details are given of the piers and possible temporary bearings, and attention is drawn to the importance of the correct design of the webs. Two possible arrangements for longitudinal prestressing cables are compared. The economic advantages of the technique, which result from a judicious combination of prefabrication and in-situ casting, are discussed. [France]

Leonhardt, F (Stuttgart University, West Germany) *Annales de l'Institut Tech du Batiment Travaux Pub* No. 301, Jan. 1973, pp 45-61, Figs., Photos., Refs.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 101035)

3A 265188

FROM STEAM TO THE LASER BEAM, EVOLUTION IN CIVIL ENGINEERING CONSTRUCTION MACHINERY [De la vapeur au rayon laser, ou, l'evolution des engins de travaux publics]

A review is presented of the discoveries and technological inventions which resulted in the mechanization of civil engineering construction sites: steam engines, electricity, compressed air, diesel engine, etc. Attention is drawn to the wide use of the laser and its qualities. Construction machinery is classified according to the nature of work it is performing: transport and handling equipment, lifting and earthmoving machinery, construction and maintenance equipment for roads and railways, tunnel drilling machines, and equipment used for the manufacture of cement and concrete. Mention is made of equipment ranging from the old steam roller to the "jumbo" laser-guided drilling machine. /TRRL/ [French]

Pontremoli, P *Travaux* pp 3-44, Figs., Photos.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 100453)

3A 265206

MILWAUKEE BOASTS 600 FT STEEL ARCH

The main bridge unit of Milwaukee's Harbor Bridge project, a through tied arch, is near completion following closure of the span recently. Delta-shaped approach piers, embedded downspouts and a blue and gold paint system for the steel exemplify the aesthetic concern of those responsible for its development. Five contracts, including the largest ever awarded in Wisconsin, provided the construction industry with an opportunity for innovative use of methods, materials and equipment. Box girder sections of the arch unit are fabricated of ASTM A588 steel, a matter of concern to more than a few engineers on projects throughout the country. The \$24,000,000 structure is the engineering feature of one of Milwaukee's most controversial and important freeways. /ASCE/

Looper, JH Anzia, RW (Howard, Needles, Tammen and Bergendoff) *ASCE Civil Engineering* Vol. 44 No. 1, Jan. 1974, pp 62-65, 2 Fig., 4 Phot.

3A 265242

PREFERRED METHODS OF CONSTRUCTION PART I: PATCHING

The introduction describes the need for standardization in methods of construction, the way in which the problem has been dealt with, and the components of the standard methods. Patching is defined together with the scope of the method, and the general aspects of the method in relation to the surfacings needing patching and the facilities & labour available. Details of the method are given under the following headings: general requirement; traffic signs; safety, welfare and other equipment, materials, tools, plant, transport, measuring equipment, organization, information, location of materials and pre-operational site situation. A comprehensive table sets out the specification and sequence of operations for preparation before patching, the treatment of cavities, base course application and compaction, wearing course application and compaction, initial and final sealing, surface treatment and pavement cleansing.

This report was co-authored by the Scottish Development Department and the Welsh Office.

Department of the Environment, England Standard 1973, 8 pp

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 209307)

3A 265276

EVALUATION OF CONSTRUCTION TECHNIQUES FOR NEW ANTIHYDROPLANING OVERLAYS

Runway surfaces that will prevent hydroplaning of highspeed jet aircraft during wet weather operations have become a primary requisite for airfields operated by the Air Force and the civilian aviation community. This report describes the materials, construction techniques, and results obtained from a program of field testing addressed to the need for antihydroplaning surfaces. The materials selected for field testing consisted of friction-textured asphalt slurry, Palmer-Pavetread, porous asphalt cold mix, porous asphalt hot mix with latex rubber, and a porous aggregate structure with a resinous binder (Bondate). The construction of test surfaces from these materials, with the exception of Bondate, are described. Special emphasis is given to the construction techniques and construction problems associated with the use of the new materials. (Modified author abstract)

Hargett, ER

New Mexico University, Albuquerque, Air Force Weapons Laboratory, (AF-683M) Final Rpt. June 1974, 58 pp

Contract F29601-74-C-0030

ACKNOWLEDGMENT: NTIS (AD-784870/8)

PURCHASE FROM: NTIS Repr. PC, Microfiche

AD-784870/8

3A 265334

ENERGY CONSERVATION IN PAVEMENT CONSTRUCTION

Effective use of energy in the construction of asphalt pavements can result in significant conservation and in most cases reduce the cost. Through the planned use of stage construction, the pavement may be developed only as required by traffic growth. Although this does not reduce the total energy requirement, it does result in the energy and cost being spread over a longer period of time and used only if demanded by traffic. Paving should be planned for completion during the summer months, which will also result in a lower energy demand for preparation of hot-asphalt mixes because aggregates in most areas will contain less water and require less heat for drying at that time. Use of the drum mixer so that lower mixing temperatures may be used will also reduce energy requirements as will use of emulsified asphalt, obviating the need to heat or dry the aggregate.

Lovering, WR *Military Engineer* Vol. 66 No. 434, Dec. 1974, pp 356-357

3A 265360

AN EXPANDED/GROUTED TUNNEL LINING

The erection is described of precast concrete tunnel lining rings designed so that their diameter and hoop thrust could be controlled when they were used as an expanded lining. The adjustment also allowed the same rings to be expanded inside a shield, where they were locked together, the lining standing without lateral support from the ground or the use of former rings. The external cavity was filled with grout, as in the construction of bolted rings. Both modes of use produced a smooth bore tunnel. The rings, which

consisted of wedge-blocks differed from the conventional form. For erection as a tied and grouted ring two holes were formed in each block, parallel with the longitudinal axis of the tunnel, and positioned so that the adjacent holes on either side of the cross joint were a constant distance apart. For the trials reported here, the concrete blocks were cast with their inner face downwards, the extrados being finishing by trowelling. Each ring was 610 mm long, and 114 mm thick and comprised 10 symmetrical wedge-shaped blocks, tapered longitudinally at 1 in 10 on two faces, with a mean arc length of either 630 mm or 650 mm. Details are outlined of the method of excavation and erection. During erection, the longitudinal holes were found to be an aid to lifting the blocks by inserting bars as handles. The trials demonstrated that using the same type of segment and similar methods of erection, either an expanded or a grouted wedge block lining could be constructed.

Collins, SP *Tunnels and Tunnelling* Vol. 6 No. 6, Nov. 1974, pp 52-54, 4 Fig., 2 Phot., 2 Ref.

3A 265445

ELEVATED STRUCTURES COMPLETED ON EUROPE'S LARGEST INTERCHANGE

Details are given of the Gravelly Hill Interchange, which forms part of the Midlands Link Motorway. The interchange has eighteen different paths which vehicles will be able to take through a free flow system. Construction problems and their solutions are outlined, and costs quoted. The interchange was completed at the beginning of April. /TRRL/

Contract Journal Vol. 240 No. 4780, Apr. 1971, pp 690-701, 3 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 60258)

3A 265559

UNDERWATER CONCRETING

The author points out that recent advances in technique and equipment have brought about a re-appraisal of the value of underwater concreting which was used in the past as a method of last resort. It is recommended that the concrete mixes have a minimum slump of 125mm. and contain at least 350kg. of cement per cubic metre, and that reinforcement and shuttering should be as simple as possible. The article discusses the advantages and disadvantages of various methods of placing concrete under water: pumping, the tremie pipe, underwater skips and toggle bags, the latter being flexible canvas skips. Also discussed is the grouting of aggregate directly in the forms, and bagwork, which is the building-up of walls underwater, using concrete-filled hessian bags. The final method discussed is the diving bell containing a skip within it. This technique approximates to placing concrete in the dry, permitting the use of conventional mixes. Its disadvantage is that the men within the bell must suffer compression and decompression with each skipful of concrete.

Greaves, IS *Civil Engineering and Public Works Review* Vol. 68 No. 806, Sept. 1973, pp 788-789, 2 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 207690)

3A 265569

OPTIMAL SCHEDULING OF TRANSPORT IMPROVEMENTS TO CATER FOR GROWING TRAFFIC CONGESTION

The purpose of this article is to investigate some aspects of the effect which the construction gear and characteristics of traffic growth can have upon the attractiveness of certain types of investment. Cases are considered where traffic flow is increasing and is independent of the proposed transport improvement. congestion cost models are derived and applied to the duplication of a shipping berth and to urban and rural roads. The method used is based on the minimisation of the present value of the total cost, in which case the minimisation of the total cost is also the maximisation of the net present value of the improvement.

Backley, DJ (New South Wales University, Australia); Gooneratne, SG (University College, London) *Journal of Transport Economics* Vol. 3 No. 2, May 1974, pp 122-135, 5 Fig., 15 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 209910)

3A 265609

NEW UNDERGROUND RAILWAY CONSTRUCTION IN MUNICH [Neue Konstruktionen beim u-Bahn-Bau in Muenchen]

After a description of the general concepts of the Munich underground railway the various methods used in the construction of the underground railway, such as open cut, shield driving, mining techniques and cover method are discussed. Details are given of problems which occur together with an indication of the solution to these. [German]

Joas, H No. 68/6, Apr. 1973, pp 18-30, 15 Fig., 6 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 341325)

3A 265660

UNDERWATER VIBRATOR

A vibratory plate unit for the compaction of sand, gravel and crushed aggregates under water has been developed. The unit weighs 1.8 tons and has a bottom plate measuring 0.9 m by 1.1 m. Each of the two self-synchronizing electric motor vibrators exert a centrifugal force of 4.8 tons, totalling 9.6 tons in a vertical direction when operating at a frequency of 1,450 vibrations/min. The vibrators are enclosed in a watertight housing and the unit may be operated from a pontoon-mounted crane. The unit has been used in compacting the circular foundation for a lighthouse where the bottom was at a depth of 18 m and comprised about 0.6 m of fine sand on hard boulder clay. It has also been used in conjunction with the building of a quay, involving compaction of crushed aggregate to form the foundation at a depth of 11 m.

Ground Engineering Vol. 7 No. 5, Sept. 1974, p 56

3A 265672

PLANNING OF ROAD PROJECTS-EARTHWORKS-JAPAN

The use of computers in the cost estimation of earthworks is described and a flow diagram illustrates the cost estimation system for project design. The report also describes methods for securing trafficability of construction machinery when cohesive volcanic ash soil is used for earthworks (mixing with other material), and methods of improving soil used as subgrade material (mixing with lime). The results are discussed of theoretical and experimental studies on design of pavement over weak subgrade. An important factor in determining pavement thickness is the strength of the foundation, particularly the subgrade. Studies are being performed on the theoretical analysis of conventional experimental methods for replacing poor subgrades with better material, and on the establishment of advanced design methods. The results are presented of research into deflection of subgrade surfaces due to wheel load. Expressway earthworks are described in an area of cohesive volcanic ash soil. Problems of road construction on peaty ground are described, and slow-and-stage execution, counterweight fill execution, pushing out replacement, sand-drain, and sand compaction-piles methods are outlined. The stability of cuts, embankments and slopes has been researched. Various procedures are considered for slope protection to deal with the problem of failure resulting from surface and seepage water during rainfall.

Presented at the XIVth World Road Congress, Prague, Czechoslovakia, 1971.

Kuno, G (Chuo University, Japan); Kohno, H (Civil Engineering Institute, Japan); Tohi, M (Japan Highway Public Corporation); Yamamura, K (Ministry of Construction, Japan)

Permanent International Association of Road Congr Book I-15, 1971, 31 pp, 18 Fig., 4 Tab.

3A 265695

FLEXIBLE PAVEMENTS, SPAIN

In the Report a summary is given of the method of structural design of flexible pavements laid on very weak subgrade with CBR as low as 2 or less, which is a condition frequently encountered in Japan. Also included is a description of the so-called sandwich method which has steel plates in the intermediate layer and has been specially designed to solve the soft subgrade problem. Full-scale test pavements and performance surveys of existing pavements have been made in various places to study the applicability of the new design. Some typical examples are described in this report. Also, the method of performance survey and the general conditions of the survey and research for determining the timing of pavement repair and the method of repair based upon the serviceability which is derived from the performance

survey are reported. As for bituminous binders, their present status in our country, including special bituminous materials, is briefly explained. Bitumen stabilized roadbases have been widely used in our country and the economic benefits of this type of stabilization has been probed especially in large projects such as Tokyo-Nagoya Expressway construction. The design standards of bitumen stabilized base course in Tokyo-Nagoya Expressway and those specified in the Asphalt Pavement Manual are described in this report. Full-scale test pavements for various purposes have been carried out in order to study bituminous mixtures. Also referred to are the test pavements which have been designed to study the characteristics of bituminous mixtures such as stability, adhesion, and resistance against abrasion by tyre chains. A few interesting results are now evident although test pavements have not been subjected to traffic long enough to obtain comprehensive results. Precautions for laying bituminous mixture during cold weather in our country are mentioned. Thin wearing course overlays are used for road maintenance. The results of full-scale test pavements to compare the different types of thin wearing courses are also given in the report. /Author/ Presented at the XIVth World Road Congress, Prague, Czechoslovakia, 1971.

Luelmo, FS Bocaleri, SR Alonso, LV

Permanent International Association of Road Congr Book II-21, 1971, 31 pp, 3 Fig., 3 Tab.

3A 265736

EXPERIENCE WITH BITUMINOUS PAVEMENTS FOR FEDERAL MOTORWAYS AND HIGHWAYS [Experience des Chaussees Bitumineuses Pour Autoroutes et Grande Routes Federales]

The author reviews the tendencies in the Federal Republic of Germany, in flexible pavement construction: construction methods, evolution, problems encountered, control measures to ensure quality. The favorite surfacing at the moment is Gussasphalt, because of its resistance to abrasion, ease of application, and because it eliminates the need for compaction. 25 typical structures have been standardized. The corrugation of a Gussasphalt surfacing has no effect on its skidding resistance but helps in the insertion of surface chippings. The tendency at the present time is to eliminate it. The optimum chippings content is under study and the tendency is towards the maximum permissible content of 55%. The other points under investigation are: high-bearing capacity base course, resurfacing operations, replacement of granular frost blankets by an additional bituminous layer and the coating process without dedusting. Excellent results were obtained with a permanent decentralized quality control of raw materials, quality control of the manufacture of bituminous mixtures, and acceptance controls which give a five-year guarantee for dense surfacings. [French/Dutch]

Nakkel, E *Bitume Informations* No. 24, Aug. 1971, 3-29, 4 Fig., 29 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 100381)

3A 265751

MODELLING

CURRENT DEVELOPMENT OF POKROVSKY'S METHOD OF MODELLING COMPOSITE CONSTRUCTION INVOLVING LARGER VOLUMES OF SOIL, AND THE ANALYSIS OF COMPOSITE SOIL CONSTRUCTION BY METHODS ESTABLISHED FOR STEEL STRUCTURES ARE DISCUSSED. IT IS ASSUMED THAT THE ELEMENTARY VOLUME BEHAVES ACCORDING TO THE PRINCIPLE OF EFFECTIVE STRESS; THAT ALL TIME EFFECTS RELATE TO STEADY OR TRANSIENT FLOW OF A PORE FLUID PHASE; AND THAT THE EFFECTIVELY STRESSED SOIL PHASE IS A RIGID OR ELASTIC OR PLASTIC CONTINUUM WHICH IS TIME-INDEPENDENT. POKROVSKY'S METHOD IS APPLIED TO THE VARIATION OF WATER LEVELS AND TO THE APPLICATION OF EXTERNAL STATIC LOADING.

Published in the Proceedings of the Symposium on the Role of Plasticity in Soil Mechanics, September 13-15, 1973, Cambridge, England.

Bolton, MD English, RJ Hird, CC Schofield, AN Manchester University, England Conf Paper 1973, pp 251-8, 14 Fig., 6 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 210303)

3A 272003

CRASH CUSHION TRAILER PROTECTS WORKERS, DOUBLES PRODUCTION THRU ADDED SECURITY

Although accidents to maintenance workers are comparatively infrequent, occasions do arise when vehicles in lanes adjacent to the work areas go out of control and hit construction equipment and workers, despite warning signs and traffic cones placed before and around the work site. Use of the new crash cushion trailer developed by Texas Transportation Institute has resulted in doubled productivity by maintenance crews, because they can concentrate on their work without having to watch out for traffic. The crash cushion trailer consists of thirty 55-gallon steel barrels, welded together at the bottom and top rims, riding on a single axle and two wheels and connected by a hitch to a truck. The truck, which doubles as a supply or equipment truck, moves behind the work crew at a distance of approximately 200 feet. Out-of-control vehicles traveling in the direction of the work site are likely to impact the trailer instead of the men and machinery. The steel drums crumple in a controlled manner, bringing the errant car to a safe stop and at the same time saving the workmen from injury. Each trailer would cost about \$1,500 if all new materials were used, but costs can be cut considerably by using second-hand equipment. For instance, used paint drums can be used instead of new drums. In this case, 11-inch holes must be cut in the top and bottom in place of the regular 8-inch holes to allow for the heavier gauge metal of the used paint drum (16 gauge instead of 20 gauge). This saves around \$9.60 a drum, or a total of \$270 for the whole unit.

Highway Research News No. 54, 1974, pp 52-54, 5 Phot.

PURCHASE FROM: TRB Repr. PC

3A 276009

MODERN TUNNEL CONSTRUCTION-A CONFERENCE HELD BY STUVA IN STUTTGART

The following papers are briefly discussed: Tests on and Practical Experience with Slurry Trench Walls, Subsoil Injection and Steel Tunnel Lining in the Construction of the Underground Railway in Vienna, by Ellinger; Results of Research Carried Out By Stuva, by Girmau; Technical Problems Encountered During the Construction of the Urban Railway Near the Main Station in Frankfurt/Main, by Eule; Modern Design of Underground Railway Stations, by Hussmann; The Sonnenberg Tunnel in Lucerne as an Example of Driving Large Tunnel Sections in Hard Rock With Fully Mechanized Heading Machines, by Feil; The Use of Freezing Techniques in Civil Engineering, by Neunert; Planning of the Urban Railway in Stuttgart, by Bubel; and Experience During the Construction of Subterranean Traffic Facilities in Stuttgart, by Schurr. /TRRL/ [German]

Blennemann, F *Strasse Bruecke Tunnel* Vol. 24 No. 4, Apr. 1972, pp 85-92, 2 Fig.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 300550)

3A 276022

LOW COST ROAD CONSTRUCTION

The publication contains the following reports: Low Cost Roads in the Service of Agriculture, by Frowein, WA; Experiences in the Planning of the Agricultural Road Network in Hungary, by Gaspar, L; Design of the Longitudinal Section of Agricultural Roads, by Hernandez, JL; Notes on Farm Roads, by Hruza, J; The Recent Planning and Traffic Loading of Agricultural Roads with Reference to Modern Agricultural Machines, by Klempert, B; The Quality of Agricultural Roads, by Kyritsis, S; Specification and Construction Method for Agricultural Roads Treated with Calcium Chloride, by Laporte, JG; Study of the Design of the Agricultural Road Network, by Leclerque, J and Therasse, R; The Stress on Agricultural Roads, by Moeser, H; Rationalization of Agricultural Road Construction, by Ott, R; Low Cost Road Construction--Diagnosis, Forecast, Therapy, by Seidel, J; Erosion at the Edges of Roads and in Fine-Grained Subsoil with Particular Reference to Victoria, Australia, by Turner, AK; and The Contribution Made by Agricultural Roads in a Catchment Area, by Wilson, TV and Lignon, JT. /TRRL/

Schriftenreihe d Dt Nationalen Komitees d Inter No. 4, 134 pp, Figs., Tabs.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 300442)

3A 291064

OVERCOMING ABNORMAL EARTH PRESSURE IN KUBIKI TUNNEL

During the construction of the Kubiki Railway Tunnel in Japan, strong swelling earth pressure was encountered in a silt rock zone and the 230 M long heading was ruptured. It was decided to use the "short bench" method of excavation to reduce the time during which the section was unsupported by the concrete lining. Tunnel lining methods are briefly discussed. /TRRL/

Civil Engineering in Japan Vol. 9 1970, pp 30-1, 3 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 204005)

3A 291079

SWITZERLAND NUMBER 9 AUTOROUTE DULEMAN TUNNELS AT BELMONT, CHAUDERON CRIBLETTE AND ANCHORED WALLS AT CHAUDERON AND CRIBLETTE

The article gives details of the design and method of construction used for the Belmont, Chauderon and Criblette tunnels as part of the N.9 autoroute between Lausanne and Chexbres. The tunnels each comprise two tubes whose cross section varies between 74-80 sq.m. depending on rock conditions. The roadway width is 7.75M with a clearance of 4.5M. The method of tunnel driving known as the Belgian method was used. It consists in driving a heading at the crown over the entire length and then excavating the core and the walls. Details are also given of the anchored walls constructed to retain the overburden on the upslope side of the cuttings at the approach to both tunnels. /TRRL/

Betschen, G (Societe Generale Pour L'Industrie, Lausanne) *Tunnels and Tunnelling* Vol. 5 No. 2, Mar. 1973, pp 159-164, 7 Fig., 4 Phot.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 205799)

3A 291109

STUDIES OF STABILIZATION PAVEMENT SHOULDERS-PRILIMINARY REPORT

Data collected during a bibliographic study of shoulder stabilization are presented. Details are given of the object of shoulders, their structure and geometrical features, drainage, current types, and construction methods. The main techniques of shoulder stabilization are described, and conclusions are drawn, particularly as regards design. /TRRL/

Rodrigues, M

Laboratorio Nacional de Engenharia Civil R&D Rept. Vol. 52/1 Feb. 1962, 16 pp, 6 Fig., 35 Ref.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 204816)

3A 291126

THE CASE FOR STEEL PLATE TUNNEL LININGS

The case for steel tunnel linings is presented. The author suggests the development of a steel lining for tunnels consisting of plates machine-cut to size, transported flat to the construction site, and then rolled to the required radius. The ground deformations would be accommodated by the elastic and ductile straining of the ring as a whole, locating lugs would be provided to assist erection, and joints would be made watertight by sealing welds. The cost of fabrication and site welding is estimated to be around \$35 per ton. The importance of perfect circularity and uniform hydrostatic pressure is discussed. /TRRL/

Chapman, J *New Civil Engineer* No. 48, 1973, 30 pp, 2 Fig.

ACKNOWLEDGMENT: Transport and Road Research Laboratory (IRRD 206842)

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RETRIEVAL TERM INDEX

The Retrieval Term Index includes all terms in the HRIS thesaurus list and other terms useful to manually retrieve relevant records of documents published in this part of this publication. A term may consist of two or more words, and some terms may be followed by qualifying terms set off by slashes. Index terms are arranged alphabetically. Under each term is given the document record number, which consists of two digits for the subject area number and six digits for the TRIS accession number. The postings are listed under each retrieval term in the order of their occurrence in this part of this publication.

Coordinating two or more terms is often useful in the search for document records. If one is interested in quality control in highway construction, for example, he or she can see by looking under the terms QUALITY CONTROL and

HIGHWAY CONSTRUCTION that document record 080387 listed under subject area 1A, System Construction, Management, and Quality Control, deals with that topic. The coordination process can be extended to more than two terms and to the other indexes in this book, but it will often be more convenient to use computer retrieval for complicated coordinations.

Certain terms are not useful retrieval terms unless coupled or coordinated with other terms. Examples might include DESIGN or EVALUATION. For example, it is likely that document records listed under both DESIGN and STRAIN GAGES contain information that differs from that in document records listed under both EVALUATION and STRAIN GAGES.

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2A 217449

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AVAILABILITY OF DOCUMENTS CITED IN THIS VOLUME

When it is known by HRIS that full-text copies of documents are available from an organization other than the publishing agency, the name and address of the document distribution center are given in an availability statement below the abstract of the HRIS document record. When a document is ordered, the document title, author, and publisher should always be given.

Publications of the Transportation Research Board referred to in this issue are available from the Transportation Research Board. Articles and reports issued by other agencies are NOT available from TRB. They may be obtained from the publication source shown immediately following the name of the author on the document record or from the document distribution center identified by the availability statement that follows the abstract on the document record.

ASCE

American Society of Civil Engineers
345 East 47th Street
New York, New York 10017
Telephone 212-644-7671

ASME

American Society of Mechanical Engineers
345 East 47th Street
New York, New York 10017
Telephone 212-644-7703

DOTL

U.S. Department of Transportation Library
400 Seventh Street, S.W.
Washington, D.C. 20590
Telephone 202-426-2565

ECMT

(All documents available through OECD)
European Conference of Ministers of Transport
2 rue Andre Pascal
Paris 75775, France
Telephone 524.97.22

ESL

Engineering Societies Library
United Engineering Center
345 East 47th Street
New York, New York 10017
Telephone 212-644-7611

GPO

U.S. Government Printing Office
Superintendent of Documents
Washington, D.C. 20402
Telephone 202-783-3238

IEEE

Institute of Electrical and Electronics Engineers
345 East 47th Street
New York, New York 10017
Telephone 201-981-0060

Reports emanating from research projects sponsored by the Federal Highway Administration and the Urban Mass Transportation Administration are normally available from the National Technical Information Service. If the abstract carries a document order number (PB or AD followed by 6 digits), the report is available from NTIS.

When no availability is specified, the user should consult an established transportation library.

A loan service for publications and a photocopy service for articles and papers are available at two TRISNET Centers as explained on page viii.

A large number of documents are available from a few sources. The names, addresses, and telephone numbers of those sources are listed below under the abbreviation used for each.

IPC

IPC (America), Inc.
205 East 42nd Street
New York, New York 10017
Telephone 212-889-0700

IRRD

International Road Research Documentation
19 rue de Franqueville
75 Paris, 16e, France
Telephone 1-524.92.42

ITTE

Institute of Transportation and Traffic Engineering
University of California
412 McLaughlin
Berkeley, California 94720
Telephone 415-642-3604

NAE/NAS/NRC

National Academy of Sciences
Publication Sales
2101 Constitution Avenue, N.W.
Washington, D.C. 20418
Telephone 202-389-6731

NTIS

National Technical Information Service
5285 Port Royal Road
Springfield, Virginia 22161
Telephone 703-321-8543

NTCL

Transportation Center Library
Northwestern University
Evanston, Illinois 60201
Telephone 312-492-5273

OECD

OECD Publications Center
1750 Pennsylvania Avenue, N.W.
Room 1207
Washington, D.C. 20006
Telephone 202-298-8755

PPI

Pergamon Press, Inc.
Maxwell House, Fairview Park
Elmsford, New York 10523
Telephone 914-592-7700

RTAC

Roads and Transportation Association of Canada
875 Carling Avenue
Ottawa, Ontario K1S 5A4, Canada
Telephone 613-521-4052

SAE

Society of Automotive Engineers
400 Commonwealth Drive
Warrendale, Pennsylvania 15096
Telephone 412-776-4841

TRB

Transportation Research Board
Publications Office
2101 Constitution Avenue, N.W.
Washington, D.C. 20418
Telephone 202-389-6251

TRRL

Transport and Road Research Laboratory
Crowthorne, Berkshire RG11 6AU
England
Telephone Crowthorne 3131

TSCl

Technical Information Center
Transportation Systems Center
U.S. Department of Transportation
55 Broadway
Cambridge, Massachusetts 08619
Telephone 617-494-2306/2193/2783

UITP

International Union of Public Transport
Avenue de l'Uruguay 19
B-1050, Brussels, Belgium
Telephone 73-33-25

XUM

Xerox University Microfilms
300 North Zeele Road
Ann Arbor, Michigan 48106
Telephone 313-761-4700

Other abbreviations that are used include:

Orig PC	Original paper copy
Repr PC	Reproduced paper copy of the original document
Req Price	Price on request

LOAN AND PHOTOCOPY SERVICE FOR DOCUMENTS CITED IN THIS VOLUME

The Northwestern University Transportation Center Library and the University of California Institute of Transportation Studies Library are functioning as TRISNET Centers in the operation of a prototype document delivery system under contract to the U.S. Department of Transportation. The publications cited in this volume may be requested from either of these libraries.

The purpose of the TRISNET Centers is to provide the documents identified through search of the TRIS abstracting and indexing services (HRIS and the Air, Railroad, and Maritime Transportation Research Information Services).

In referring your requests to either library, please cite for each publication

Accession number
Author
Title
Publisher or journal title
Date of publication

The request may be either for loan of the publication for a period of 2 weeks plus estimated mailing time (Northwestern accepts a user's request directly, but University of California requires submission of an interlibrary request) or for

photocopies of articles and conference papers. If the document is unavailable in the library, referral to best available source will be made.

Loan services are free when publications are mailed at the book rate. If the user requires priority mailing, the library will charge for mailing costs. Photocopies of articles or individual conference papers are made at the rate of 10 cents per page plus a handling charge of 50 cents per item. In all cases invoices are mailed with the loan or photocopy.

The TRISNET Center at either library may be contacted as follows:

Northwestern University
Transportation Center Library
Evanston, IL 60201
312-492-5273
TWX 910-231-0872

University of California
Institute of Transportation Studies Library
412 McLaughlin Hall
Berkeley, CA 94720
415-642-3604

WHAT EACH ONGOING RESEARCH SUMMARY CONTAINS

The items of information contained in each ongoing research summary are described below. Some summaries are incomplete with respect to one or more items of information. The omitted information was not available to HRIS at the time of processing this volume.

Document Record Number

HRIS document records for summaries of ongoing research projects are listed within HRIS subject areas according to 6-digit TRIS accession numbers. A 6-digit accession number, by which documents are listed, is given at the beginning of each summary. The subject area is shown at the top of each page. In general there are gaps between accession numbers of successive summaries.

Title

The title of the research project is given immediately after the accession number.

Performing Research Agency

Abbreviated name of the agency or agencies that conduct the research. When furnished to HRIS, the agency-assigned project number appears to the right of the agency name.

Investigators

Surnames and initials of the research investigators if known.

Funding Agency (Sponsor)

The name of the agency or agencies that sponsor the project by providing all or some part of the funds. Any sponsor project numbers or other identifying data appear to the right of the sponsor's name, either on the same line or on the following line.

Project Data

Known project data identified by the following abbreviations for the data items:

AS project status
RD reporting data
AD funding approval data
CD contract date
SD project start date
DC estimated project completion date

TF total funds
FT type of funding
CN contract or grant number
CT contract type
FY funds by fiscal year

Summary Statement

Objective and scope of the project, methods used, and results obtained.

Supplemental Notes

Additional information about the project such as announcement of the availability of a special package to aid in the implementation of the results of the research project.

Citations

Reports that emanated from the research project during the last year. Full text reports for projects sponsored by the U.S. government are generally available from the National Technical Information Service, Springfield, Virginia 22161, telephone 703-321-8543. Reports that emanate from other research projects may be obtained from the research agency or the sponsor. Agency addresses are given in the Source Index.

HRIS Information Sources

Name of the agency or other information system furnishing the information to HRIS. When more than one source is given, the project summary represents a merger of the information from the sources shown.

Accession References

The name of the information source. Abbreviations are the same as those for abstracts.

HRIS Accession Reference

Cross reference to other records that includes a 2-character alpha-numeric prefix, the 2-digit subject area number, and the 6-digit HRIS accession number, which was used before the TRIS accession numbering system was adopted.

Sample Research Summary

The following example identifies the items of information in a research project summary.

Research summary

TRIS Accession Number → 3R 020022

Project Title → **SETTLEMENT OF BRIDGE APPROACHES AND EMBANKMENTS**

Summary Statement → THE CAUSES OF SETTLEMENT OF BRIDGE APPROACHES ARE BEING DETERMINED AND METHODS OF DESIGN AND CONSTRUCTION ARE BEING DEVELOPED WHEREBY SETTLEMENT MAY BE PREVENTED. LONG TERM DATA ARE BEING COLLECTED FROM SETTLEMENT PLATFORMS, MERCURY-FILLED SETTLEMENT GAGES, PROFILE MEASUREMENTS AND SLOPE INDICATORS AT SOME TEN BRIDGE SITES. BASED ON A PRELIMINARY ANALYSIS OF DATA OBTAINED TO DATA ALONG WITH DATA OBTAINED FROM TWO GENERAL SURVEYS OF MANY APPROACHES, THE MAJOR CAUSES OF POST-CONSTRUCTION SETTLEMENT OF MANY BRIDGE APPROACHES APPEARS TO BE (1) SLOPE INSTABILITY DUE TO PROGRESSIVE FAILURE AND (2) SECONDARY COMPRESSION OF APPROACH EMBANKMENT FOUNDATIONS. CONFIRMATION OF THESE OBSERVATIONS IS IN PROGRESS.

References → REFERENCES:
Mercury-Filled Settlement Gauge Hopkins, TC; Deen, RC, Kentucky Bureau of Highways, Research Division, HRB Record, Dec. 1972
Bluegrass Parkway Bridges over Chaplin River Hopkins, TC, Kentucky Bureau of Highways, Research Division, Feb. 1973
Slope Stability Analysis: Computerized Solution of Bishop's Simplified Method of Slices, Yoder, SM; Hopkins, TC, Kentucky Bureau of Highways, Research Division, Feb. 1973
Remedial Stability Analysis of Unstable Eastern Approach Embankment, Bluegrass Parkway over Chaplin River, Hopkins, TC; Yoder, SM, Kentucky Bureau of Highways, Research Division, May 1973

Performing Agency → PERFORMING AGENCY: Kentucky Department of Transportation, Bureau of Highways, Research Division, Study No KYHPR-64-17

Investigators → INVESTIGATOR: Havens, JH Deen, RC Hopkins, TC

Sponsoring Agency → SPONSORING AGENCY: Kentucky Department of Transportation, Bureau of Highways; Federal Highway Administration, Department of Transportation

Responsible Individual → RESPONSIBLE INDIVIDUAL: Sallberg

Project Data → HP&R 64-17
STATUS: Active NOTICE DATE: Feb. 1975 START DATE: Jan. 1964 COMPLETION DATE: Jan. 1978 TOTAL FUNDS: \$336,000

HRIS Information Source → ACKNOWLEDGMENT: Kentucky Department of Transportation, Federal Highway Administration (003168353)

WHAT EACH ABSTRACT CONTAINS

The items of information contained in each abstract of published technical papers, articles, and reports are described below. Some abstracts are incomplete with respect to one or more items of information. The omitted information was not known to HRIS at the time of processing for this volume.

Document Record Number

An eight-digit number by which documents records are listed. The first two digits identify the HRIS subject area used to classify the document record. The subject area number is given at the top of each page. The last 6 digits identify the TRIS accession number that is used to arrange the document records within a subject area. In general there are gaps between the numbers of successive document records.

Title

Title of the document record, given immediately after the accession number.

Abstract

A summary of the information in the source document. Informative abstracts generally have 200 to 250 words and contain details about the important elements of the document. Indicative abstracts usually have 100 to 150 words and describe what is discussed but in less detail. Articles selected from the open literature are published in full length if they are very short (200 words or less). HRIS document records of bibliographies have no abstracts, or they may include one or two summary statements indicating the content of the bibliography. Abstracts prepared by the author of the paper, article, or report are identified by the word *Author* at the end of the abstract. If HRIS did not know who prepared the abstract, the agency from which the abstract was acquired is indicated at the end. If no indication is given, the abstract was prepared by HRIS.

Supplemental Notes

Additional information about the source of the document such as the name, location, and date of the conference where the paper was presented.

Authors, Publication Data, Document Data

Surname and initials of the personal author and coauthors of the paper; name of the source document, and the name of the publisher or corporate author; data that further identify the specific issue number of a serial publication, locate the particular paper within the publication by page number, and provide bibliographic data about the paper, such as the number of figures, tables, references, appendixes, and date of publication.

HRIS Information Source

Name of the agency furnishing the information to HRIS. This line is included on HRIS document records when only the abstract of a full paper, report, or article was furnished HRIS by another agency or information system. It is an additional aid to the reader in locating and acquiring the complete document.

Availability

Name and address of the center where full-text copies of the document may be purchased or borrowed.

Accession References

Document record numbers for abstracts obtained from other information systems, prefixed by the initials of the information system that provided HRIS the information. The following initials are used:

CRIS	Current Research Information System, U.S. Department of Agriculture
DOT	U.S. Department of Transportation
EI	Engineering Index
ESL	Engineering Societies Library
FHWA	Federal Highway Administration, U.S. Department of Transportation
GPO	U.S. Government Printing Office
HRIS	Highway Research Information Service, Transportation Research Board
HSRI	Highway Safety Research Institute
HUD	U.S. Department of Housing and Urban Development
IPR	Institute of Road Research, Brazil
IRF	International Road Federation
IRRD	International Road Research Documentation, Organisation for Economic Co-operation and Development
ITTE	Institute of Transportation and Traffic Engineering
NCHRP	National Cooperative Highway Research Program
NHTSA	National Highway Traffic Safety Administration, U.S. Department of Transportation
NTIS	National Technical Information Service
NUTCL	Northwestern University Transportation Center Library
RTAC	Roads and Transportation Association of Canada
SAE	Society of Automotive Engineers
SSIE	Smithsonian Science Information Exchange
SRIS	Safety Research Information Service, National Safety Council
TRAIS	Transportation Research Activities Information Service, U.S. Department of Transportation
TRB	Transportation Research Board, National Academy of Sciences
TRIS	Transportation Research Information System
TSC	Transportation Systems Center, Technical Information Center
TRRL	U.K. Transport and Road Research Laboratory
UMTA	Urban Mass Transportation Administration, U.S. Department of Transportation
XUM	Xerox University Microfilms

Sample Abstracts

The following examples identify the items of information in abstracts of an article and a report.

Abstract of an article

Document Record Number

TRIS Accession Number

HRIS Subject Area Number

Title

Abstract

Authors, Publication Data, Document Data

1A 260465

USING SHOTCRETE TO SUPPORT UNDERGROUND STRUCTURES

A conference was conducted to discuss the making, testing, and using of shotcrete for underground support. With regard to the making of shotcrete, quality control was considered essential. It was believed that average 28-day compressive strengths in the range of 3,000-4,000 psi (20.6-27.5 million N/sq m) were more realistic than the presently specified 5,000 psi (34.4 million N/sq m) compressive strength at 28 days. Opinion on the maximum size of coarse aggregate to be used in a shotcrete mix favored at least 1/2-inch (13 mm) maximum size. The importance of compatibility tests of the cement and accelerator to be used was emphasized. Though remotely controlled nozzles and wet mix shotcrete equipment has had wider use in Europe, there was considerable interest shown in the use of skilled nozzlemen as employed in the U.S. Cube, core, probe, impact, and pull-out tests were discussed, and it was concluded that such tests need further development. In discussions of where to use shotcrete, it appeared that shotcrete offered economies in nominally unlined water tunnels built by the drill and blast method, where it could serve the dual function of support and final lining. It also appeared to offer economies where a drill and blast tunnel had a persistent need for support and coverage of the rock to prevent deterioration due to moisture change or stress relief. Though it is not believed to be presently compatible with the tunneling machine, an example was presented where a tunneling machine had been designed to accommodate the use of a specific shotcrete system.

Morris, JW (Bureau of Reclamation) *ASCE Civil Engineering* Vol. 43 No. 9, Sept. 1973, p 17

Abstract of a report

Document Record Number

TRIS Accession Number

HRIS Subject Area Number

Title

Abstract

Authors, Publication Data, Document Data

2A 083579

COMPACTION OF ASPHALT CONCRETE PAVEMENTS

This research project was initiated in order to study the compaction of asphalt concrete pavements. It was determined that adequate densities were not being obtained with the California Standard Specifications and new Standard Special Provisions were written. A rolling procedure was developed for both thick-lift and thin-lift construction. Measurements were made of recently constructed pavements to determine the riding qualities associated with the various construction methods using different lift thicknesses. Standard Special Provisions were written to improve the final surface roughness by limiting the lift thicknesses. Research was also conducted on the use of nuclear gages to determine asphalt concrete densities and a method was written for the use of nuclear gages in conjunction with the qualification of rollers. /FHWA/

Study sponsored by California DOT, Division of Highways in cooperation with FHWA.

Cechetini, JA Sherman, GB
California Division of Highways, (19 301-762503-633294) Final Rpt. CA-DOT-TL3294-4-7409, Feb. 1974, 35 pp

Contract D-05-26

HRIS Information Source

Availability

Document Order Data

ACKNOWLEDGMENT: Federal Highway Administration (P-0066)

PURCHASE FROM: NTIS Repr. PC, Microfiche

PB-239051/AS

