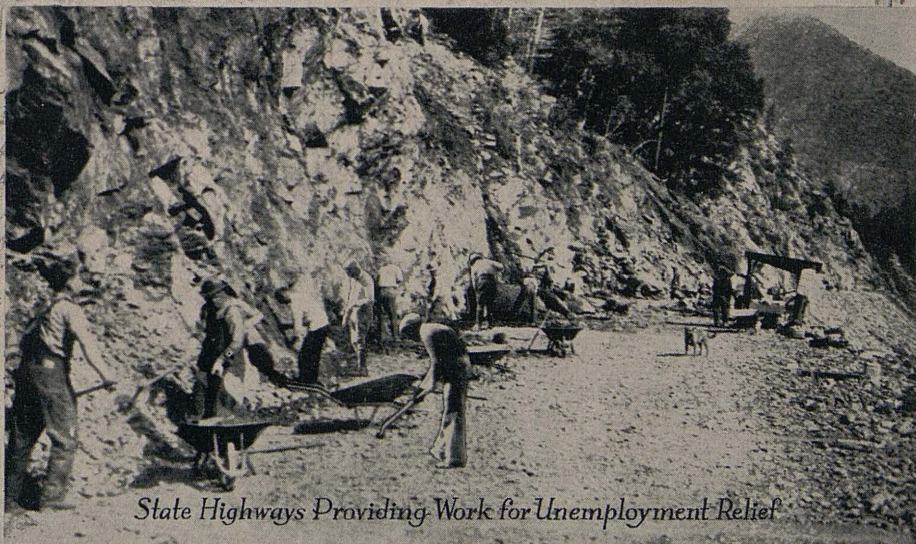


CALIFORNIA HIGHWAYS *and* PUBLIC WORKS



State Highways Providing Work for Unemployment Relief

Official Journal of the Department of Public Works
OCT-NOV. State of California 1932

D50 Illuminant, 2 degree observer

inches

1	39.12	65.43	49.87	44.26	55.56	70.82	63.51	39.92	52.24	97.06	97.06	92.02	87.34	82.14	72.05	62.15	51.90
2	15.07	18.72	22.23	22.86	24.49	31.38	59.80	46.07	18.57	1.13	11(A)	0.23	0.21	0.43	0.28	0.19	
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Golden Thread

16	18.00	17	18.00	19	8.29	3.44	51.41	72.46	72.95	29.37	54.91	43.96	82.74	52.78	50.87	29.87	29.87
17	0.01	0.04	0.80	0.73	0.19	0.49	19.43	72.46	72.95	29.37	54.91	43.96	82.74	52.78	50.87	29.87	29.87
18	0.01	0.04	0.80	0.73	0.19	0.49	19.43	72.46	72.95	29.37	54.91	43.96	82.74	52.78	50.87	29.87	29.87
19	0.01	0.04	0.80	0.73	0.19	0.49	19.43	72.46	72.95	29.37	54.91	43.96	82.74	52.78	50.87	29.87	29.87
20	0.01	0.04	0.80	0.73	0.19	0.49	19.43	72.46	72.95	29.37	54.91	43.96	82.74	52.78	50.87	29.87	29.87
21	0.01	0.04	0.80	0.73	0.19	0.49	19.43	72.46	72.95	29.37	54.91	43.96	82.74	52.78	50.87	29.87	29.87
22	0.01	0.04	0.80	0.73	0.19	0.49	19.43	72.46	72.95	29.37	54.91	43.96	82.74	52.78	50.87	29.87	29.87
23	0.01	0.04	0.80	0.73	0.19	0.49	19.43	72.46	72.95	29.37	54.91	43.96	82.74	52.78	50.87	29.87	29.87
24	0.01	0.04	0.80	0.73	0.19	0.49	19.43	72.46	72.95	29.37	54.91	43.96	82.74	52.78	50.87	29.87	29.87
25	0.01	0.04	0.80	0.73	0.19	0.49	19.43	72.46	72.95	29.37	54.91	43.96	82.74	52.78	50.87	29.87	29.87
26	0.01	0.04	0.80	0.73	0.19	0.49	19.43	72.46	72.95	29.37	54.91	43.96	82.74	52.78	50.87	29.87	29.87
27	0.01	0.04	0.80	0.73	0.19	0.49	19.43	72.46	72.95	29.37	54.91	43.96	82.74	52.78	50.87	29.87	29.87
28	0.01	0.04	0.80	0.73	0.19	0.49	19.43	72.46	72.95	29.37	54.91	43.96	82.74	52.78	50.87	29.87	29.87
29	0.01	0.04	0.80	0.73	0.19	0.49	19.43	72.46	72.95	29.37	54.91	43.96	82.74	52.78	50.87	29.87	29.87
30	0.01	0.04	0.80	0.73	0.19	0.49	19.43	72.46	72.95	29.37	54.91	43.96	82.74	52.78	50.87	29.87	29.87

centimeters

Colors by Munsell Color Services Lab

Don Williams

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Highway Jobs for 9000 Men Bring Relief to 30,000 Family Dependents

Department of Public Works and Highway Commission Expending \$6,317,000 on Road Work Under Governor's Order to Relieve Unemployment Situation

UNDER urgent orders from Governor James Rolph, Jr., to bend every effort toward repulsing the grim spectre of unemployment that becomes more menacing as the winter season advances, the Department of Public Works, under Director Earl Lee Kelly, and the California Highway Commission are carrying out the Governor's instruction to devote every penny of State and Federal funds legally available to the cause of unemployment relief.

To this end the two State agencies have provided for the expenditure of \$6,317,000 in giving relief employment to approximately 9000 men bringing steady pay roll money to the support of some 30,000 family dependents in every part of the State.

This \$6,317,000 employment fund is made up of \$4,667,000 Federal aid money giving jobs to 3000 men working under contractors and \$1,650,000 of State funds giving employment throughout the winter to 3000 men with families and 2000 to 2500 single men in highway and forest camps.

Twenty projects totaling 54.8 miles of road construction and including 11 bridges are now under way with an estimated cost of \$3,418,000. Twelve additional projects totaling \$1,885,400 will be advertised by December 1st,

making a grand total of \$5,303,600 worth of work under way by that date.

The \$1,650,000 highway fund includes \$1,230,000 for the expansion of maintenance crews in the ten districts of the Division of Highways, \$120,000 for the establishment of a highway construction camp in Los Angeles County and \$300,000 to which will be added

\$100,000 for use in establishing forest camps adjacent to State highways. These forest camps will be administered cooperatively by the Division of Forestry and the Department of Public Works and the men will be engaged in work for the protection of the highways.

The increased maintenance program will continue similar work carried on during the two previous winters. This type of work is chosen for the major portion of the relief work because it lends itself to a maximum increase in personnel. The funds have been divided between the northern and south-

ern portions of the State and distributed to the districts for increasing their maintenance crews.

It is estimated that the \$1,230,000 to be used for the expansion of maintenance activities will provide employment for more than 3000 men working three days a week over a period of six months.



GOVERNOR JAMES ROLPH, JR.

Earl Lee Kelly Appointed Director of Public Works by Governor Rolph

EARL LEE KELLY of Redding, who has served with distinction as chairman of the California Highway Commission and director of the State Tax Research Bureau under the present administration was appointed director of the Department of Public Works by Governor James Rolph, Jr., on October 14th, was immediately sworn in and took over the duties of his new office.

During his tenure as chairman of the Highway Commission Mr. Kelly covered almost every mile of the State highway system in the course of his official duties and efficiently guided the deliberations and decisions of the Commission from the day that body took office.

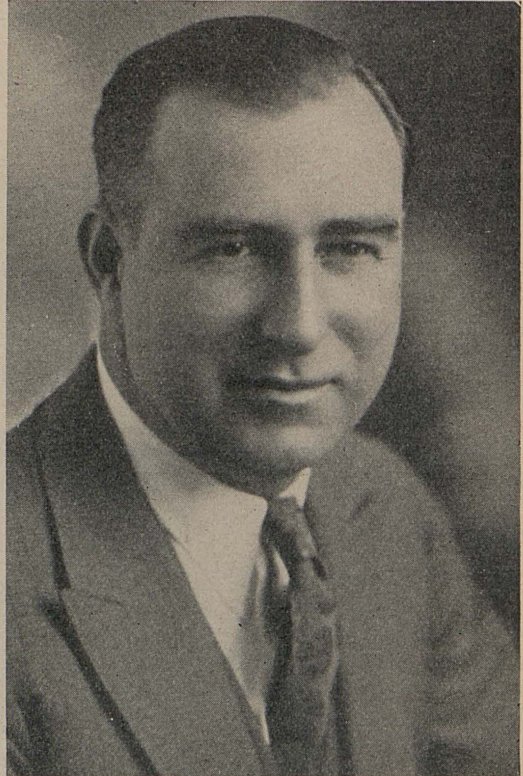
He therefore brings to his new position a wealth of knowledge and experience concerning every problem and policy in the development of the State's vast highway system and a demonstrated executive capacity to wisely direct and successfully manage the affairs of this important department of the State government controlling the expenditure of many millions of the public funds.

BAY BRIDGE RESPONSIBILITY

In addition to the work of the Division of Highways, the Division of Architecture and the Division of Water Resources, Director Kelly will have jurisdictional supervision over the construction of the great San Francisco-Oakland Bay Bridge that the Department of Public Works is charged with erecting and maintaining for a period of ten years or until the bridge revenues have repaid the \$62,000,000 and any further sums advanced for the purchase of bonds by the Federal Reconstruction Finance Corporation.

In appointing Mr. Kelly to this high office, Governor Rolph chose a young man whose active and successful career in business, civic and political life has made him an outstanding figure in the State—the career of a self-made man.

As a poor boy in Humboldt County, Earl Lee Kelly was determined to get a good education and worked his way through Eureka



EARL LEE KELLY

schools by carrying and selling newspapers. He worked his way through the University of California by securing employment during vacation periods, in one instance driving mules for a contractor on a highway job in Placer County over which he now has jurisdiction. He graduated from the University law school in the class of 1915 and secured employment with a title and abstract company.

SERVED AS "BUCK PRIVATE"

Before he could get fairly started in this business the United States entered the World War and he became a "buck private" in the 12th Infantry, 8th Division. Returning from army service Mr. Kelly started for himself in the title and insurance business in Redding with one typewriter that he lugged under his arm back and forth between the county court-

(Continued on page 17)

Commissioner Harry A. Hopkins Made Chairman of State Highway Board

HARRY A. HOPKINS of Taft, Kern County, is the new chairman of the California Highway Commission endorsed by Governor Rolph as successor to Earl Lee Kelly recently elevated by the Governor to the directorship of the Department of Public Works. Mr. Hopkins has been a member of the present unsalaried commission since it took office and its work has become an all-absorbing hobby with him. He has made an intensive study of all phases of the State's progress in highway development and eminently qualified himself for the new honor by outstanding work as a commissioner that has made him one of the best informed men in the State on highway policies and problems.

With the background of a long and varied career of success in business and civic life, Mr. Hopkins says:

"In all of my business, social and civic activities, I have never found anything so interesting as the activities I am now engaged in as chairman of the California Highway Commission through endorsement of the Governor."

SON OF PIONEER

The son of one of the pioneer stage drivers of California who escaped the bullets of bandits to organize a large horse and cattle raising business and now lives in retirement in Los Angeles, Mr. Hopkins graduated from the Los Angeles High School and soon was attracted by the oil business with which he has been continuously connected in different capacities. His duties as assistant field manager for a large company took him into the Kern County oil areas. He settled at Taft in 1909 and as the first postmaster named the town after the President of the United States. When the city was incorporated in 1910 he was a member of the first board of city trustees serving eight years, and became the first mayor.

In 1910 he organized a public utilities company and installed a city water system and later started an ice company of which he has been manager and secretary-treasurer ever since. He has taken a part in oil develop-



HARRY A. HOPKINS

ments all over the State and has interests in Huntington Beach, Signal Hill and Midway oil fields. As operator of the Pacific Oil Salvage Company he has had experience in the contracting business and the operation of heavy equipment. He is identified with the California Oil and Gas Association and the American Petroleum Institute.

Mr. Hopkins' contributions to the civic and social life of his community and State have covered a wide range of activities. As an organizer of the Kern County Chamber of Commerce, he served as chairman of its finance and highway committees. He helped to organize and served as president of the West Side Associated Charities with all welfare and member organizations clearing through its office.

(Continued on page 21)

Tehachapi Flood Damage to Highway and Bridges \$45,000—15 Bodies Found

By **WALTER BEUTHEL**, Assistant District Engineer

THE Tehachapi range of mountains, which is crossed by the main line of the railroads and a secondary highway route from Bakersfield to Mojave, is subject to very violent rainstorms during the spring and fall seasons. Nearly every year some flood damage occurs. Delays to travel are not uncommon although a continuous process of strengthening and improving the highway is the policy of the State. The storms, except during the winter season, are usually short and cover a relatively small area. Run-off is extremely rapid due to heavy precipitation, the absence of vegetation and the topography of the country.

The torrential rains which occurred during the last week of September 1932, in this region, were unusual in intensity, extent and duration. The storm began on September 28th in the plateau region of Tehachapi and the surrounding higher country. Some small damage to culverts and the road was reported soon after.

The rain continued at intervals and reached cloudburst volume on September 30th during the afternoon and evening. The storm total at Tehachapi was over four inches and the maximum in the mountains probably several times this figure.

MASS OF DEBRIS

The brush, logs and mud from a wide area of mountain country was brought to the channel of Tehachapi Creek and carried downstream as the storm progressed. From the vicinity of Cameron to near Monolith a deposit of mud and debris to a maximum depth of three feet was left on the road.

West of Tehachapi a drainage pipe, five feet in diameter, was dislodged from the embankment and moved a thousand feet.

Near Tehachapi and Monolith the water covered the road to a considerable depth and washed great channels along the roadside, resulting in the loss of much surfacing and embankment.

Near Woodford a long freight train with five engines waited on a sidetrack as a passenger train passed. The engines were dis-

tributed through the freight train at about equal intervals. Strangely enough, one of those giant mallet locomotives stood over a large reinforced concrete arch culvert which carried the two tracks over Tehachapi Creek. Another engine ahead was near the creek over a water-soaked embankment.

HURLED INTO CREEK

As the water rose in the creek the culvert proved inadequate to carry the deluge. The water rose to a height of six feet on the freight cars as the debris shut off the flow below them.

Then suddenly the flood was released as the train separated and the locomotive fell to the creek bed, carrying several cars with it.

The water shot directly against the highway built in the canyon wall. The road was obliterated and the rock scoured clean for 155 feet. A partial loss of width occurred for 300 feet more.

In the path of the released waters stood the Kaad Service Station where about a dozen people had taken refuge from the rain. The building and people were swept away, only the concrete floor remaining. The locomotive on the embankment in the forward part of the train sank into the creek, disappeared in the mud and was not found for several days.

BRIDGES CARRIED AWAY

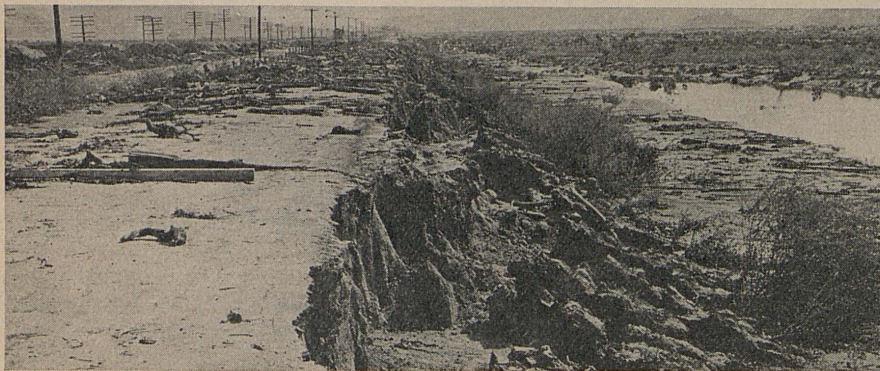
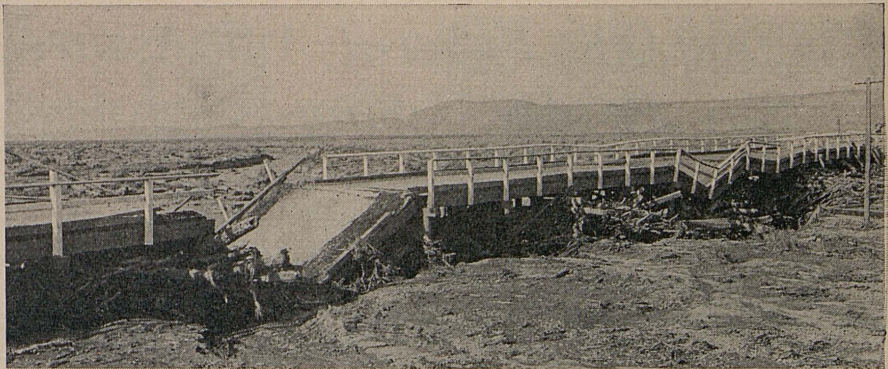
The wall of water continued on down the canyon, wrecking several railroad bridges and damaging the tracks. No further highway damage occurred until the flow reached Caliente Wash. There the canyon ends and Tehachapi Creek, reinforced by and known as Caliente Creek, normally spreads out and sinks into the sand.

The flood, however, carried away both the railroad bridge and the highway bridge over Caliente Creek. It also reached a railroad borrow ditch and continued on to Walker Basin Creek a mile further. The debris carried was enormous and clogged the rail-

(Continued on page 38)

BROKEN DOWN

by flood debris hurled like battering rams against the underpinning, the old highway bridge across Walker Basin Creek was put out of commission by the Tehachapi disaster.

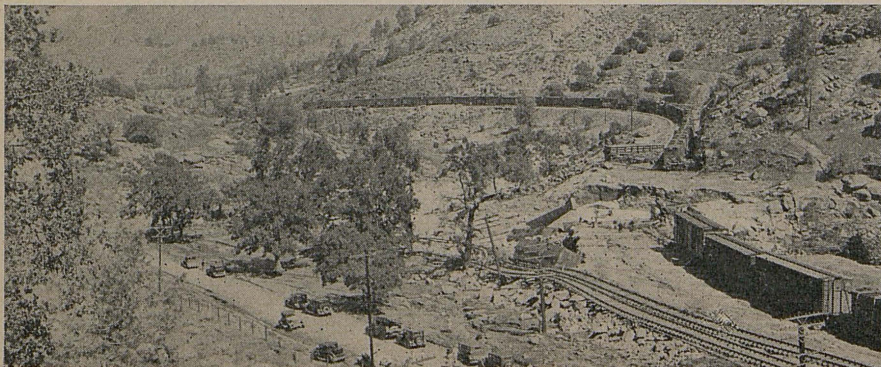
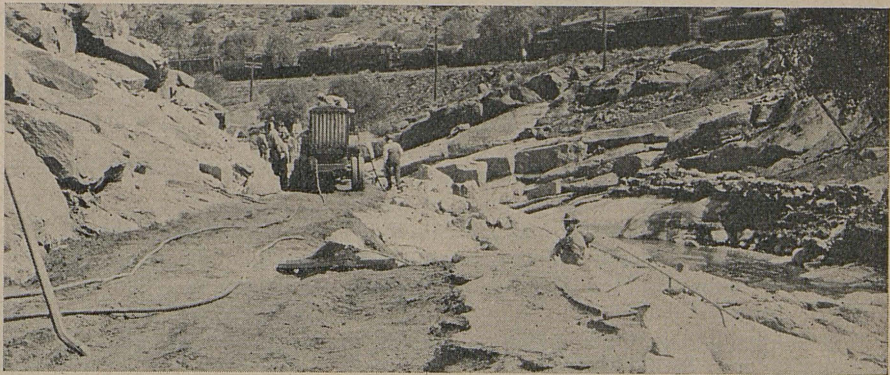


SAVED BY OIL.

Effect of drift and scour on highway about a mile west of Bend. Note damage stops at edge of the oil mat surface of the road.

DOWN TO BED-ROCK.

The road was washed away and the rock scoured clean for 155 feet along Tehachapi Creek. Road crew with compressor for drilling and shooting quickly got road open for one-way traffic.



ENGINE AND CARS

went down into creek at Woodford when flood washed out culvert under tracks and broke long freight train carrying many men to death in the torrent.

\$62,000,000 Federal Aid Assured for Bay Bridge Giving Work to 8300 Men

CONTRACTS for the construction of the San Francisco-Oakland Bay Bridge will be let February 15th. This welcome news to the entire State, that the \$75,000,000 project will become a reality, was recently announced by Director of Public Works, Earl Lee Kelly and Chief Engineer, C. H. Purcell.

The Reconstruction Finance Corporation has made an official commitment to purchase \$62,000,000 of the Bay Bridge revenue bonds, bearing 5 per cent interest. This commitment was obtained by a special committee sent to Washington by the State Bridge Authority at the behest of Governor Rolph. The committee included Harrison S. Robinson and Joseph R. Knowland of Oakland, Leland W. Cutler of San Francisco, Chief Engineer Purcell, Bridge Engineer Chas. E. Andrew and C. C. Carleton, attorney of the State Department of Public Works. The return of the special committee was celebrated by civic ceremonies in both San Francisco and Oakland.

LEGISLATION REQUIRED

The Reconstruction Finance Corporation requires the State Toll Bridge Authority to finance the approaches to the bridge, estimated at \$6,000,000, by the time the structure is completed and to maintain and operate it at State expense. These requirements will necessitate action by the California Legislature in January.

The maintenance funds, after the bridge is completed, will be budgeted out of the regular maintenance fund the same as on all of our State highways and bridges. Our existing law, provides that on completion, this bridge may become a part of the State highway system for maintenance only. The corrective law will be necessary in order that the action of one Highway Commission shall continue as binding in the future so that the bondholders may be assured the agreement will be legally carried out.

The citizens of Oakland and San Francisco will pay the greatest amount toward the construction of the bridge proper due to the fact that the larger amount of tolls will naturally come from this source. The traffic tolls paid

by travelers from other parts of the State in proportion, will be small.

RELIEF FOR JOBLESS

The approaches adopted and agreed upon are only such connections as are necessary to properly serve traffic so that bridge earnings can be the maximum.

The first contract to be let will cover the foundations for the huge structure, estimated to cost \$15,240,000. The second will include the San Francisco anchorage, estimated to cost \$1,110,000; the Yerba Buena Island Tunnel Crossing, \$2,100,000; and dredging for mole construction, \$3,450,000—a total of \$6,660,000. The third contract will cover the West Bay Superstructure, costing approximately \$16,600,000. The final contract for the East Bay Superstructure will approximate an expense of \$8,900,000.

A large measure of relief to the unemployment situation in the San Francisco Bay area is assured with the start of the bridge. The project will employ directly 6000 men over a period of four years and 2300 additional workers in local shops.

LARGE SAVINGS ASSURED

Completion of the structure will result in a great economy for all who cross the bay. The savings in time and money may be summarized as follows: Each commuter will save between 10 and 15 minutes on each trip. Automobiles will save 30 minutes per trip. This time saving computed at 50 cents per hour for an estimated 35,000,000 commuters crossing the bay will amount to at least \$3,000,000 per year. In addition, the 16,000,000 auto passengers will save \$4,000,000 or a total saving of \$7,000,000 per year.

The total tolls to be paid by both interurban and auto passengers during 1937 are placed at \$6,356,000. A comparison of these figures shows that the traffic crossing the bay will actually save more money in time than it will cost them to cross the bay. This saving will increase each successive year while the bridge is being paid for.

In addition the saving on account of reduced tolls over those now charged, assum-



Photo Courtesy of San Francisco Chronicle.

TRIUMPHANT AMBASSADORS OF CALIFORNIA, George T. Cameron, Leland W. Cutler, Joseph R. Knowland and Harrison S. Robinson, members of the Advisory Fiscal Committee of the California Toll Bridge Authority, reported to Governor Rolph and fellow bridge officials on returning from Washington their success in obtaining from the Reconstruction Finance Corporation an advance of \$62,000,000 for the purchase of the bridge bonds. Seated, in the group above (left to right), are Mr. Cameron, Mr. Cutler, Governor Rolph, Rolland Vandegrift, State Director of Finance, and Mr. Robinson. Standing are Earl Lee Kelly, Director of Public Works, Mr. Knowland and Chief Engineer C. H. Purcell.

ing that ferry tolls remain as at present, will amount to approximately \$30,000,000 over the 20-year period during which time the bridge will be paid for, and will then become a free bridge.

\$30,000,000 LESS TOLLS

In other words, the public travel over the bay will pay, through tolls, for this bridge in 20 years after it is opened, after which time the bridge will become free of tolls. During that time they will have saved more in time value than they will have spent for tolls, and in addition they will have saved \$30,000,000 in tolls as compared with the ferry tolls now being charged.

The principal dimensions and quantities of materials to be used in the Bay Bridge are listed below:

Length of Project—	
San Francisco Terminal to San Francisco Anchorage.....	4,200 feet

West Bay Crossing.....	10,450 feet
Island Section.....	2,950 feet
East Bay Crossing to Toll Plaza.....	19,400 feet
Toll Plaza to Oakland Terminal.....	6,500 feet
Total	43,500 feet—8½ miles

Quantities of Materials—

Structural Steel	152,000 tons
Cable Wire	18,000 tons
Reinforcing Steel	17,000 tons
Concrete	1,000,000 cu. yds.
Cement	1,300,000 bbl.
Timber	30,000,000 f.b.m.
Paint	200,000 gal.

West Bay Crossing—

Height of towers above water.....	465 and 505 feet
Depth of piers below water.....	100 to 210 feet
Height of center anchorage above water.....	301.5 feet
Length of center spans.....	2,310 feet
Length of side spans.....	1,160 feet

Clearances (Vertical)—

Center of center span.....	200 feet
At center anchorage.....	216 feet
Number of cables.....	2
Number of wires in each cable.....	17,020
Diameter of each wire.....	0.195 in.
Total length of cable wire.....	68,950 miles
Total length of 2½" suspender ropes.....	43 miles

East Bay Crossing—

Length main span.....	1,400 feet
Clearance above high water.....	185 feet

"Matrimony" is a serious word, says a magazine writer. Word? We thought it was a sentence.—*Atlanta Constitution.*

"Is your wife fond of listening in?"
"Not half so much as she is of speaking out."—*Georgia Highways.*

Determination of Oil Content for Oil Road Mixes by Surface Area Analysis

By F. N. HVEEM, Assistant Testing Engineer, Research Department

The so-called "California Type" of oil surfaced road has won wide renown for durability and low construction cost. The success in building such roads depends upon using the correct amount of oil for a given grading and aggregate. Over-oiled mixes produce surfaces that become pushed and rutted under traffic. Raveled surfaces result from lack of oil. Engineers differ on how to determine the right amount. The following article describes the method developed by the writer and used by the Materials and Research Department of the California Division of Highways.

THE INCREASING demand for improved highway surfaces combined with a reduction in available funds per mile of road to be improved has necessitated the greatest economy in construction consistent with traffic demands. As a result the question of low cost road surfacing has, of recent years, presented a serious problem to the highway engineer. This situation has encouraged the development of the inexpensive oiled surface types of California and elsewhere.

Without discussing the relative merits of widely used oiled surface treatments and penetration macadams, it can be stated that one of the most successful methods is the oil mix process, sometimes called "California Type." Here the oil treated aggregate may be mixed either on the road by graders, or in a central mixing plant with the binding medium ranging from fuel oil to cutback asphalt. The underlying principles are the same, regardless of the nature of the binding medium or method of mixing.

OIL CONTENT VARIES

Any surfacing process that best meets the requirement of low initial cost must inevitably permit the use of suitable local aggregate without expensive treatment.

The successful use of local materials which vary in grading and character has shown that the amount of oil required for best results also varies considerably. In the past there has been a lack of agreement as to a

satisfactory method for determining in advance the proper amount of oil for different mixes. Engineers have even differed considerably as to the correct amount of oil for a given grading and aggregate.

Many highway builders have shown a strong preference for low oil content or dry mixes. The belief that such dry mixes are the most stable is not borne out by stability tests and recent surveys show that throughout the West the tendency is toward a higher oil content.

Where a sensible attempt has been made to control the amount of oil, very few examples of over oiled roads have been observed. On the contrary, a number of projects have indicated a lack of oil by raveling under traffic.

FORMULAS DEVELOPED

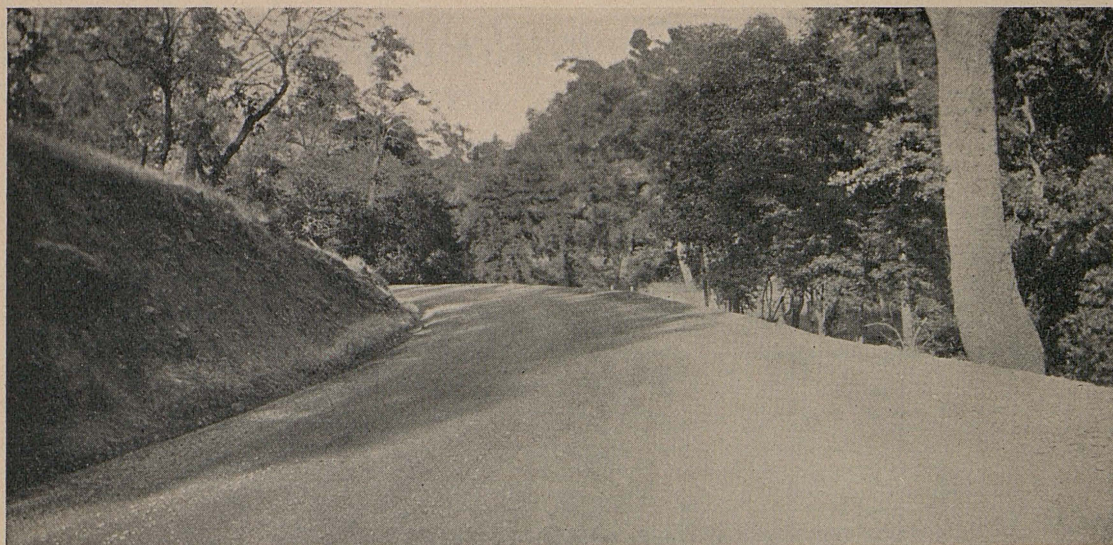
Experience proves that many materials need, for best results, a definite amount of oil and also that it is frequently difficult to determine by inspection during construction whether or not this correct amount is being used. Even though experienced

men may be able to gauge the amount of oil by appearance or "feel," such methods can not be included in specifications. Also men with the requisite experience are frequently not available when needed.

Some specifications (California) have attempted to fix the oil requirements by means of a "pat stain test" which is made by placing a sample of the oiled material passing a 10-mesh screen on a piece of white paper, applying pressure through a wood block and exam-



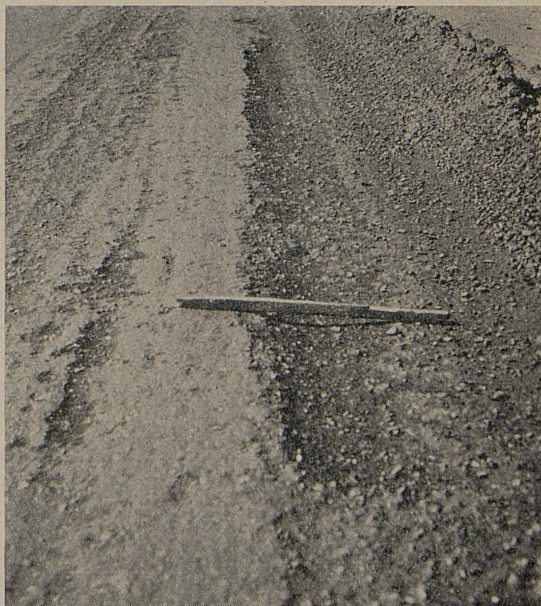
F. N. HVEEM



ONE HUNDRED PER CENT right is this "California Type" highway—hard, smooth and durable with low initial cost. The picture shows a primary road of proper oil mix construction in Tehama County.



TOO MUCH OIL in the mixture causes the road surface to become pushed and rutted under traffic due to instability and resulting in much quicker deterioration with a largely increased expense for maintenance.



NOT ENOUGH OIL in the mixture produces a surface that becomes badly raveled under traffic.

ining the resulting stain on the paper. The test is difficult to interpret properly and is generally conceded to be too erratic to be of great value.

Several formulas have been developed. Probably the most widely used has been the formula developed by McKesson and Frickstad which provides that $P = .015 a + .036 b + .017 c$.

Where P = percentage of oil by weight
 a = % by weight of material retained on a 10-mesh sieve.

b = % by weight of material passing No. 10 and retained on No. 200.

c = % by weight of material passing 200-mesh sieve.

This pioneer formula has had considerable usefulness, but the consensus of opinion now is that while correct in form, the numerical coefficients first chosen give too low an oil content and do not give consistent results between wide ranges in grading and type of aggregate.

FACTS AND THEORIES

The development of a more satisfactory method for estimating correctly the oil requirements has necessi-

How Oil Mix Formula was Developed

(Continued from page 9)

TABLE OF SURFACE AREA EQUIVALENTS

TABLE # 1 10 SIEVES			TABLE # 2 7 SIEVES			TABLE # 3 7 SIEVES		TABLE # 4 4 OR 5 SIEVES		TABLE # 5 3 SIEVES				
SIEVES	SUR. AREA		SIEVES	SUR. AREA		SIEVES	SUR. AREA	SIEVES	SUR. AREA	SIEVES	SUR. AREA			
PASS.	RET.	CONSTANTS	PASS.	RET.	CONSTANTS	PASS.	RET.	PASS.	RET.	PASS.	RET.	CONSTANTS		
*Wash		% x 300												
#200	Wash	% x 200	#200		% x 250	#200		% x 250	#200		% x 250	#200	% x 250	
#100	#200	% x 120	#100	#200	% x 120									
#80	#100	% x 75				#80	#200	% x 115						
#50	#80	% x 55	#50	#100	% x 60				#40	#200	% x 80			
#40	#50	% x 36	#30	#50	% x 32	#40	#80	% x 50						
#30	#40	% x 27												
#20	#30	% x 18	#10	#30	% x 15	#20	#40	% x 20	#10	#40	% x 18			
#10	#20	% x 11				#10	#20	% x 11						
#3	#10	% x 5	#3	#10	% x 5	#3	#10	% x 5	#3	#10	% x 5			
#1	#3	% x 3	#1	#3	% x 3	#1	#3	% x 3	#1	#3	% x 3	#1	#10	% x 4

* Silt remaining in suspension over 15 seconds and removed by elutriation.
 # Sand passing 200 mesh but not removed by elutriation.
 Note:— Value shown in tables #2, 3, 4 and 5, for passing #200 sieve applies to average dust. Will be in error for some materials.

APPLICATION

Use table according to number of testing sieves used.
 Reducing number of sieves will reduce accuracy.
 By sieve analysis determine the amount of each size of aggregate. Express in terms of percent of total. Multiply the percent of each size by the constant given for that size. The constant is the equivalent area in sq. ft. of one pound of material of that size. Add results and total will represent surface area of the entire sample in terms of sq. ft. per lb.

tated time and opportunity for the study of pioneer work under various conditions and methods of control. The facts and theories underlying the development of a revised formula may be more clearly understood if set forth in the order of their conception.

Many examples of successfully oiled roads indicated that the correct percentage of oil in a mixture might be anywhere from 3 to 10 per cent. A section was selected for analysis where the material had been plant mixed and hence accurately proportioned by weight in a modern batching hopper. During construction the aggregate was separated into two sizes; in one bin was the material from No. 3 screen (.263-inch opening) to dust, the other bin containing the aggregate passing one inch and retained on No. 3 screen. Complete field construction records were available which included sieve analysis taken twice each day with the dust content determined by elutriation.

During the work the proportions of fine and coarse aggregate had been changed and it was observed that an increase in the amount of fines (No. 3 to dust) required an increase in the amount of oil to maintain a consistent appearance. So it was surmised that the oil requirement was directly related to the surface area of the aggregate since surface area is the element that is most definitely affected by the degree of fineness of the mixture.

A thorough study was made of the work of others on surface area equivalents, and particularly the numerical values arrived at by the painstaking work of

Captain Edwards, of Toronto, Canada,* although the screen sizes used by Edwards did not correspond to the standard sieves in use in California and his calculations did not extend to any particles below No. 100 sieve. As the dust content has long been known to have considerable effect on the oil requirement, it seemed desirable to develop a ready method for assigning surface area values to unit weights of any size that could be measured, including the dust.

The size of opening in standard testing screens is known, hence by plotting the reciprocals of these screen sizes as abscissas and the surface area values as ordinates, the resulting straight line graph forms a basis from which surface area equivalents may be assigned to any size group of particles. See Fig. I.

Further investigation indicated that the oil coverage factor (amount of oil for one square foot of surface area) is not a constant but varies with the size of the particles. After considerable research and much interpolation a series of curves shown in Fig. II were developed to take care of the relationship between film thickness and particle size.

TWO FACTORS SHOWN

These curves reflect the theory that the proper amount of oil in any mixture of different sized particles depends, first, on the surface area, and, second, on the fact that the average film thickness for similar aggre-

* Proc. A. S. T. M. Vol. XVIII, Part II, 1918.

(Continued on page 22)

FIGURE II

CHART FOR DETERMINING OIL CONTENT FROM SURFACE AREA
OF COMBINED AGGREGATE — AS COMPUTED FROM FIGURE I

PROCEDURE

1. FIND SURFACE AREA OF SAMPLE ON LOWER MARGIN OF CHART.
2. FOLLOW THE LINE UPWARD TO ONE OF CURVES
3. THEN TO RIGHT MARGIN INDICATING BITUMEN INDEX, I. E. LBS. OF OIL PER SQ FT. OF SURFACE AREA.
4. MULTIPLY SURFACE AREA OF SAMPLE BY THE INDICATED BITUMEN INDEX.
5. RESULT WILL GIVE LBS. OF OIL PER LB. OF AGGREGATE OR OIL RATIO

NOTE:— NUMBERS 0-10 ON CURVES RELATE TO SURFACE FACTORS.
LOWER NUMBERS APPLY TO SMOOTH HARD PARTICLES
HIGHER NUMBERS INDICATE INCREASING ROUGHNESS.
VALUES ARE FOR AGGREGATES WITH A SP GR OF 2.65.
FOR AGGREGATES OF ANY SP GR CALCULATE AS SHOWN BELOW.

$$\text{OIL RATIO} = \frac{2.65}{\text{ACTUAL SP. GR.}} \times \text{SURFACE AREA} \times \text{BIT INDEX}$$

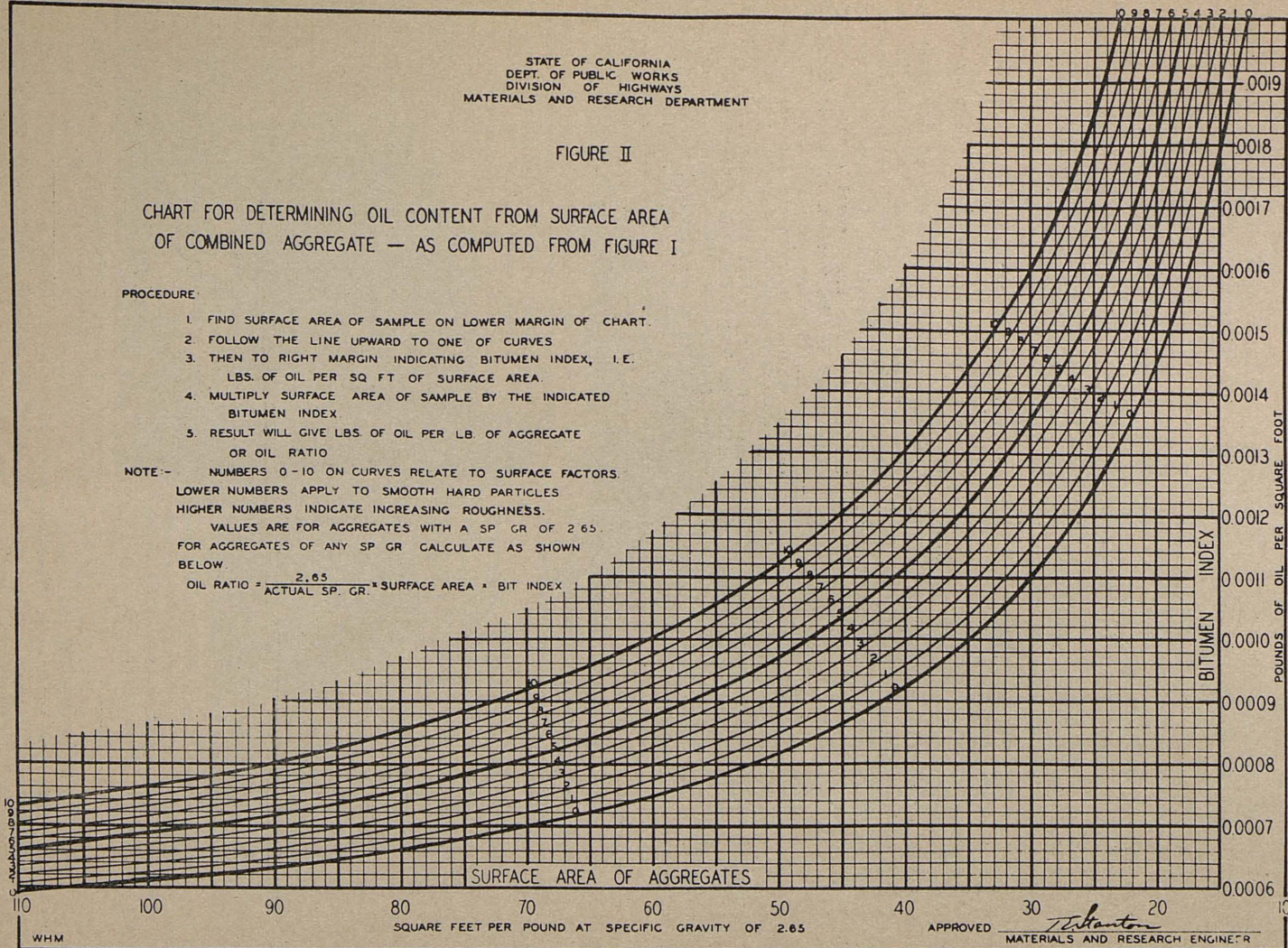


Chart for Determining Oil Content

(Continued from preceding page)

Morgan Keaton New Assistant Deputy Director Takes Office

MORGAN KEATON of Long Beach, a former assemblyman and a former State adjutant of the American Legion, was appointed Assistant Deputy Director of the Public Works Department by Governor Rolph on November 9th to fill that vacancy on the department staff.

Mr. Keaton has been engaged in the real estate and insurance business in Long Beach where he has also taken a prominent part in civic affairs. He was elected assemblyman from the 76th district in 1926 and served in the 47th Legislature from 1927 to 1929. He is married and has three children.

Born in Virginia, Mr. Keaton attended Roanoke College and then went to Washington and Lee University for a four-year pre-legal course, majoring in political science and political economy.

SERVED IN WORLD WAR

In 1916 he enlisted in the First Minnesota Infantry for service on the Mexican border and in 1917 he entered the first officers' training camp at Fort Snelling, Minn.

Commissioned a second lieutenant, he was assigned to the 88th Division and served in France during the World War. Soon after returning to America he came to California and established a residence in Sacramento in 1920 where he engaged in general real estate business.

He was appointed adjutant of the American Legion, Department of California, in 1921 and served three terms in that office from 1921 to 1924.

Absent Treatment Preferred

Boxing Instructor (after first lesson): "Now, have you any questions to ask?"

Beginner (dazed): "Yes; how much is your correspondence course?"—*Georgia Highways*.

Takes a Lot

Two trains of materials, of more than 50 cars each, are required to build a mile of concrete road, according to Arizona Highways, official publication of the Arizona State Highway Commission.

A State of Uncertainty

He: "This darn self-starter won't work. There's a short circuit somewhere."

She: "Well, why didn't you lengthen it, dear."

—*Motor Trader*.

Bixby Bridge, With Longest Concrete Arch, Is Completed

By W. A. DOUGLASS, Assistant Construction Engineer

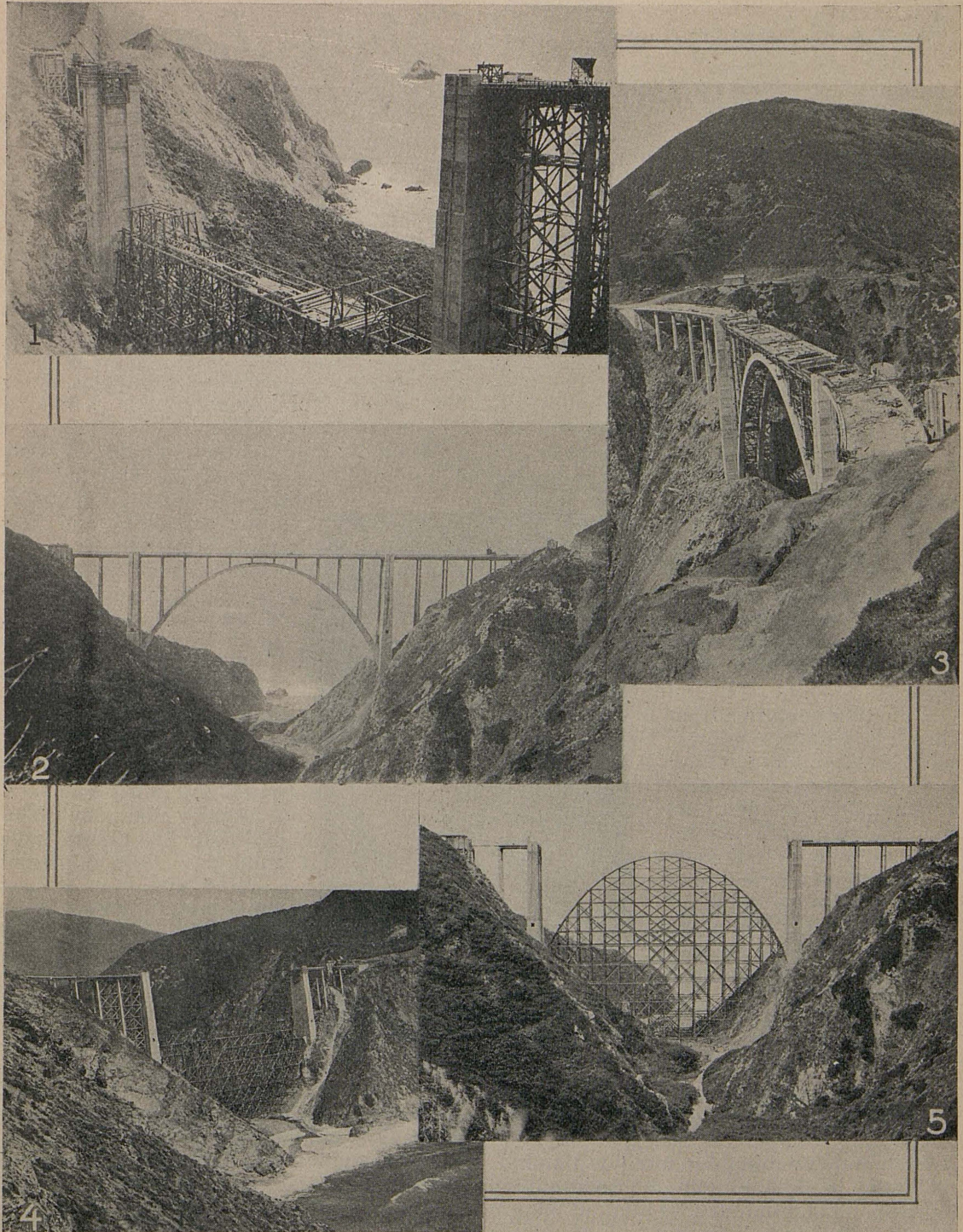
TRAVELERS from inland states, photographers and thousands of tourists have made famous such scenic roads as the Columbia River Highway in Oregon and the Redwood Highway in northern California. Another section destined for wide publicity and to attract heavy tourist travel is that extending from Monterey, the early California capital, southerly along the rugged Monterey coast to Morro Bay, and a connection with the main San Francisco-Los Angeles highway at San Luis Obispo. While an unconstructed stretch of 20 miles in southern Monterey County prevents through travel, steady progress is being made on new construction and realignment of old roads and within a few years this route will provide an alternate between Salinas and San Luis Obispo by way of Monterey.

Notable in the construction of this coast road is the series of arch bridges crossing the steep canyons high above sea level, yet within a stones throw of the breakers. Longest of these arch bridges—in fact the longest concrete arch yet constructed in the western states—is the Bixby Creek arch, 18 miles south of Carmel. The arch springs from heavy concrete abutments securely anchored in rock on the precipitous slopes of the canyon nearly 140 feet above the creek, and rises another 120 feet to span the 342 feet from center to center of abutments. The arch ribs which appear in the pictures to be thin and rather fragile, are actually five feet thick at the crown, nine feet at the springing line, and each four and one-half feet wide. The three 40-foot approach spans on the south and the six 40-foot spans on the north, bring the total length of bridge to 714 feet. Over 6600 cubic yards of concrete—860 in the arch ribs alone—600,000 pounds of reinforcing steel and 4700 cubic yards of excavation were the principle items in the contract. During construction the contractors transported materials, equipment and men across the canyon on platforms and slings suspended from a high line cable 300 feet above the water.

With the broad open exposure to high winds from the ocean, the problem of raising and holding the falsework for the arch ribs was unusually difficult. The contractor chose to avoid as much as possible of the risk by postponing erection of that span until danger of severe winter storms had passed.

The bridge was completed October 15th and by making use of temporary narrow road at the north, may be opened to traffic. A bridge across Rocky Creek a half mile north of Bixby will be completed about December 1st. At that time a connection between the present road and the new road will permit use of both bridges as well as several miles of new grade on the south, and will substitute a section of modern high speed highway for many more miles of narrow mountain road with steep grades and sharp dangerous curves. Another long stride in the Monterey coast road.

A bee can rise with three times its own weight, says an insectologist. Yes, and sit down with about 300 times its own weight.—*Thomaston Times*.



A CONCRETE RAINBOW ARCH, the longest in the West, now throws its graceful span across Bixby Creek on the San Simeon-Carmel highway. Progressive steps in its construction are pictured above. Nos. 1 and 4 are different views of the falsework as it was being built up from the canyon floor. No. 2 shows the completed rainbow of concrete with falsework removed. No. 3 is a side view of the span and roadway before railings were added. No. 5 is a top view of span and roadway before railings were added.

New Mental Hospital Master Plan Adopted for 6000 Patient Capacity

By **GEORGE B. McDOUGALL**, A. I. A., State Architect

THE site known as the Lewis Ranch consisting of 1600 acres in Ventura County was selected for a new State hospital for insane on April 29, 1932. The site is situated $1\frac{1}{2}$ miles from the town of Camarillo which is 17 miles south of Ventura and 56 miles north of Los Angeles on the Coast Highway.

Between May 11th and June 11th of this year Doctor J. M. Toner, Director of the State Department of Institutions, Doctor Herman Adler, consulting psychiatrist of the department, Paul Norman, secretary and the State Architect visited among other institutions 11 State hospitals for the insane in the eastern states to obtain first-hand information as to the latest development in such institutions.

Following return from this trip tentative preliminary sketches for a master plan for the ultimate institution and for the first unit for patients were started and modified from time to time until after eight different conferences both at the site and in Sacramento, the last one held at the site on October 5, 1932, these preliminary studies were approved and adopted.

GROUND-BREAKING IN MAY

Working drawings and specifications as required for bids are now being made and will be completed so as to permit of advertising for bids by March 1, 1933. It is expected that the ceremony of turning the first shovelful of earth at the site can be held May 1, 1933, the institution to be ready for the reception of patients in the Spring of 1934.

In the meantime provision has already been made for the housing of 50 patients in the existing wood frame buildings. These patients will be employed in farming, grading for

roads and similar work that will contribute to their physical and mental health.

The preliminary work besides the development and approval of the preliminary drawings above mentioned has covered also a contour survey of the entire site, the layout of roads both on the site and to provide approaches to it, also sewage disposal, water development, flood control, steam plant and gas and electric services.

While the working drawings and specifications for the portion of the first unit for patients now to be built are being completed and bids taken work will be gotten under way on building of roads and the development of the water supply system.



GEORGE B. McDOUGALL

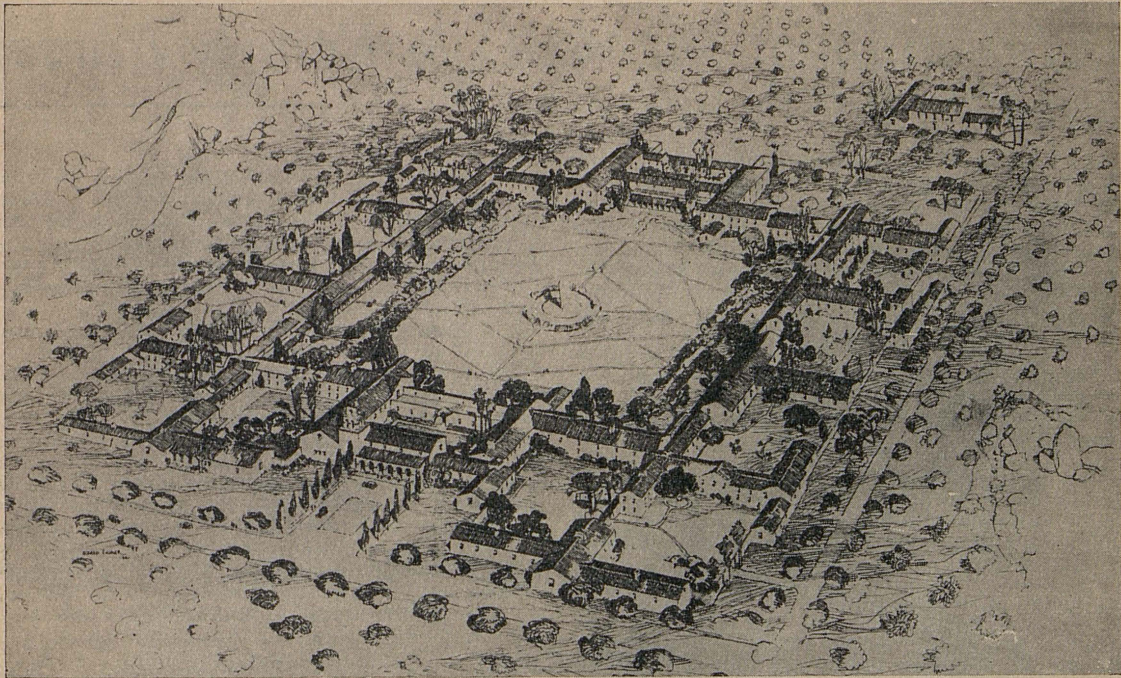
SIX THOUSAND ULTIMATE CAPACITY

The perspective view accompanying this article shows a group of buildings which will ultimately have a capacity for about 2000 patients. The portion to be built with funds at present available will have accommodations for 800 patients; one ward however will be used temporarily for 100 attendants so that the initial patient capacity will be for 700.

The master plan indicates that the ultimate institution will house 6000

patients and about 1000 employees. Of these 6000, 4000 will be in the classification of continuous treatment or custodial patients, and 2000 in the classification of curable patients.

In the provision for curable patients there will be included besides the ward and single room accommodations required, the diagnostic and hospital group which will provide all the services for classification, diagnosis, and hospitalization for both sexes as well as rooms for laboratory and research work.



JUST THE BEGINNING of one of the greatest institutions in the Nation for State care of the mentally sick is shown in this architect's perspective of the first group of buildings provided in the master plan adopted for the new State hospital near Camarillo in Ventura County. The estimated cost of these initial buildings is \$700,000. The remainder of the \$1,000,000 available fund will go for furnishings, equipment and development of grounds.

EMPLOYEES QUARTERS

The configuration of the portion of the site which is to be used for the structures composing the main institution is such as to permit of the housing of all the employees, who as already stated may ultimately number 1000, on a separated but nearby area lying higher than the patients' groups. While the employees will be accessible to the patients, their homes and living quarters will nevertheless be isolated from them. The community life of the employees can be developed along the desirable lines of any well regulated community. Building provisions for this community life are included in the master plan and will be made as the institution grows and funds are provided.

The plan scheme of the patients' structures involves the use of a connected group of one- and two-story ward units gently rising with the natural contours of the ground and enclosing a large central plaza or court and 12 smaller courts. There will be a total of 22 wards in this 2000-patient unit.

SEGREGATION PLANS

Each group for 2000 patients is to have its own feeding unit and its own industrial unit; also a hospitalization unit, administration quarters and apartments for officers.

Besides having access to the large central court, each ward will have access also to two of the smaller courts thus making possible a maximum number of segregations for the various types of patients. Two-thirds of the patients in the group will be housed on the first floor and one-third on the second.

The architectural style of the entire group will be in keeping with the California adaptation of the Medi-

terranean styles of Spain and Italy and the one- and two-story arrangement besides promoting picturesqueness, homlikeness and architectural effectiveness, will give the patients the freest access to the outdoors of the courts. All of the courts are completely enclosed thus providing control against possible escapes of patients without interfering with their freedom.

THERAPEUTIC COLOR SCHEMES

Very careful attention is to be given to the color schemes both on the exterior and interior of the buildings and also to the landscaping of the grounds of the entire institution but particularly of the large central court and the smaller courts in the patients' quarters in order to get the largest possible therapeutic value into the surroundings in which the patients live.

All spaces within the buildings will be of ample size, the corridors will be wide and there will be abundant natural light and ventilation throughout.

All the most modern electric and other devices for the control and comfort of the patients will be provided. The principal interior spaces will be acoustically treated to avoid sound reverberation.

The service group including steam plant, laundry, bakery, commissary, store house, general garage, etc., is provided for on the master plan and will be built around a court enclosed by the various units. This court will be used for the storage of surplus materials and other accumulations resulting from the operation of the hospital which will thus be available for reuse when needed and in the meantime will be out of sight.

ONE MILLION DOLLARS AVAILABLE

The construction will be of reinforced concrete frame, reinforced concrete and brick exterior walls

(Continued on page 40)

Maximum of Pay Goes to Family Purse

(Continued from page 1)

As in the past two years, men with families who live in the locality will be given the work. The Division of Highways contacts the local officials or relief agencies and selects men adaptable to the work from lists furnished by them. The men live at home, board themselves and are paid \$4 per day. The State furnishes transportation to and from the work, the trucks going out on the State's time and returning on the men's time.

This method of supplying relief by expanding maintenance work has proven to be most satisfactory as through it a maximum of money expended goes directly to the men.

It is estimated that this year seventy-five cents of every dollar spent on this type of maintenance work will go to the men as wages and twenty-five cents will go for transportation, supervision and supplies.

Of the \$1,500,000 expended last year under the direction of the maintenance engineer 84 per cent was paid out in wages to the men but as the work nearest the base of operations has been completed the cost of transportation to and from the work rises and it is estimated that this year the cost of operation will increase nearly 9 per cent.

The type of work performed by these expanded maintenance crews is selected on the requirement of a maximum amount of hand labor and a minimum amount of material. The classes of work which lend themselves to these requirements include the following:

CLASSES OF WORK

Clearing gutters and roadsides; widening roadway curves, fills and cuts; improving roadway shoulders; removing slides and filling sinks; improving drainage by extending culverts, installing sub-drains and constructing rock gutters; cultivating and trimming trees and setting out ice plant to protect cut and fill slopes from erosion.

These various classes of work secure a maximum benefit from the funds expended, and add to the capital investment in the State's highways, while not materially reducing work necessary in regular maintenance operations. Under normal circumstances much of the work performed would be deferred for a considerable time, if carried out at all.

The results obtained are most satisfactory as they provide permanent improvements to the roads and serve the purpose of carrying many families through the winter when work in many lines has slackened.

The unemployment relief camp established by the Highway Division in Los Angeles County will care for 250 men through the winter. Southern California is faced yearly with a large population of homeless laborers and such a camp can only care for a small portion of them. The men are housed and fed for six hours work a day.

FOR HAND LABOR

The phase of relief based upon the \$4,600,000 in Federal aid funds which have been made available to

California will likewise have a far-reaching effect in alleviating unemployment conditions this year. These funds are subject to the regular Federal stipulations of the percentage of the work for which the government will pay and to further provisions requiring the use of hand labor methods where they are compatible with adequate construction.

The Emergency Relief and Construction Act was approved by the President on July 21, 1932, and the Division of Highways immediately laid plans for the construction of projects which were eligible for this advancement of Federal funds. That the State highway construction program has been pushed ahead with all possible speed is evidenced by the fact that to the present time 20 projects, estimated to cost \$3,418,200 have been advertised or let to contract and it is planned that 12 additional projects aggregating \$1,885,400 will be advertised by December 1st.

The following summary and detailed list of these projects show clearly their present status, location, mileage and the types of construction which they include.

EMERGENCY CONSTRUCTION HIGHWAY PROJECTS SUMMARY

Awarded and Advertised

Type	Miles	Amount
Concrete Pavement.....	34.6	\$1,359,100
Bituminous Treated Crushed Rock Surface	8.5	342,500
Untreated Crushed Rock Surface.....	6.3	82,800
Graded Roadbed.....	5.4	327,900
Bridges	(11)	1,305,900
Subtotals	54.8	\$3,418,200

Proposed for Advertising by December 1, 1932

Concrete Pavement.....	33.0	\$1,631,400
Bituminous Treated Crushed Rock Surface	4.3	52,000
Graded Roadbed.....	6.3	102,000
Bridges	(1)	100,000
Subtotals	43.6	\$1,885,400

Total Emergency Construction Highway Projects to be under way by December 1, 1932..... 98.4 \$5,303,600

These emergency construction projects together with the expansion of maintenance forces and the establishment of the highway and forest construction camps are the means by which the Department of Public Works and the California Highway Commission are meeting the unemployment situation. Thousands of California homes will be kept intact through the winter as a result of this comprehensive program and other thousands of homeless laborers will be cared for through another trying season.

Doctor: Exercise is what you need, my man; what do you work at?

Patient: I'm a bricklayer.

Doctor: Lay an extra brick every day.

Eric Cullenward Takes Office as New Deputy Director of Public Works

ERIC CULLENWARD, former Los Angeles newspaper editor and chief of the State Bureau of Documents and Publications, was appointed by Governor Rolph on November 9th to fill the vacant post of Deputy Director of Public Works and immediately took over the duties of his new office, the third position filled by him in the State government in seventeen months.

Mr. Cullenward's rapid climb to this office of responsibility as assistant to Director Earl Lee Kelly in managing the important affairs of the Department of Public Works began with his appointment to the secretaryship of the State Highway Commission. He was drafted from this position by Governor Rolph to organize and manage the new bureau created by the last Legislature to supervise the issuance and economical distribution of State publications.

As secretary of the Highway Commission Mr. Cullenward gained an intimate knowledge of the work of the Division of Highways as well as the other Public Works divisions that especially qualifies him for his new office.

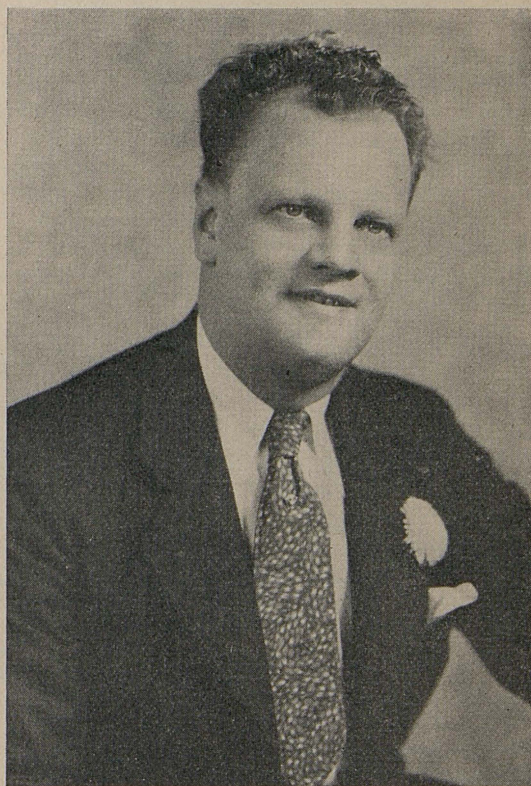
Mr. Cullenward had a long and successful career as a newspaper man before coming into public life. Starting as a young reporter in San Francisco, he rose through all the grades of that exacting profession to the rank of managing editor of the *San Francisco Examiner*.

Transferred to the *Los Angeles Examiner* as day managing editor he remained with that paper throughout the rest of his newspaper career in Los Angeles until his entrance into official life in Sacramento.

Mr. Cullenward is married and has three sons, two of whom have won distinction for their athletic prowess in Los Angeles where both of them are now attending school. One son is a promising member of the Freshman team of the University of Southern California and the other is winning honors on the Los Angeles high school team.

Small Girl Friend (to eight-year-old son of auto salesman): "Oh, I think you're lots better looking than your daddy."

Son: "I ought to be. I'm a later model."—*Georgia Highways*.



ERIC CULLENWARD

EARL LEE KELLY APPOINTED DIRECTOR OF PUBLIC WORKS

(Continued from page 2)

house and his small office because he was a one-man firm and couldn't afford another machine. From this small beginning he developed a business that caused his competitors to propose an amalgamation and made him president and general manager of the largest abstract and title business in northern California.

In addition to becoming a leading business figure Mr. Kelly took an active and prominent part in the civic and political life of Redding, serving both as a member of the City Council and as Mayor. He is a charter member of Shasta Post No. 197 of the American Legion of Redding.

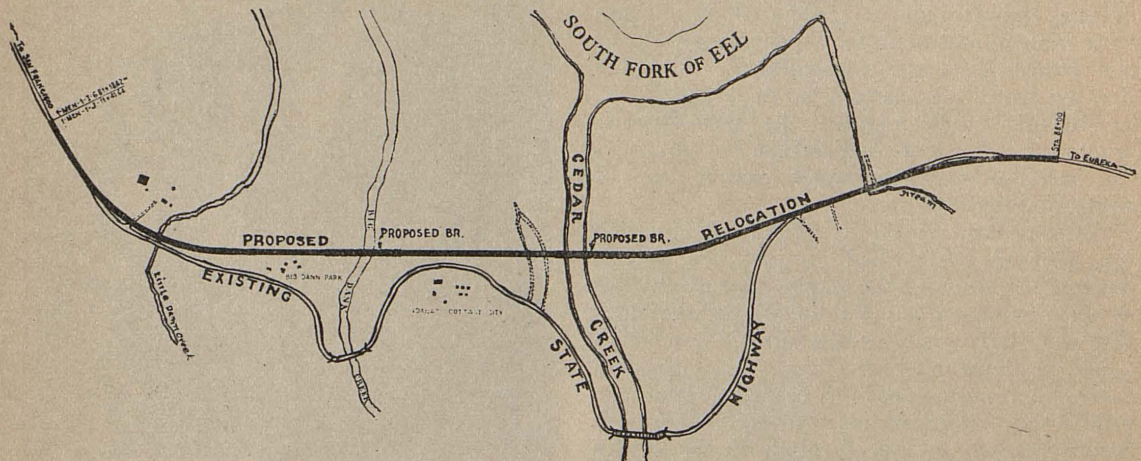
Redwood Highway Improvement Contrasts Old and New Standards

By F. N. DRINKHALL, Locating Engineer, District I

IN THESE times when we are prone to look backward and heed our neighbor's wistful remark about the "good old days," we can help spread a more optimistic outlook by contrasting conditions of today in our own field of endeavor—highways—with those of the past. To those of us who are engaged in highway building it is more or less of an old story, for we are constantly visualizing betterments in existing roads, but even we can benefit by looking backward on those "good old days" and find a certain

than two miles and in traversing this distance the traveler will now turn through less than a half a complete circle on very flat curves in place of more than two whole circles on very sharp curves.

What a contrast we find in the standards of location and also in bridge construction. The old unsightly timber bridges are to be replaced with beautiful concrete structures designed to fit the natural woodland setting, appealing to the eye as well as being a necessary part of the highway.



Map showing relocation project from Little Dann Creek to Underwoods.

pleasure and pride in the thought that we have a hand in work that is creative and for the good of the future.

IDEAL IMPROVEMENT

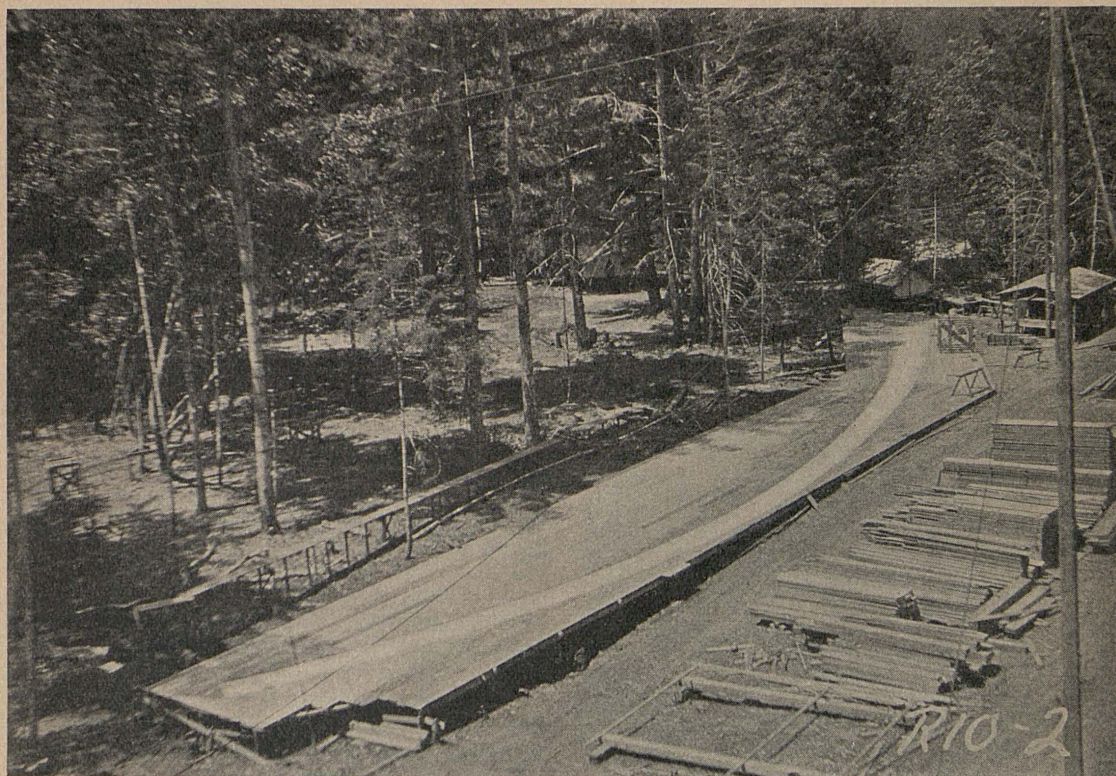
Probably the best example in contrasts that we have in District I at this time is the project on the Redwood Highway from Little Dann Creek to Underwoods, in Mendocino County. The ultimate in betterment of alignment, grades and sight distance seems to have been secured by this relocation. The old road wound around in and out of the two creeks with curvature as sharp as 100-foot radii and grades up to 7.13 per cent. These are replaced with tangent alignment, easy grades and ample sight distance.

A distance of almost a half mile has been saved for traffic in a total distance of less

"FROM TREE TO BRIDGE"

The old bridges were built by the State in 1917 literally "from the growing tree to the finished bridge." A 40-acre tract of timber was bought near the site, a portable sawmill set up and bridge timbers cut and hauled to the bridges.

Contrast this with the modern structures that are now being built across these two creeks under the latest and most efficient methods known. The old bridge across Big Dann Creek consisted of a main span of 180 feet and approaches with an overall length of 240 feet. The new concrete bridge calls for one 320 open spandrel arch span and six girder approach spans with an overall length of 583 feet. At Cedar Creek there is a 135-foot timber span and approaches with total



"TAILORING FOR BRIDGES DONE HERE" might be an appropriate sign for this unique pattern shop in the woods of Mendocino County on the highway relocation project between Big Dann Creek and Cedar Creek. On this big platform the contractor lays out to actual size the form and falsework construction for half of each of the 320-foot arches for the two concrete bridges over the creeks, just as a tailor lays out a pattern for the cloth he is to cut.

length of 367 feet, while the new concrete bridge also uses one 320-foot open spandrel arch and six girder approach spans, with an overall length of 607 feet.

HIGH STRUCTURES

While the bridges are remarkable for the length of their main arch spans, they will also be noteworthy because of their height. The Cedar Creek bridge will be 225 feet above the bottom of the creek, while that across Dann Creek will be 185 feet above the creek, and the traveler in passing over them will be literally rolling through the tops of the giant Redwood trees which furnish a truly beautiful setting for these splendid structures.

The contrasts in engineering standards revealed by an inspection of the relocation plans will perhaps be exceeded by the contrasts in comfort, safety and beauty of landscape which the traveler will experience in passing over the completed project next year.

An interesting feature in connection with the construction of the concrete arch bridges

over Cedar Creek and Big Dann Creek is the arch layout platform used by the contractor. These arches, while of slightly different shape and rise, are of equal span, 320 feet. Both spans are high above the bottoms of the canyons. The slopes are steep and covered with loose material. Construction of falsework and forms in place therefore presented costly difficulties.

The contractor solved the problem by establishing a storage yard and plant on the high ground between the two bridges, performing all carpentry work under ideal conditions. From the yard the completed units of forms and falsework were transported to the bridge sites by industrial cars and high-lines.

The full-size platform was built for the layout of one half the arch face. The two halves are symmetrical but a slight modification was necessary for the second bridge. This method is typical of the contract work as the yard plant includes aggregate bunkers, concrete plant, a blacksmith shop and a small sawmill.

Earth and Earthwork in Highway Construction—Soil and Treatment

By C. S. POPE, Construction Engineer

This is the second of a series of articles by C. S. Pope on soil investigations made by the Highway Division of the California Department of Public Works with reference to highway subgrades. The first article discussed early soil studies. This article deals with the treatment of adverse soils and the accepted conclusions and practice resulting from more recent investigations.

BEFORE proceeding further with the discussion on soils, it seems that a better understanding of the subject may be had by defining the classes of soil usually encountered in highway work which require special treatment.

Soils may be assumed to be composed of clay, silt, loam, and sand, or combinations of these materials with moisture present and its physical phenomena are directly related to the preponderance of one or more of the elements.

Clay may generally be considered as produced from two sources, that is, residual clays which are those formed in place and transported clays which are those which have been brought to the location where they are found from more distant locations. The definitions of these materials as given by the Bureau of Public Roads are as follows:

MATERIALS DEFINED

Clay—That portion of the soil sample which remains in suspension after eight minutes subsidence to a depth of 8 cm. from the surface of the liquid, but which is thrown down when a centrifugal force equal to 500 times the force of gravity is exerted upon the suspended material for a period of one-half hour.

Silt—That portion of the soil sample which passes a 200-mesh sieve and which settles out of a mixture of soil and water after eight minutes subsidence to a depth of eight cm. from the surfaces of the liquid.

Sand—That portion of the soil sample which passes a 10-mesh sieve and which is retained on a 200-mesh sieve and which settles out of the mixture of soil and water after eight minutes subsidence to a depth of 8 cm. from the surface of the liquid.

Suspension Clay—That portion of the soil sample which remains in suspension when a

centrifugal force equal to approximately 500 times the force of gravity is exerted upon the suspended material for a period of one-half hour.

SUBJECT TO TEST

As indicated in the first article on this subject, certain characteristics of soils herein-after described are now subject to test.

These characteristics are all more or less interrelated but the most important are freedom from volumetric change and stability of bearing power.

Subgrade Treatment—A most necessary condition to be obtained in a subgrade over which pavement is to be constructed is that it should be free from *volumetric* changes, and it appears that there are only three methods of securing this at present.

METHODS OF TREATMENT

The first method of treating adverse soil is the one in general use under which the subgrade is covered with a coat of gravel six inches to 12 inches in thickness, which has twofold functions. First, it protects the underlying soil from evaporation and maintains it in a condition of normal moisture. Secondly, it probably offers a somewhat elastic or springy base which absorbs in its particles such expansion and contraction as occurs in the subgrade, which movement, because of the relative uniformity of moisture content in a blanketed soil, is, no doubt, much less than in a subgrade not so protected.

The second method is to mix the gravel or sand in with the adverse soil, which has been found by various investigators to reduce the expansion and contraction almost in direct proportion with the amount of adulteration.

The third method is to place on the soil a thick layer of sand which is intended to act as a mulch and preserves the moisture con-

(Continued on page 33)

“The Indispensable Woman” Wins Post of Interim Directorship

WHILE much was being heard about “the forgotten man” in the political campaign just ended, a sudden change in the executive personnel of the Department of Public Works brought to public attention “the indispensable woman.”

Between the departure from office of the former director and the appointment of his successor there was an interim of four days when that office was filled by Miss Myrtle V. Murray, “the indispensable woman.”

This honorable appellation was given Miss Murray, secretary of the Department of Public Works, just prior to her appointment as interim director, when, according to press reports, her name was mentioned during a discussion of department personnel with Governor Rolph and it was generally agreed that “she is indispensable.”

ONLY WOMAN DIRECTOR

Governor Rolph showed faith in this verdict by appointing Miss Murray, Director of the Department of Public Works with all the honors and emoluments of that office and she was sworn in October 10, 1932, the first and only woman director in the history of the Department. She carried on efficiently and successfully until October 14th when she resigned upon the appointment of Director Earl Lee Kelly.

This high honor came to Miss Murray as the result of her record of more than twenty years of efficient service in the State's employ under five governors and six directors.

Entering the service of the State as a girl in 1911, she became a stenographer in the Highways Division as the Department was then known. The staff then consisted of a chief engineer, an assistant and two stenographers.

WON PROMOTION

Miss Murray made such a success in her new job that when a call came from the Governor's office for another stenographer she was given the position.

Hiram Johnson was then Governor and Miss Murray served in his office and throughout the term of his successor Governor Stephens for eight years returning in 1921 to the newly organized Department of Public Works as its secretary which position she held continuously until her brief tenure of



MISS MYRTLE V. MURRAY

office as director. Upon her resignation from that office she was appointed Administrative Assistant and Secretary by Director Kelly.

HARRY A. HOPKINS MADE CHAIRMAN OF STATE HIGHWAY BOARD

(Continued from page 3)

During the war, as chairman of the West Side Oilfields Chapter of the Red Cross, he had charge of all civilian relief and handled over \$25,000 in administering funds in the flu epidemic when school, hotel, club and private buildings including his own home were taken over and used as hospitals.

He was an organizer, first secretary and president of the Taft Rotary Club, and has been connected with the Kern County Council of the Boy Scouts of America for ten years serving as director and president.

Mrs. Hopkins has taken an equally active interest in civic, and social life and has been honored with the presidency of the Woman's Club. She and Mr. Hopkins were schoolmates and graduated in the same class. They have two children, a son and a daughter.

Method of Determining Oil Content

(Continued from page 10)

gates diminishes as the average particle diameter becomes smaller.

These curves are, of course, empirical as to quantity values, having been established by plotting calculated oil coverage factors as ordinates against surface area equivalents as abscissas.

The curves show the relation between the average bituminous film thickness (Bitumen Index)* and the total surface area of a unit weight of aggregate. An increase in surface area is necessarily accompanied by a decrease in the average diameter of the particles and the allowable film thickness diminishes in the same direction.

The various curves (ranging from 0 to 10) are arranged to compensate for increased surface area of particles due to roughness or irregularities. If this variable could be measured it would be possible to apply the value as a correction to the theoretical surface area and use a single curve to determine the correct coverage factor. At the present time the surface factor is estimated by inspection of the aggregate and the proper curve is selected to correspond.

LUBRICATION PRINCIPLE

There is some difference of opinion as to the fundamental principles underlying this variation in film thickness according to diameter of particles. From observation in other lines of research (Ceramics for instance) it would appear that the mass of the particle has a direct bearing on the film of water that is retained. Reference might be made to Newtons "Directly as the Mass," etc. Whatever the cause may be, however, it is not considered that the results with oiled mixtures are sufficient proof that particles will only attract and hold surface films relative to their diameters.

The writer believes that instability of a bituminous treated pavement and lubrication of the mass are synonymous terms. Then since road oils and asphalts are viscous liquids, the principles of lubrication are in operation and it follows that small particles are more easily lubricated than heavy ones, there is a *necessity* for a diminished oil coverage in order to maintain stability as the particles decrease in size.

This naturally brings up the question as to the principles underlying stability of asphaltic mixtures but it is not desired at this time to enter into that rather extensive subject.

Since the development of the above method, the oil content has been calculated for several thousand samples and the results checked by field work. It is usually possible to select the correct surface factor curve by inspection of the aggregate.

METHOD DESCRIBED

Following is a description of the method for determining the correct amount of asphaltic oil or cutback asphalt to be used in mixed oiled gravel or crushed stone surfacing, as developed by the writer and used by the Materials and Research Department of the California Division of Highways:

In general, the method is based on analyzing the

* This term was used by Mr. A. R. Ebberts. Proceedings Sixth Annual Conference "Asphalt Paving Conference," 1927, Circular No. 49.

material by sieving and determining surface area values from sieve analysis, with recognition of the following factors:

First—The correct oil content is directly related to the surface capacity of the aggregate. This surface capacity is affected by three variable factors, each of which may vary independently of the others.

A—Most important, is variation in surface area due to variation in grading. Small particles have a greater surface area than the same weight of large ones.

B—Variation in surface area due to shapes and character of surfaces of particles.

C—Variation in absorption capacity of different aggregates.

Second—It has been established that the oil film or coverage factor must vary according to the average size of the particles.

Surface area equivalents of a sample of aggregate may be determined from sieve analysis. The sample is sieved and the amount of each size expressed as a per cent of the total.

RESULTS OBTAINED

A constant is assigned for each size which represents the surface area in square feet per pound.

The percentage factor of each size is multiplied by the constant for that size, the results added give the surface area equivalent for the grading represented by the entire sample.

This method may be used in connection with any number of sieves. More accurate results are obtained with a large number of size divisions, particularly of the finer particles.

The results thus obtained represent a mathematical relationship between surface areas of different aggregate gradings.

Variation of surface area between different classes of materials of the *same grading*, due to differences in shape and surface characteristics of the particles, must at present be estimated by inspection until laboratory tests are perfected. Rough irregular particles have a greater surface area than smooth spherical ones.

DETERMINED BY TESTS

Variation in absorption must be determined by trial or laboratory tests. This variation is due to the capacity of different rock structures to attract and hold varying thicknesses of asphaltic residue on their surfaces.

At the present time the formula is applied as indicated in the table. (See table.) This table is compiled to permit of using either a full set of testing sieves or a smaller number; the table to be used depending on the number of sieves available. The dust content should be determined by washing through a No. 200 sieve or by elutriation.

Having arrived at the surface area equivalent for the grading represented, the amount of oil required is calculated by multiplying the surface area by the "Bitumen Index." The "Bitumen Index" is a factor indicating the amount of oil in pounds required to cover one square foot of surface area.

It has been established that the oil film or cover-

Practice Recommended by Laboratory

(Continued from preceding page)

age factor must vary according to the average size of the particles.

The "Bitumen Index" chart gives the coverage factor range that may be applied to different surface area equivalents. It will be noted that in fine grading combinations which have high surface area equivalents, the coverage factor is smaller and the tolerance more restricted than in coarse combinations.

CORRECTIONS NECESSARY

Corrections are necessary for aggregates having a specific gravity greatly above or below 2.6. A lighter aggregate should require more oil by weight and a heavier rock will require less. In order to definitely determine and measure all the factors which may be present and correctly evaluate their effect on oil content and quality of mix, it is necessary to make a laboratory study of the material and furnish the field men with constants that are correct for the particular aggregate being used. Considerable difference in quality of results may be anticipated with different aggregates regardless of structural strength, resistance to abrasion, or grading.

To translate the oil ratio into terms of per cent of the combined mix, divide weight of oil by combined weight of aggregate and oil.

The "Bitumen Index" curves are numbered 0 to 10. These numbers are designated as surface factors or "curve numbers" and apply to rock surface textures of

varying degree of roughness. The lower curves apply to smooth particles and the higher curves indicate increasing roughness.

In application, when the desirable position in the graduated curves has been fixed for a certain grading of a given aggregate, the same relative position (curve number) is to be maintained for all gradings of that aggregate. This will enable the construction forces to adjust the oil ratio to conform to variation and changes in grading as it affects surface area.

SURFACE FACTORS

The laboratory recommends the surface factor (curve number) for each aggregate. This curve is used in the field in calculating the exact oil requirement of the material being used. A given surface factor applies as long as the aggregates are similar in quality to the sample tested at the laboratory.

The Surface Area Equivalent Chart can be used to indicate the general relative stability values of aggregate. Any material that requires the lower surface factors is usually not highly stable. The most satisfactory materials generally require oil curve line No. 3 and above. It is probable that any material or grading requiring a "Bitumen Index" below .0007 will be more likely to show distress in wet weather than if a heavier coverage factor could be used.

These last observations are general and do not apply in every case; exceptions will be noted to all the above.

(Continued on page 28)

Example Showing Application of Method

Assuming a sample graded as below having a recommended surface factor #5 and with a specific gravity of 2.40.

Standard Testing Sieve	Percent Passing	Using Constants from table I- Fig. I			Constants from table #4- Fig. I		
		Proportion Pass.	Ret.	Surf. Area Constants	Proportion each size	Surface Area Constants	Surface Area Sample
Wash	6	Wash	--	.06 x	300 =	18.0	} .11 x 250 = 27.5
#200	11	200	Wash	.05 x	200 =	10.0	
#100	18	100	200	.07 x	120 =	8.4	} .18 x 80 = 14.4
#80	20	80	100	.02 x	75 =	1.5	
#50	25	50	80	.05 x	55 =	2.7	} .16 x 18 = 2.9
#40	29	40	50	.04 x	36 =	1.4	
#30	32	30	40	.03 x	27 =	0.8	} .55 x 4 = 2.2
#20	36	20	30	.04 x	18 =	0.7	
#10	45	10	20	.09 x	11 =	1.0	} 1.00
#3	60	3	10	.15 x	5 =	0.7	
#1"	100	1	3	.40 x	3 =	1.2	
				1.00			1.00
Surface Area of sample in sq.ft.per lb. =					46.4		47.0

(Error between tables will vary with different gradings)

Referring to the chart, (Fig.II) it will be found that a surface area of 46.4 on curve number 5 gives a bitumen index of .0010² pounds (of oil per square foot). The product of surface area and bitumen index gives the oil ratio. As the surface area curves are based on a specific gravity of 2.65 and the sample has a specific gravity of 2.40 a correction will have to be made. Hence, $\frac{2.65}{2.40} \times 46.4 \times .0010^2 = 5.2$ = oil ratio or 100 lbs. of aggregate will require

5.2 lbs. of oil.

Sixteen Major Highway Projects Including Five Bridges Advertised

HIGHWAY construction projects estimated to cost \$4,095,300 were planned for advertising during the month of October by C. H. Purcell, State Highway Engineer and Chief of the Division of Highways in his monthly report to the Director of the Department of Public Works.

This advertising program included 16 major projects composed of 11 road projects and five bridge projects. The road improvements cover work on nearly 58 miles of State highway and amount to an estimated cost of \$2,693,300. The five proposed bridge projects will involve the construction of six structures, estimated to cost approximately \$1,062,000. The work is distributed well over the State, the projects being located in 12 counties.

Rapid progress is being made in getting under way 40 odd projects to be financed with the aid of the \$4,600,000 Federal Aid funds allotted to California by the Emergency Relief and Construction Act. The Division has advertised seven of these projects, four of which have already been let to contract, and 12 more estimated to cost a total of \$3,144,800 are among the 16 projects planned for advertising in October.

The Division of Highways is bending every effort to expedite the advertising of projects eligible for federal aid highway work, that the State may avail itself of this emergency construction money within the time limit set for its advancement.

PROPOSED PROJECTS

Following are brief descriptions of a few of the important projects proposed for October advertising:

In San Diego County two improvements are proposed for the San Diego-El Centro lateral. These two projects plan the reconstruction of that portion of this important route between Chocolate Creek and Viejas Creek, a distance of approximately nine miles. The westerly portion of this improvement involves the relocation of the highway between Chocolate Creek and Alpine and the portion easterly of Alpine includes the

straightening of the alignment and improvement to the grade on the present location with a complete change of alignment at the crossing of Viejas Creek.

The new highway will provide a graded roadbed 36 feet wide and will be paved with Portland cement concrete 20 feet wide. Both the new grade and alignment will be up to modern standards of highway construction and the completion of these two projects will replace the worst portion of this highway between San Diego and El Centro. The easterly end of the improvement will connect with the new pavement on the south side of Descanso Mountain and the westerly end will connect with the new pavement now being placed between Bostonia and Chocolate Creek.

The modernizing of this lateral highway is an important factor to the future development of the Imperial Valley and the proposed improvements, together with the many miles of pavement which have been placed on this route in the past few years, will provide this fertile garden spot with modern highway facilities to the coast at San Diego.

COAST IMPROVEMENT

An important improvement to the inter-beach section of the Oxnard-Serra Highway is proposed at the intersection of the State highway with Culver Boulevard southeasterly of the beach town of Venice in Los Angeles County. A 40-foot Portland cement concrete pavement has just been completed on the section of this highway between Washington Boulevard and El Segundo and the proposed improvement will complete the work between these two points.

TWO GRADE SEPARATIONS

The proposed work consists of constructing two grade separations at this intersection. The two structures will be placed side by side and will carry Culver Boulevard and the tracks of the Pacific Electric Railway over the State highway. The structures will consist of steel plate girders on reinforced concrete abutments and will provide a clear roadway on the State highway 60 feet in

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Work Advanced to Bids in October

The schedule of projects proposed by the Division of Highways to be advertised for bids during the month and prior to November 1 include 16 major highway projects in 12 counties with an estimated total cost of approximately \$3,755,300. These projects comprise 11 road jobs and five bridges covering some 58 miles of State highway located in 12 counties. Included in the list are 12 projects that will be financed with the aid of Federal Emergency Relief funds.

DETAILED LIST OF PROJECTS

County	Location	Miles	Type of Surface
*Los Angeles	Mountain View Rd. to Orange Ave.	4.3	Port. Cem. Con. Pave.
*San Diego	Alpine to Viejas Creek	4.4	Port. Cem. Con. Pave.
Los Angeles	Piru Creek to Gorman	11.9	Port. Cem. Con. Pave.
*Santa Clara	Oregon Ave. to Whisman Road	4.7	Port. Cem. Con. Pave.
*Santa Clara	Whisman Rd. to Lawrence Sta. Rd.	3.5	Port. Cem. Con. Pave.
*Alameda	Dublin to Castro Hill	6.7	Port. Cem. Con. Pave.
*Ventura	Hueneme Rd. to Little Sycamore Ca.	11.6	Port. Cem. Con. Pave.
*San Diego	Chocolate Crk. to Alpine	3.4	Port. Cem. Con. Pave.
*Merced	Merced to Merced Airport	0.6	Port. Cem. Con. Pave.
*Marin	Richardson's Bay to Sausalito	2.1	Asphalt Conc. Pave.
*Mono	Whisky Creek to Convict Creek	4.3	Bit. Treat. Crush. Rock
*Yolo	Across Yolo By-pass		Widen'g Yolo Causeway
*Stanislaus	Across Tuolumne River at Modesto		Steel and Conc. Br.
San Luis Obispo	Across Pico and Little Pico Creeks		2 Steel Str. Bridges
Los Angeles	Under Culver Bvd. and Pac. Elec. Tracks		Reinf. Conc. Overhead Crossing
Sacramento	In North Sacramento		Flood Gates in Levee

* Federal Emergency Relief Fund Project.

SUMMARY

Type	Miles	Amount
Concrete Pavement.....	53.2	\$2,641,200
Bituminous Treated Crushed Rock Surface.....	4.3	52,100
Bridges.....	(5)	1,062,000
Totals	57.5	\$3,755,300

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Editors of newspapers and others are privileged to use matter contained herein. Cuts will be gladly loaned upon request.

EARL LEE KELLY.....Director
JOHN W. HOWE.....Editor

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A HIGHWAY VALUE

The public which uses the highway between Los Angeles and Bakersfield may view each step in new construction work with considerable satisfaction. A contract has just been let for paving the first unit, the amount being \$379,820, and the total cost of the road will be in the neighborhood of three millions of dollars.

But from the figures made public, no expenditure could yield a more handsome return to the people. It is estimated that the shortened road, the eliminated curves and the better grades will save the motor traffic an annual sum of \$1,369,000 in operating costs.

But that is only a part of the advantage in so far as the southern San Joaquin valley is concerned. The tortuous Ridge Route has resulted in deflecting the travel of thousands of tourists to the Coast route, and Bakersfield and Kern County have been distinct losers thereby. When the new highway is completed, reducing the mileage very materially and supplying an easy and safe highway, we shall note an immediate increase in travel between Bakersfield and the southern metropolis. That means that thousands of people will come into this valley who would otherwise travel the Coast route. And we have more than once published the illuminating figures as to the value to a community of each touring car passing through it. No investment made, then, within recent years, is going to yield a better return, both to the traveling public and to the valley points than the new highway which is now to be paved.—*Bakersfield Californian*.

She—"Now what are you stopping for?"

He—"I've lost my bearings."

She—"Well, at least you're original. Most fellows just run out of gasoline."—*National Motorist*.

Yolo Causeway Job Spreading Work to 20,000 Californians

FREQUENTLY we see staggering figures, compiled by someone with a flare for freak statistics, of the "end to end" lengths of materials used in various structures. Let us consider the possibilities of such figures on the 20-foot width to be added to the present $3\frac{1}{8}$ -mile-long Yolo Causeway 5 miles west of Sacramento.

If the separate pieces were laid end to end the lines would be as follows:

Timber Piling.....	30 miles
Redwood Stringers.....	56 miles
3" x 6" Redwood Flooring.....	290 miles
Pile Caps.....	$3\frac{1}{2}$ miles

The stringers will be fastened to the caps with drift pins for which it will be necessary to bore 13 miles of holes and 17 miles of bolts and pins will be used. Spiking down the flooring will require 800 kegs—over two carloads of nails. Nearly six million board feet of California lumber will be used—in terms of houses—enough for over 400 cottages or for a town of 2000 people. Incidentally the Causeway, if converted, would provide this imaginary town with 55 blocks of sidewalk and paved streets.

It is likely that already fifteen thousand to twenty thousand people in the State are benefiting directly and indirectly from the rush of work in the sawmills and woods, producing lumber for the Causeway. Producing materials for the ten thousands tons of asphalt concrete paving and the 300 tons of steel and hardware will affect hundreds more. The local benefit of the half million dollar job will be felt through the large erection crews and their dependents throughout the winter and till midsummer of 1933.

Incidentally Sacramentans will be able to travel westward and return without the hazard of the narrow, dangerous 21-foot Causeway which has become a bottleneck to automobile traffic.

"Mother, Dad's brought home the new car."

"How do you know?"

"He got out to open the gate."—*Georgia Highways*.

Mrs. Bindler—"Is there any difference, Thomas, do you know, between a fort and a fortress?"

Mr. Bindler—"I should imagine a fortress, my dear, would be more difficult to silence."—*Tennessee Road Builder*.



An important Superior Court decision sustaining the right of irrigation district directors to change the plans after bonds have been voted; the employment of hand labor in cleaning drainage canals and by-pass areas; the approval of a program of bank protection on the Sacramento Flood Control project in cooperation with the Federal Government involving expenditure of \$100,000 by July 1, 1933, and details of other activities of the Division of Water Resources are among the interesting features in the regular monthly report of State Engineer Edward Hyatt as follows:

A decision of great importance to California irrigation districts was rendered by the Superior Court under date of August 29, 1932, and involves the authority of the directors of an irrigation district to make major changes in plans after bonds have been voted for the construction of a project. In the case in point, the El Dorado irrigation district, pursuant to Section 30 of the Irrigation District Act, employed an engineer to prepare plans and estimates for irrigation works. Based on the report presented by the engineer, the board of directors estimated that the sum of \$1,300,000 in bonds would be necessary to carry out the project. The report and estimate were submitted to the bond certification commission (now the California Districts Securities Commission) composed of the Attorney General, State Superintendent of Banks and State Engineer, as required by Section 30a of the irrigation act. The commission gave its approval and the bonds were voted on January 20, 1927. Thereafter \$600,000 in bonds were sold, the proceeds placed in the construction fund and the money expended. On December 20, 1928, a supplemental engineering report was submitted to the directors, approved by them and submitted to and approved by the bond certification commission. This report made certain major changes in the original construction plan; and thereafter an additional \$350,000 in bonds were sold and construction was continued under the modified plan.

COURT SUSTAINS BOARD

The question before the court was as to the legality of expenditures on the modified plan, and in summing up the court states in part as follows:

"The single question which is presented to us is whether the district had the power to use the funds derived from the sale of the bonds in accordance with a plan which differed substantially from that upon which the original estimate was based * * *. In considering the authority of the district and its directors, it should be remem-

bered that the legislative power over such districts is plenary, and that they might be formed and permitted to issue bonds without any vote of the electorate at all. There is no constitutional right of residents of such district to vote on bond issues. This right, however, is given to the electors by the California Irrigation Act * * *. It is urged by interveners that the resolution of the board, the notice of the election and the proposition placed upon the ballot incorporated the plan of the first engineering report so as to make any subsequent change a violation of a contract with the electors, and emphasis is also placed upon the publicity given the original report, which was distributed among the voters of the district. It is clear that the publication and distribution of such an informal report can not be deemed to limit the statutory powers of the board. The electors vote with presumed knowledge of those powers."

After discussing the points brought up in the case and citing decisions bearing on the same, the court finds that:

"The board had the power to proceed under the modified plan, and the obligations incurred thereunder were valid."

DELINQUENTS AIDED

The directors of the San Ysidro Irrigation District, San Diego County, have ordered the suspension for six months of the rule requiring the shutting off of water from users delinquent in their payments. This district furnishes domestic water for the town of San Ysidro, and for other communities near the Mexican border.

A recent trip was made over a portion of the mountain division of the Nevada Irrigation District for the purpose of inspecting certain work proposed for the protection of conduits against snow slides and for the installation of control work at the Milton heading. The Paradise, Butte County, and El Camino, Tehama County, irrigation districts were visited, in connection with proposals for the installation of measuring devices for water service. Visits in connection with information of their activities were also made to the Linden, San Joaquin County, El Dorado, El Dorado County, Glenn-Colusa and Princeton-Glenn-Codora, Glenn County, and Richvale, Butte County, irrigation districts.

A regular meeting of the California Districts Securities Commission was held on September 8, at its office in San Francisco.

The calling of an election for the submission of a \$409,000 refunding bond issue, under the refinancing plan of the Terra Bella district, was approved by the commission. Under an agreement with the bondholders this issue will be exchanged for \$818,000 outstanding bonds of the district.

(Continued on page 30)

Highway Bids and Awards for September

EL DORADO COUNTY—Between Placerville and the Railroad Crossing, about 1.7 miles, to be treated with fuel oil and cut-back asphalt. District III, Route 11, Section D. Tiffany, McReynolds & Tiffany, San Jose, \$4,223.30; Hemstreet & Bell, Marysville, \$4,792.25. Contract awarded to C. W. Wood, Stockton, \$4,086.50.

FRESNO COUNTY—Between Fancher Creek and Fresno, 2.7 miles to be graded and paved with A. C. District VI, Route 4, Section B. Peninsula Paving Co., San Francisco, \$93,925.50; Valley Paving Const. Co., Fresno, \$104,103.65; Griffith Co., Los Angeles, \$99,400.50; Hanrahan Co., San Francisco, \$88,602.50. Contract awarded to Union Paving Co., San Francisco, \$83,526.80.

LOS ANGELES COUNTY—Between Washington Boulevard and El Segundo about 4 miles earth shoulders to be treated with oil. District VII, Route 60, Section C. William Ward, Los Angeles, \$2,770; H. E. Cox & Son, Pasadena, \$2,900; Pecos H. Calahan, Glendale, \$3,000; L. A. Paving Co., Inc., Los Angeles, \$3,000; Oilfields Trucking Co., Taft, \$3,420. Contract awarded to Southwest Paving Co., Los Angeles, \$2,720.

LOS ANGELES COUNTY—Between 13 $\frac{1}{2}$ and 15 miles north of Castaic, 4 deck plate girder bridges to be constructed. District VII, Route 4, Section I. Herbert M. Baruch Corporation, Ltd., Los Angeles, \$169,884.43; Sander Pearson and Dimmitt & Taylor, Los Angeles, \$212,220.60; Neves & Harp, Santa Clara, \$190,105.25; Bodenhamer Construction Co., Oakland, \$197,513.20; Gist & Bell, Arcadia, \$179,019; Obert Bros., Los Angeles, \$182,316.10; Lynch Cannon Engineering Co., Los Angeles, \$174,259.30; Sharp and Fellows Contracting Co., Los Angeles, \$165,397. Contract awarded to Weymouth Growell Company, Los Angeles, \$154,611.55.

MENDOCINO COUNTY—Between Little Dann Creek and Heagneys, about 1.8 miles to be graded and surfaced with crusher run base and about 4.5 miles to be surfaced with uncrushed gravel or stone. District I, Route 1, Section J. Chigris and Sutsos, San Francisco, \$83,689; Hein Bros. Basalt Rock Co., and J. V. Galbraith, Petaluma, \$86,006.75; Clyde W. Wood, Stockton, \$87,270.50; Hemstreet & Bell, Marysville, \$88,877.50; E. B. Bishop, Sacramento, \$79,468.05. Contract awarded to A. Teichert & Son, Inc., Sacramento, \$78,943.75.

MONO COUNTY—Constructing a workman's cottage at Sonora Junction Station. District IX. J. W. Stewart, Bridgeport, \$2,398; T. Johanns, San Francisco, \$2,488; C. J. Sumner, Lone Pine, \$2,665. Contract awarded to F. M. Banta, Bishop, \$2,100.

MONO COUNTY—Between West Walker (Canyon) River and 2 miles south of Coleville, 2.4 miles to be graded. District IX, Route 23, Section K. Tiffany, McReynolds & Tiffany, San Jose, \$11,717.20; Harms Bros., Galt, \$9,721.70; F. G. Smith & F. D. O'Neal, Long Beach, \$11,279.60; Geo. Herz & Co., \$15,681.50; Larson Bros., Galt, \$9,329.10; Isbell Construction Co., Carson City, Nevada, \$12,346; Robinson Roberts Co., Los Angeles, \$13,573.30. Contract awarded to Oilfields Trucking Co., Taft, \$8,516.70.

MONTEREY COUNTY—Between San Remo Divide and Carmel River, 3.7 miles to be graded and surfaced with selected material and bituminous binder. District V, Route 56, Section H. Von der Hellen & Pierson, Castaic, \$129,954.35; Clyde W. Wood, Stockton, \$147,219.40; M. J. Bevanda, Stockton, \$132,417.70; E. C. Coats, Sacramento, \$130,357.20; S. H. Palmer & J. P. Holland, Inc., San Francisco, \$139,179.20; Merritt-Chapman & Scott Corporation, San Pedro, \$127,561.60; Fred W. Nighbert, Bakersfield, \$163,044.05; D. McDonald, Sacramento, \$134,844.85; Force Construction Company, Piedmont, \$158,649.90. Meyer Rosenberg, San Francisco, awarded contract, \$123,886.42.

MONTEREY COUNTY—Between San Ardo and San Lucas, about 4.6 miles in length, bituminous surface treatment to be applied. District V, Route 2, Section G. Clyde W. Wood, Stockton, \$15,390; M. J. Bevanda, Stockton, \$15,903; H. E. Cox & Son, Pasadena, \$17,632; U. B. Lee, San Leandro, \$15,561; W. A. Dontanville, Salinas, \$19,013.30; Oilfields Trucking Co., Bakersfield, \$18,929.70; Fred W. Nighbert, Bakersfield, \$16,843.50; Peninsula Paving Co., San Francisco, \$16,904.30. Con-

tract awarded to Granite Construction Co., Ltd., Watsonville, \$13,547.

SAN JOAQUIN COUNTY—Construction of Stockton Maintenance Station buildings. District X. C. J. Hopkinson, Sacramento, \$8,724; J. F. Shepherd, Stockton, \$7,916; Luigi Cosentino, Dunsmuir, \$8,500; Theo. Johanns, San Francisco, \$8,800; Alfred H. Vogt Co., Inc., San Francisco, \$9,390; H. H. Henning, Stockton, \$7,777; Ecker & Stegmiller, Stockton, \$8,952; Frank P. Guyon, Stockton, \$8,575; C. H. Dodd, Stockton, \$8,237; J. Witzelberger, Woodland, \$7,924; Thos. J. Doyle, San Francisco, \$7,971. Contract awarded to J. J. Cavanagh, Stockton, \$7,670.

SANTA CRUZ COUNTY—Between Inspiration Point and Scotts Valley, 5.9 miles to be graded. District IV, Route 5, Section B. Hemstreet & Bell, Marysville, \$384,224.95; C. W. Wood, Stockton, \$286,468.45; Isbell Construction Co., Carson City, Nevada, \$459,026; Peninsula Paving Co. and J. P. Holland, Inc., San Francisco, \$289,013.35; Merritt-Chapman & Scott Corporation, San Pedro, \$348,103.05; VanderHellen and Pierson, Castaic, \$316,138.10; Porter Bros. Corporation and Robert P. Porter, San Francisco, \$333,324.03; M. J. Bevanda, Stockton, \$331,225.50; The Utah Construction Co., San Francisco, \$543,157; George Pollock, Sacramento, \$346,464.50; Meyer Rosenberg, San Francisco, \$362,654.55; T. M. Morgan Paving Company, Los Angeles, \$357,135; Union Paving Co., San Francisco, \$358,722.15; Frederickson & Watson Construction Co., and Frederickson Bros., Oakland, \$364,995.80; D. McDonald, Sacramento, \$359,978.30; Granfield, Farrar & Cardin, San Francisco, \$351,705.60; E. G. Coats, Peterson & Isgren, Sacramento, \$312,268.20; Kern & Kibbe, Portland, Ore., \$356,574.80; Weymouth Crowell Co., and E. Penn Watson, Jr., \$341,846.10. Contract awarded to Mittry Bros. Construction Co., Los Angeles, \$230,181.75.

STANISLAUS COUNTY—7.9 miles A. C. pavement to be planned. District X, Route 4, Sections A, B. Asphalt Pavement Planing Company, Oakland, \$5,011.20. Contract awarded to Standard Road Planing Co., San Luis Obispo, \$4,008.96.

TULARE COUNTY—Between Lemon Cove and Three Rivers, 8.4 miles to be graded and surfaced with bituminous treated crushed gravel or stone. District VI, Route 10, Section E. Frederickson Bros., Oakland, and Jones & King, \$327,783.10; M. J. Beranda, Stockton, \$389,483.70; A. Teichert & Son, Inc., Sacramento and C. T. Malcom, \$368,014.35; Union Paving Co., San Francisco, \$399,959.60; Meyer Rosenberg, San Francisco, \$331,263.90; S. H. Palmer, San Francisco, \$369,810.70; Peninsula Paving Co., Inc., and J. P. Holland, San Francisco, \$324,518.60; Contract awarded to Thompson Bros., Fresno, \$299,789.85.

PRACTICE RECOMMENDED BY LABORATORY

(Continued from page 23)

In conclusion, it might be said that these curves are not necessarily ideal and it is not unlikely that changes in shape of curves (in other words variation in relative values) will be developed for variations in viscosity of liquids. The need for such change does not seem to be pressing in the oils and cutbacks but may be a future refinement.

It may also be of interest to state that the principle of variable film thickness on a surface area basis appears to be applicable to Portland cement concrete.

The water index curve is similar although not identical to the "Bitumen Index" curves. Water being necessary to produce workability in concrete, it would seem that the lubrication principle explains the analogy.

Happiness is a perfume you can not pour on others without getting at least a few drops on yourself.

Seven Thousand Square Miles Mapped in Cooperative Topographic Program

By EDWARD HYATT, State Engineer

ANNOUNCEMENT was made last November of the topographic mapping program which had recently been arranged between the Topographic Branch of the U. S. Geological Survey and the office of State Engineer, looking toward completion at the earliest practicable date of reasonably satisfactory topographic base maps of the remainder of California. It is gratifying at this time to announce that the program is well abreast of the schedule and advancing most satisfactorily.

The program adopted by the two cooperating parties proposed the mapping of some 75,000 square miles at an estimated cost of \$1,660,000, which at the current rate of expenditure would require some 14 years to complete. Of the 75,000 square miles then proposed for mapping some 7000 square miles have since been surveyed and the advance sheets on 3300 square miles are already published. The quadrangles completely surveyed include the following:

Anaheim No. 1, Anaheim No. 2, Anaheim No. 3, Anaheim No. 4, *Antelope Plain, *Barstow, Cloud, *Coal Oil Canyon, Downey No. 4, *Dunsmuir, *Etna, *Harvester, *Hayes Ranch, La Panza, Los Bolsas, *Lokern, *Lone Tree Well, No. 57, No. 65, Santa Ana No. 1, Santa Ana No. 2, Santa Ana No. 3, *West Camp, *West of Goose Lake, White River No. 2, White River No. 3, Yreka.

As evidence of the general distribution of this work it may be stated that during the year field surveys were made in 15 different counties of the State. The extent to which the work has been accelerated will be ap-

preciated by the following comparison of work done in the fiscal year 1931-1932 with that in the fiscal year 1930-1931:

Item—	Year	
	1930-1931	1931-1932
Field work—quadrangles surveyed	10	29
Office work—quadrangles drafted	10	16
Advance sheets—No. published	17	15
Engraved sheets—No. published	9	10
Vertical control—miles of levels	0	1030

During the past year some experimentation has been carried on looking toward the evolution of new methods for expediting the work and decreasing the cost. The work on the Barstow Quadrangle was of this nature, it being representative of a large area in southeastern California on which considerable preliminary field work had already been done by the city of Los Angeles in connection with its Colorado River surveys. Work is now in progress on the Truckee and Colfax sheets in an effort to devise an economical method for revising culture and making desirable corrections on quadrangles previously mapped and published



EDWARD HYATT

by the Geological Survey. A test of aerial photographic methods is now in progress on the Lakeport sheet.

The State of California, through the office of the State Engineer, contributes 50 per cent to the cost of this work and shares proportionately with the U. S. Geological Survey the responsibility for determining a correct order of mapping, appropriate scales and the most economical methods. The progress which is being made with the adopted program is most gratifying.

(NOTE.—Names preceded by asterisk indicate quadrangles for which advance sheets are already published.)

\$100,000 Bank Protection Project

(Continued from page 27)

FLOOD CONTROL AND RECLAMATION

a. *Maintenance of Sacramento Flood Control Project.*

The irrigation of willows planted along the East levee of the Sutter By-pass for protection has been discontinued for the season. The pile driver crew has completed driving seven new bents in the Franklin Road bridge and the work of repairing the deck has been practically completed. Incidental repairs on a number of other bridges have also been made, principally replacing floor planking. Gates are now being placed on three bridges leading into the by-pass, to control the movement of sheep in the by-pass and on the levees.

HAND LABOR EMPLOYED

Cleaning of several of the drainage canals has commenced, the work consisting of removing the grass, brush and tules by hand labor. Fall maintenance clearing in the by-pass area began on September 19 with a force of 25 men. Several other crews will be put to work in the near future and the work will continue for approximately 75 days. It is expected that from 65 to 80 men will be employed.

The revetment along the south side of the Sacramento By-pass, where the current has a tendency to cut and undermine the concrete pavement, has been protected with a layer of cobbles. This work was started some time ago and was completed in this period upon delivery of the final order of cobbles.

For the purpose of keeping down the growth of young willows, 1661 goats have been pastured in the lower Sutter By-pass.

b. *Sacramento Flood Control Project—Bank Protection.*

Work has been completed on the emergency bank protection work done in cooperation with Reclamation District No. 1500 on the left bank of the Sacramento River at the Ely ranch. A length of 400 feet has been protected at a cost of \$1,800.

Maintenance work is being continued on the floating river construction equipment and one watchman is on the outfit at all times.

A program of permanent bank protection in cooperation with the Federal Government has been approved, involving the expenditure of \$100,000 by July 1, 1933. This program includes permanent rock protection at 13 places on the Sacramento River and Three Mile Slough, from Moulton weir to Rio Vista. On account of the lack of State money available for the purpose, the State will contribute only \$10,000 of the total amount for the first year's program. For future work the Federal Government will contribute twice the amount contributed by the State. The State's contribution for this year will consist of the construction of protection at Tyndall Mound on the Sacramento River about eight miles above Knights Landing.

c. *Russian River Jetty.*

During the last period a crew of 11 men has been

engaged continuously in quarrying and placing rock in the jetty. The rock wall is now practically completed to the steel trestle. The derrick has been moved in the quarry, which will make it possible to handle a large quantity of good rock at a low cost. Since operations commenced in June of this year, the average labor cost has been 75 cents per ton actually placed in the levee, including all work done on the job, involving structure and equipment repairs and maintenance of track.

d. *Emergency Flood Protection and Rectification of Rivers.*

Work has commenced on two small bank protection jobs on the Mad River in Humboldt County, in cooperation with the land owner, involving an expenditure of approximately \$2,000. Arrangements are being made for continuing channel rectification work on the San Jacinto River in cooperation with the San Jacinto Levee District.

e. *Sacramento Flood Control Project.*

Reports have been rendered on several applications before the reclamation board and work done under various applications has been inspected.

The reclamation board has authorized the expenditure of \$8,000 for clearing in the American River By-pass in connection with the construction of the North Sacramento levees. Work will be commenced immediately by force account.

f. *Flood Measurements and Gages.*

A new recording gage shelter and well have been installed on the Yuba River at Hammonton. In the office the work of collecting data and preparing reports on high water conditions for the past season and for all seasons up to date for which reports have not been published heretofore, has been continued.

WATER RIGHTS

Applications to Appropriate.

Twenty-four applications to appropriate water were received during the month of August; 15 were denied and 18 were approved. In the same period three permits were revoked and two licenses were issued. The essential data concerning each of the applications received and approved will be found elsewhere in this publication.

Field investigations of projects under permit were made during the month in Sacramento, Calaveras, Amador, El Dorado and Placer counties.

ADJUDICATIONS

Shasta River (Siskiyou County). Findings in accordance with the decision of the court are being prepared by the division.

Whitewater River (San Bernardino and Riverside Counties). Case pending in the Superior Court of Riverside County awaiting developments in regard to the proposed All American Canal from Colorado River.

River Flows Slowly Increasing

(Continued from preceding page)

Clover Creek (Shasta County). The Clover Creek case is pending in the Superior Court of Shasta County awaiting the court's pleasure in setting a date for hearing.

Butte Creek (Siskiyou County). Case pending in the Superior Court of Siskiyou County awaiting action by the parties involved.

Deep Creek (Modoc County). The schedule of allotments adopted by the water users for trial distribution during the 1932 irrigation season was administered by a water master throughout the month.

Franklin Creek (Modoc County). The schedule of allotments for trial distribution for the 1932 irrigation season was administered by a water master throughout the month.

Eagle Creek (Modoc County). The waters of Eagle Creek were distributed throughout the month in accordance with the plan for trial distribution adopted for the 1932 irrigation season.

WATER DISTRIBUTION

Burney, Hat, North Cow, Oak Run and Clover creeks (Shasta County). Water master service on these streams was continued throughout the month.

Little Shasta River and Lower Shasta River (Siskiyou County). Water master service on these streams was continued throughout the month.

West Fork of Carson River (Alpine County). Water master service on this stream was continued throughout the month.

Cedar, Davis, Deep, Eagle, Emerson, Franklin, Mill, New Pine, Owl, Pine and Soldier creeks and South Fork Pit River (Modoc County). Water master service on these streams was continued throughout the month.

Pit River in Big Valley (Modoc and Lassen counties). Supervision of diversions from Pit River in Big Valley continued throughout the month.

SACRAMENTO-SAN JOAQUIN WATER SUPERVISOR

Field work including measurements of all diversions, return flow, use of water, salinity, etc., throughout the Sacramento-San Joaquin territory, has continued during the past month. Apparently the minimum flow of the Sacramento River at Sacramento was reached about August 9th when the flow was 2000 second-feet. The flow has now increased to 2400 second-feet. The San Joaquin River at Vernalis continues to fall and the present flow which is the minimum to date, is 960 second-feet. The combined river flow to the delta is now about 3400 second-feet. If there were no consumptive use of water in the delta, this flow is just about the amount required to prevent salinity from encroaching into the delta. The actual irrigation consumption of water in the delta at the middle of September is, however, about 2700 second-feet. The total flow to the delta has therefore been insufficient to prevent salinity encroachment and

salinity of 100 parts of chlorine per 100,000 parts of water is now between Emmaton and Three Mile Slough Bridge in the Sacramento River and in the vicinity of Jersey in the San Joaquin River. With the consumption of water in the delta now decreasing and the flow of the Sacramento River slowly increasing, it is probable that the maximum salinity encroachment for the season in the Sacramento delta has been reached although there may be a further slight advance in the San Joaquin delta. The salinity at Emmaton on September 6th was 144 parts and on September 10 it had dropped to 120. The following tabulation gives a comparison of the salinity at some of the stations on September 10, 1932, and the corresponding salinity on September 10, 1931.

Station—	Salinity in parts of chlorine per 100,000 parts of water	
	9/10/32	9/10/31
Point Orient.....	*1680	1780
Point Davis.....	1520	1750
Bullshead.....	1320	1580
Bay Point.....	940	1460
Collinsville.....	400	1180
Antioch.....	*270	1100
Emmaton.....	120	970
Jersey.....	*68	800
Central Landing.....	8	250
Middle River P. O.....	9	250
Rio Vista.....	28	640

* September 6th.

In the field work, especial attention is now being given to obtaining the data on the acreage and crops under all river diversions and to the census of all irrigated crops and acreages in the delta.

CALIFORNIA COOPERATIVE SNOW SURVEYS

Routine field and office work has continued under this project during the past month. In the field the brushing out and re-signing of all courses in the South Yuba area were completed. A trip was made to complete arrangements and details of the surveys in the South Kings, Bishop, Mono, Tuolumne, Merced and upper San Joaquin River basins. In the Kings River Basin a shelter cabin is to be constructed to replace one burned down during the past winter. In the Bishop-San Joaquin-Kings basins manways are being constructed at Piute and Bishop Pass cabins to facilitate finding and entry of the cabins during heavy snow conditions. This was proven to be badly needed on the surveys in March, 1932. In the Merced River Basin the Snow Flat snow course has been changed to the original Snow Flat about one mile east of the former location. This is in Yosemite National Park and this and all other snow courses in the park are surveyed in cooperation with the park service.

Office work has included the computations and maintenance to date of stream flow and precipitation tabulations, etc.

(Continued on page 38)

Two Grade Crossing Separations Among Projects Advertised

(Continued from page 24)

width. The construction of these two grade separations is to be undertaken cooperatively with the State, Los Angeles County and the Pacific Electric sharing in the cost.

In the report for September advertising proposed improvement to the Bay Shore Highway in Santa Clara County was noted. The additional funds provided for emergency highway construction projects made it possible to finance the paving of the section of this highway between Oregon Avenue and Lawrence Station Road where the project had been budgeted for grading and temporary bituminous treated crushed rock surfacing. To secure the best results the original project was divided and the grading and paving will be done under two projects.

A 60-foot graded roadbed with a Portland cement concrete pavement will be placed on each section.

REDWOOD HIGHWAY JOB

Another important improvement in the bay area is the proposed improvement of the southerly terminus of the Redwood Highway. This project proposes the grading and paving of this popular highway from the recently constructed bridge across Richardson's Bay into the town of Sausalito. This project involves the realignment of much of this portion of the heavily traveled Redwood Highway and the construction of a 56-foot roadbed and a 40-foot asphalt concrete pavement on a crusher run base.

In Stanislaus County a major improvement is to be made to the Los Angeles-Sacramento arterial at the southerly city limits of Modesto. This project provides for the construction of a 50-span steel girder bridge on concrete piers across the Tuolumne River. The total length of the structure will be 2050 feet and the concrete deck will provide a clear roadway 30 feet wide with two 5-foot sidewalks. This new bridge is to be placed on a revised alignment of this trunk highway through the city of Modesto.

WIDER CAUSEWAY

An improvement of vital interest to thousands of motorists will be the widening of the causeway across the Yolo By-pass just west of Sacramento in Yolo County. The

FOREMAN'S HEROIC AID SAVES LABORER'S LIFE

District Engineer L. H. Gibson of District V makes the following report:

"Quick thought and action on the part of Junior Highway Construction Crew Foreman L. A. Bartlett, employed by the Division of Highways at Convict Camp No. 22, on the Carmel-San Simeon Highway in Monterey County, probably saved the life of one of the convicts in his charge.

On a recent morning members of a crew of convicts were engaged in clearing the right of way about 12 miles north of Camp No. 22 on the Monterey coast when one of the convicts, while attempting to move a large rock, was bitten by a rattlesnake.

Mr. Bartlett who was a short distance away ran to the man's aid and slashed his wrist where he had been bitten by the snake, and without thought of any danger to himself, although his lips were cracked, sucked the blood from the wound and applied first aid treatment. The man apparently suffered very little ill effect from the bite due to the quick work of Mr. Bartlett."

AID FOR STABILIZATION

The 1932 annual report on Public Improvements and Tax Rate of the American Association of Engineers, says:

"Timed public works seem to offer the best means of aiding in the stabilization of industry and trade. The idea rests on the assumption that the only remedy for unemployment is employment, by concentrating the greatest volume of public construction in those years that would otherwise be lean.

present structure, located on the main artery between the State Capitol and the San Francisco Bay area, was constructed some 18 years ago and its roadway width of 20 feet was long considered ample, but with the present day heavy and fast-moving traffic the width of this trestle has become inadequate.

The proposed improvement will widen the structure on the southerly side with a timber trestle and the new roadway width will be 42 feet with a 3-foot sidewalk. The entire roadway width of the deck will be surfaced with asphalt concrete and the present bascule span at the easterly end of the structure will be replaced with a double leaf lift span. The total length of this causeway is 16,538 feet and its widening will greatly increase the safety to the large volume of traffic which daily travels this important artery.

Conclusions Drawn from Soil Studies

(Continued from page 20)

tent at what may be termed *normal moisture* content.

It seems that the problem has two or three phases. One is to so treat the soil that it retains the *normal moisture* content and, therefore, no volumetric change at all times and this theory will require that we abolish the "baked subgrade," and that subgrades at the time of laying concrete should be in a condition of normal moisture when pavement is laid. This phase does not necessarily insure proper bearing power.

The second general phase of the soil treatment is that sufficient bearing power should be provided to sustain the loads when the moist adverse soil is in a condition of normal saturation. The most notable failures in cases of this kind have been where the thickness of subbase provided for flexible pavement such as oil macadam or asphaltic concrete was not sufficient to distribute the loads imposed upon it over an area wide enough to decrease the pressure per square foot to safe proportions.

DRAINAGE CONSIDERATIONS

Both the experiments of the Illinois Highway Commission and the Bureau of Public Roads as well as our experiments indicate that a soil containing a considerable percentage of clay and having a high water holding capacity can not be drained by any means so far devised, and drainage, therefore, is not a cure for weak subgrade in some soils.

The construction of side drains may hold the water content at normal but can not decrease it, and it is, therefore, necessary to design a pavement not for a baked subgrade but for a subgrade containing a normal amount of moisture.

Conclusions—The studies so far made by various investigators of soil characteristics indicate that the following facts are accepted in relation to soils and sands and these determinations and conclusions are of value in this study.

1. The water-carrying capacity of sands is in inverse relation to the voids.
2. Volume shrinkage in clays is proportional to the excess water over that required to fill the pores—the larger the amount of excess water the greater the shrinkage.
3. Volume shrinkage of clays is proportional to

fineness of grain—the finer the grain the greater the shrinkage.

4. The greater the volume of shrinkage of clays the greater the tensile strength.

5. Increased clay content is accompanied by increased moisture retention and increased volume change.

6. Capillary action is greater in fine soils than in soils of coarse grain.

7. Capillary action is least in a vertical direction upward and is augmented by gravity.

TESTS REQUIRED

Application—Beginning with the year 1927, the construction manuals of the Construction Department have required that on all grading and paving jobs, field and laboratory examinations should be made of material entering into subgrade construction and should be examined for:

- (1) Lineal shrinkage.
- (2) Moisture equivalent.
- (3) Bearing power, when indicated as desirable.
- (4) Alkali content.

Lineal shrinkage is required not to exceed 5 per cent for soils or for binder in surfacing and not to exceed 3 per cent for filler in oil mixes.

Moisture equivalent in excess of 20 per cent is considered undesirable.

A bearing power of less than 30 pounds per square foot is considered unsatisfactory.

An alkali content of more than two and one-half in 1000 is undesirable.

"WATCH THE OTHER FELLOW" IS GOOD DRIVING RULE

One of the sound rules for safe driving is to "watch the other fellow." When we form the habit of doing just that we keep our eyes on the road ahead. When we keep our eyes on the road ahead it's ever so much easier to keep our minds on the all-important job of driving safely.

Watching the other fellow develops a new interest in him, too. It fosters a badly needed highway courtesy. It is a constant reminder that the road is owned by all, and not by any one driver. It tells us that the other fellow has equal rights with our own.

When we consider driving a privilege, rather than a right, we will all get along better. And when we make it a practice of watching the other driver we will come to realize that driving is a mutual proposition, and that our highways will become safer only when we develop that spirit of fairness to all when we are at the wheel.—*National Safety Council.*

Program of Roadside Development Under Way in Southern California

By H. DANA BOWERS, Landscape Engineer

In addition to the planting of evergreen ground covers that remove fire hazards from roadsides and the protection of slopes from erosion by suitable plantings, the use of unemployed labor relief crews permits building drinking fountains, protective walls, stone gutters and other so-called beautification units as described by H. Dana Bowers in this final article on that subject.

SOME of the most noteworthy beautification projects accomplished in southern California have been the establishment of drinking fountains, lookout points, parking areas and protective rubble walls along the Crest Drive from San Bernardino to Big Bear Lake. This route has a peak 16-hour traffic of approximately 5000 cars, for the most part pleasure bent. It is justly named the Crest or Rim of the World Drive as it affords vast panoramas of scenic splendor, including desert, mountain, and valley scenes.

Due to the altitude many ascending cars stop to cool their motors and to replenish their water supply. For this purpose springs have been developed at every available source and the water carried to fountains where it is accessible to the traveler. These fountains are usually located on some scenic point protected by colorful naturalistic rubble walls.

WORK FOR UNEMPLOYED

The water is also available for fire fighting purposes and connections have been installed at the fountains to permit filling of tank equipment.

All this work, including the laying of rock gutters to limit erosion, has been done with unemployed relief labor.

A parking area and drinking fountain was constructed across from the Sand Hill maintenance yard near Yuma, with Athol trees surrounding it to afford a small, relatively cool area for public use. The appreciation of this effort to provide public comfort is readily seen in the number of cars stopping there daily.

The following grade separations have been planted to vines and trees in order to stop erosion on unpaved slopes and to frame the

structures to present a more worthwhile appearance:

Route 9 on Foothill Boulevard, Glendora Subway, Malaga Subway and Cucamonga Subway.

Route 2 on Camino Real, Irvine Overhead, Galavan Overhead, two subways at Serra and the Oceanside Subway.

SLOPES PLANTED

The Rubidoux bridge at Riverside was framed with ivy and native shrubs to harmonize with the work the city has been doing on the highways adjacent to the bridge.

The Gish Subway on Route 31 on the Cajon Pass will be planted to various varieties of cactus. The arid conditions there prohibit the use of any but self-sustaining plants and the effect from such a planting should be very interesting.

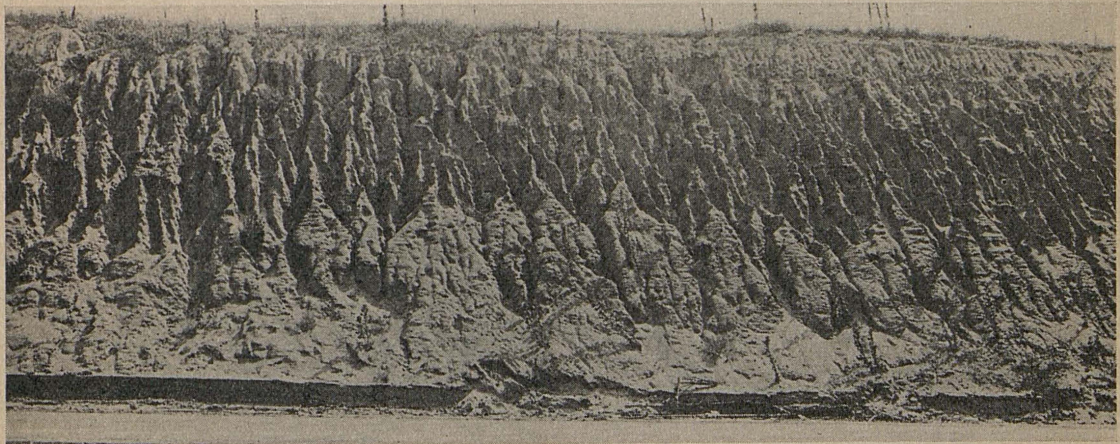
The use of unemployed relief workers and funds has made it possible to accomplish many useful beautification projects not likely to be done by public subscription or civic bodies.

Civic work has usually been confined to tree planting and occasional small parks within the right of way. Our policy at present provides for the maintenance of trees upon receipt of the initial cost and the first year maintenance by the permittee. The maintenance of parks is deemed too expensive and generally the permittee is required to assume all future maintenance.

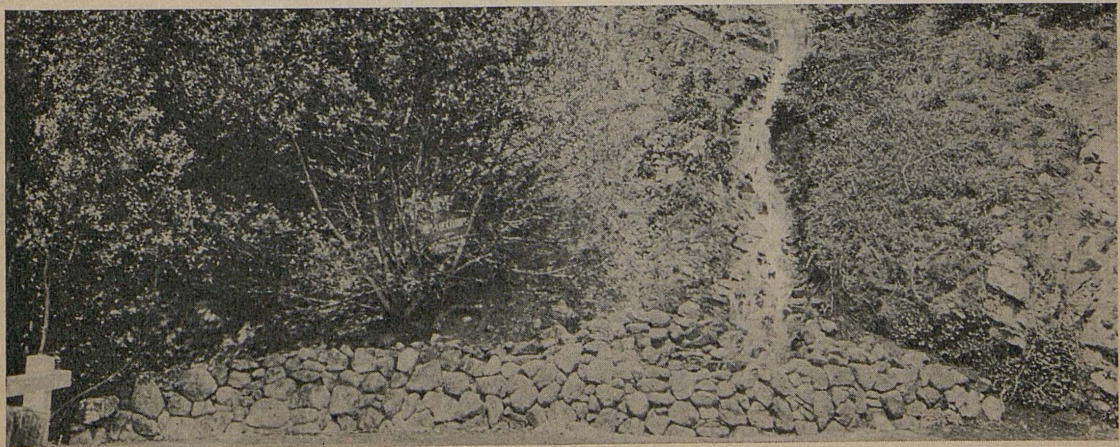
A program of clearing the undesirable brush and debris and removing dead and dangerous trees is carried out each season not only to reduce the fire hazard and eliminate danger to motorists, but also to improve the highways from a material and aesthetic point of view. A very material benefit is the destruction of breeding spots for insect pests.



PROTECTION AND PREVENTION are exemplified in the above scene. Contingents of unemployment relief workers are building rock gutters to catch drainage waters from the mountain slope, thus protecting the road.



HERE'S THE REASON for slope plantings. Eroded banks like the one in this picture not only are unsightly but the maintenance cost of removing sloughed material from the road runs up high every season.



BEAUTY AND UTILITY are combined in this cascade and fountain pool constructed on the Crest Road in San Bernardino County. Springs are diverted to the fountain, affording a water supply for motorists and fire fighters.

Water Applications and Permits

Applications for permits to appropriate water filed with the Department of Public Works, Division of Water Resources, during the month of September, 1932.

MONO COUNTY—Application 7359. Gilbert C. Wedertz, Bridgeport, Cal., for 0.0025 c.f.s. from an unnamed spring, tributary to upper Twin Lake, to be diverted in Sec. 6, T. 3 N., R. 24 E., M. D. B. and M. For domestic purposes. Estimated cost \$300.

TEHAMA COUNTY—Application 7360. Crusade Prospectors, c/o M. E. Heiser, 2504 Cabrillo Street, San Francisco, Cal., for 100 c.f.s. from (1) Deer Creek, (2) Smoky Creek Tributary to (1) Sacramento River, (2) Deer Creek, to be diverted in (1) Sec. 27, T. 27 N., R. 3 E., M. D. B. and M., (2) Sec. 15, T. 26 N., R. 3 E., M. D. B. and M. For mining and domestic purposes.

HUMBOLDT COUNTY—Application 7361. Charles Doss, Orleans, Cal., for 3 c.f.s. from Red Cap Gulch, tributary to Klamath River, to be diverted in Sec. 9, T. 10 N., R. 5 E., H. B. and M. For mining purposes. Estimated cost \$1,000.

TRINITY COUNTY—Application 7362. Charles J. Worden, Box 232, Weaverville, Cal., for 50 c.f.s. from Canyon Creek, tributary to Trinity River, to be diverted in Sec. 1, T. 34 N., R. 11 W., M. D. B. and M. For mining purposes.

SAN LUIS OBISPO COUNTY—Application 7363. City of San Luis Obispo, c/o J. B. Lippincott, 714 West Tenth Street, Los Angeles, Cal., for 3000 acre-feet per annum from Salinas River, tributary to Monterey Bay, to be diverted in Sec. 36, T. 29 S., R. 13 E., M. D. B. and M. For municipal purposes.

EL DORADO COUNTY—Application 7364. C. M. Carter, R. D. Nicol and W. P. Austin, c/o C. M. Carter, 1733 Jefferson Street, Oakland, Cal., for 100,000 acre-feet per annum from South Fork American River, tributary to American River, to be diverted in Sec. 21, T. 11 N., R. 9 E., M. D. B. and M. For municipal purposes. Estimated cost \$9,000,000.

EL DORADO COUNTY—Application 7365. C. M. Carter, R. D. Nicol and W. P. Austin, c/o C. M. Carter, 1733 Jefferson Street, Oakland, Cal., for 614,000 acre-feet per annum from South Fork of American River, tributary to American River, to be diverted in Sec. 21, T. 11 N., R. 9 E., M. D. B. and M. For irrigation purposes (450,000 acres). Estimated cost \$9,000,000.

SAN DIEGO COUNTY—Application 7366. Julius Wieden, c/o H. Delemere Thurber, Fallbrook, Cal., for 1 c.f.s. from an unnamed creek, tributary to Santa Margarita River watershed, to be diverted in Sec. 1, T. 9 S., R. 5 W., S. B. B. and M. For irrigation and domestic purposes (10 acres). Estimated cost \$1,000.

EL DORADO COUNTY—Application 7367. B. W. Stone, 24 California Street, San Francisco, Cal., for 500 c.f.s., 125,000 acre-feet per annum from Rubicon River, Pilot Creek, Gerle Creek, Loon Lake, Buck Island Lake, Rock Bound Lake and Little South Fork of Rubicon River, tributary to American River drainage area, to be diverted in Sec. 9, T. 13 N., R. 16 E., Sec. 11, T. 12 N., R. 12 E., Sec. 24, T. 13 N., R. 13 E., Secs. 11, 31 and 34, T. 14 N., R. 14 E., Sec. 4, T. 13 N., R. 15 E., Sec. 2, T. 13 N., R. 14 E., all M. D. B. and M. For municipal purposes.

PLACER COUNTY—Application 7368. F. M. Chrisman, 1023 Russ Building, San Francisco, Cal., for 250 c.f.s., 200,000 acre-feet per annum from Middle Fork of American River, tributary to Sacramento River, to be diverted in Sec. 36, T. 15 N., R. 13 E., M. D. B. and M. For power purposes (250 h.p.). Estimated cost \$18,000,000.

PLACER COUNTY—Application 7369. F. M. Chrisman, 1023 Russ Building, San Francisco, Cal., for 250 c.f.s., 200,000 acre-feet per annum, from Middle Fork of American River, tributary to Sacramento River, to be diverted in Sec. 36, T. 15 N., R. 13 E., M. D. B. and M. For municipal purposes. Estimated cost \$15,000,000.

PLUMAS COUNTY—Application 7370. State of California, Dept. of Public Works, Division of Highways, Public Works Bldg., Sacramento, Cal., for 0.025 c.f.s. from unnamed hillside spring, tributary to Spanish Creek, thence East Branch North Fork Feather River, to be diverted in Sec. 10, T. 25 N., R. 9 E., M.

D. B. and M. For industrial and recreational purposes. Estimated cost \$100.

TEHAMA COUNTY—Application 7371. State of California, Department of Public Works, Division of Highways, Public Works Bldg., Sacramento, Cal., for 0.025 c.f.s. from an unnamed spring, tributary to Battle Creek, to be diverted in Sec. 24, T. 29 N., R. 3 E., M. D. B. and M. For domestic and fire protection. Estimated cost \$1,100.

PLACER COUNTY—Application 7372. H. G. Stibbs, 234 Holbrook Bldg., San Francisco, Cal., for 250 c.f.s. from (1) Secret Canyon, (2) Little Secret Canyon, (3) El Dorado Canyon, (4) West Branch El Dorado Canyon, tributary to Middle Fork American River, to be diverted in (1) Sec. 1, T. 15 N., R. 12 E., (2) Sec. 1, T. 15 N., R. 12 E., (3) Sec. 19, T. 15 N., R. 12 E., (4) Sec. 35, T. 15 N., R. 11 E., all M. D. B. and M. For mining purposes. Estimated cost \$5,000.

HUMBOLDT COUNTY—Application 7373. Thomas K. Walker, Weitchpec, Cal., for 0.5 c.f.s. from Diamond Creek and Taylor Springs, tributary to Klamath River, to be diverted in Sec. 17, T. 10 N., R. 5 E., H. B. and M. For irrigation purposes.

HUMBOLDT COUNTY—Application 7374. Mrs. Anna Fries Walker, c/o Thomas K. Walker, Weitchpec, Cal., for 0.5 c.f.s. from Diamond Creek and Taylor Springs, tributary to Klamath River, to be diverted in Sec. 17, T. 10 N., R. 5 E., H. B. and M. For mining purposes.

SANTA CRUZ COUNTY—Application 7375. Ethel A. Simms, Route 4, Box 164, Santa Cruz, Cal., for 0.33 c.f.s. from a well, tributary to San Lorenzo River, to be diverted in Sec. 36, T. 10 S., R. 2 W., M. D. B. and M. For irrigation and domestic purposes (6 acres). Estimated cost, \$565.

SISKIYOU COUNTY—Application 7376. Murty Brickley, c/o James D. Fairchild, Attorney, Yreka, Cal., for 2.5 c.f.s. from Walker Creek, tributary to Klamath River, to be diverted in Sec. 18, T. 46 N., R. 11 W., M. D. B. and M. For irrigation and domestic purposes (80 acres). Estimated cost, \$25.

SISKIYOU COUNTY—Application 7377. M. J. Brickley, c/o James D. Fairchild, Attorney, Yreka, Cal., for 2.5 c.f.s. from Walker Creek, tributary to Klamath River, to be diverted in Sec. 18, T. 46 N., R. 11 W., M. D. B. and M. For irrigation and domestic purposes (50 acres). Estimated cost, \$100.

SAN BERNARDINO COUNTY—Application 7378. Gustav Goecke, Lillian V. Goecke, Julius Thorp, and E. B. Thorp, c/o Gustav Goecke, 301 Hermosa Avenue, for 0.25 c.f.s. from an unnamed spring, tributary to Arastra Creek, to be diverted in Sec. 34, T. 2 N., R. 2 E., M. D. B. and M. For domestic purposes. Estimated cost, \$800.

SIERRA COUNTY—Application 7379. S. H. Snow, Sierra City, Cal., for (1) 6.00 c.f.s., (2) 4.00 c.f.s. from (1) Butcher Ranch Creek, (2) Branch of Butcher Ranch Creek, tributary to East Branch of North Fork of North Fork of Yuba River, to be diverted in (1) Sec. 1, T. 20 N., R. 11 E., M. D. B. and M., (2) Sec. 6, T. 20 N., R. 12 E., M. D. B. and M. For mining purposes. Estimated cost, \$1,000.

CALAVERAS COUNTY—Application 7380. Calaveras Water Users Association, Inc., c/o Virgil M. Air-ola, Attorney, San Andreas, Cal., for (A) 4.7 c.f.s., (B) 7.0 c.f.s., (C) 3.3 c.f.s., (D) 5.0 c.f.s., from natural flow of Angels Creek and natural and regulated flow of North Fork Stanislaus River as discharged into Angels Creek resulting from the diversion of the natural flow of said Stanislaus River as augmented and equalized by storage reservoirs thereon known as Union Reservoir, Silver Valley Reservoir and Utica Reservoir, tributary to Stanislaus River, to be diverted in (A) Sec. 33, T. 4 N., R. 14 E., M. D. B. and M., (B) Sec. 4, T. 3 N., R. 14 E., (C) Sec. 7, T. 3 N., R. 14 E., (D) Sec. 12, T. 3 N., R. 13 E., all M. D. B. and M. For irrigation and domestic purposes (14,610 acres). Estimated cost, \$50,000.

SAN DIEGO COUNTY—Application 7381. Dana Burks, c/o Thomas H. King, 608 Electric Bldg., San Diego, Cal., for 25 c.f.s. and 100,000 acre-feet per annum from Coyote Creek, tributary to San Felipe Creek, thence Salton Sea, to be diverted in (point of direct diversion and point of recovery of stored water).

Appropriations Granted to Users

(Continued from preceding page)

Sec. 26, T. 9 S., R. 5 E., Secs. (points of diversion to underground storage) 4, 5, 8 and 9, T. 9 S., R. 5 E., all S. B. B. and M. For irrigation and domestic purposes (18,000 acres).

SIERRA COUNTY—Application 7382. J. F. Siegfried, Downieville, Cal., for 7.5 c.f.s. from Jim Crow Creek, tributary to South Fork of North Fork of Yuba River, to be diverted in Sec. 6, T. 19 N., R. 11 E., M. D. B. and M. For mining purposes. Estimated cost, \$1,500.

SIERRA COUNTY—Application 7383. Clifford A. Thompson, c/o R. F. Taylor, Downieville, Cal., for 3.0 c.f.s. from Howard Creek, tributary to North Fork of North Fork of Yuba River, thence North Fork Yuba River, Yuba River, Feather River and Sacramento River, to be diverted in Sec. 26, T. 21 N., R. 12 E., M. D. B. and M. For mining purposes. Estimated cost, \$500.

SAN BENITO COUNTY—Application 7384. O. F. Haller, Hollister, Cal., for 1000 acre-feet per annum, from Dos Picachos Creek, tributary to Pajaro River, to be diverted in Sec. 16, T. 12 S., R. 6 E., M. D. B. and M. For irrigation purposes (1000 acres). Estimated cost, \$1,000.

EL DORADO COUNTY—Application 7385. E. D. N. Lehe, Al Tahoe, Cal., for (1) 500 acre-feet per annum, (2) 5 c.f.s., from (1) Star Lake and (2) Cold Creek, tributary to (1) Cold Creek, (2) Lake Tahoe, to be diverted in (1) Sec. 30, T. 12 N., R. 19 E., M. D. B. and M., (2) Sec. 11, T. 12 N., R. 18 E., M. D. B. and M. For municipal and domestic purposes.

EL DORADO COUNTY—Application 7386. N. L. Apollonia, 1708½ O Street, Sacramento, Cal., for 0.025 c.f.s. from waste and seepage waters in unnamed ravine, tributary to Brush Creek, thence South Fork American River, to be diverted in Sec. 4, T. 10 N., R. 12 E., M. D. B. and M. For domestic purposes. Estimated cost, \$400.

EL DORADO COUNTY—Application 7387. E. H. Richmond, 225 Cedar Street, Roseville, Cal., for 600 gallons per day from an unnamed spring, tributary to South Fork American River, to be diverted in Sec. 26, T. 11 N., R. 15 E., M. D. B. and M. For domestic purposes. Estimated cost \$50.

LOS ANGELES COUNTY—Application 7388. United States, Angeles National Forest, 501 Brownstein-Louis Bldg., Los Angeles, Cal., for 0.002 c.f.s. from Squaw Creek, tributary to Little Rock Creek, to be diverted in Sec. 13, T. 3 N., R. 11 W., S. B. B. and M. For domestic purposes. Estimated cost, \$8.

LOS ANGELES COUNTY—Application 7389. United States, Angeles National Forest, 501 Brownstein-Louis Bldg., Los Angeles, Cal., for 0.005 c.f.s. from San Olene Creek, tributary to Big Santa Anita Creek, thence San Gabriel River, to be diverted in Sec. 3, T. 1 N., R. 11 W., S. B. B. and M. For domestic purposes. Estimated cost, \$175.

LOS ANGELES COUNTY—Application 7390. United States, Angeles National Forest, 501 Brownstein-Louis Bldg., Los Angeles, Cal., for 0.005 c.f.s. from Rush Creek, tributary to West Fork of San Gabriel River, to be diverted in Sec. 20, T. 2 N., R. 11 W., S. B. B. and M. For recreation and domestic purposes. Estimated cost, \$10.

TRINITY COUNTY—Application 7391. Anna Safford Gamble, 1700 Ellis Street, San Francisco, Cal., for 0.05 c.f.s. from unnamed spring, tributary to Trinity River, to be diverted in Sec. 7, T. 37 N., R. 7 W., M. D. B. and M. For irrigation and domestic purposes (2 acres). Estimated cost, \$225.

BUTTE COUNTY—Application 7392. Ray L. Wakeman, Box 197-A, Route 1, Oroville, Cal., for 0.33 c.f.s. from Cottonwood Creek, tributary to Dry Creek, to be diverted in Sec. 33, T. 20 N., R. 3 E., M. D. B. and M. For irrigation and domestic purposes on 20 acres. Estimated cost, \$150.

RIVERSIDE COUNTY—Application 7393. Lloyd Wright, 1125-1130 Board of Trade Bldg., Los Angeles, Cal., for 0.02 c.f.s. and 2.64 acre-feet per annum from Bear Trap Canyon, tributary to Strawberry Creek, to be diverted in Sec. 12, T. 5 S., R. 2 E., S. B. B. and M. For recreational purposes. Estimated cost, \$6,500.

PLACER COUNTY—Application 7394. J. E. Starratt, Box 185, Roseville, Cal., for 10 c.f.s. from Shirt Tail Creek, tributary to North Fork American River,

to be diverted in Sec. 25, T. 15 N., R. 10 E., M. D. B. and M. For power and domestic purposes (170.5 h.p.). Estimated cost, \$2,000.

PLUMAS COUNTY—Application 7395. Joseph Perich, 2190 Meyers Street, Oroville, Cal., for 1.5 c.f.s. from Bellbar Creek, tributary to Middle Fork Feather River, to be diverted in Sec. 17, T. 23 N., R. 11 E., M. D. B. and M. For mining and domestic purposes. Estimated cost, \$50.

SISKIYOU COUNTY—Application 7396. Helen Russell Prince, 726 Sutter Street, San Francisco, Cal., for 0.5 c.f.s. from North Fork of Russian Creek, tributary to North Fork Salmon River, thence Salmon River and Klamath River, to be diverted in Sec. 19, T. 40 N., R. 10 W., M. D. B. and M. For irrigation and domestic purposes (11.5 acres).

Permits to appropriate water, issued by the Department of Public Works, Division of Water Resources, during the month of September, 1932.

TRINITY COUNTY—Permit 3968, Application 6827. Humboldt Placer Mining Co., Blocksburg, Cal., September 1, 1932, for 175 c.f.s. from Stuarts Fork Trinity River, Owens Creek, Van Matre Creek and Slate Creek, tributaries of Trinity River in Sec. 3, T. 36 N., R. 9 W., M. D. B. and M., Secs. 12 and 24, T. 35 N., R. 10 W., M. D. B. and M., and Sec. 4, T. 34 N., R. 9 W., M. D. B. and M. For mining and domestic purposes.

TRINITY COUNTY—Permit 3969, Application 6985. Majestic Mines Co., Boston, Mass., September 1, 1932, for 100 c.f.s. from Rush Creek, tributary to Trinity River in Sec. 5, T. 34 N., R. 9 W., M. D. B. and M. For mining and domestic purposes. Estimated cost, \$50,000.

LOS ANGELES COUNTY—Permit 3970, Application 7148. Division of Highways, Dept. of Public Works, State of California, Box 1103, Sacramento, Cal., September 6, 1932, for 2000 gals. per day from Templeton Spring, tributary to Piru Creek in Sec. 12, T. 6 N., R. 18 W., S. B. B. and M. For industrial and domestic purposes, highway construction and maintenance, support of shade trees and use of traveling public. Estimated cost, \$1,000.

LOS ANGELES COUNTY—Permit 3971, Application 7214. U. S. Angeles National Forest, 501 Brownstein Bldg., Los Angeles, Cal., September 6, 1932, for 0.003 c.f.s. from unnamed spring, tributary of Piru Creek watershed in Sec. 12, T. 6 N., R. 18 W., S. B. B. and M. For fire fighting purposes. Estimated cost, \$500.

SIERRA COUNTY—Permit 3972, Application 7129. H. L. Berkey, 728 E. 4th St., Tucson, Ariz., September 7, 1932, for 60 c.f.s. from Canyon Creek, tributary to Yuba River in Sec. 18, T. 21 N., R. 10 E., M. D. B. and M. For mining purposes. Estimated cost, \$30,000.

ALPINE COUNTY—Permit 3973, Application 7294. J. E. Taylor, Oakley, Cal. and L. H. Honey, 625 N. Regent St., Stockton, Cal., September 7, 1932, for 400 gals. per day from a spring, tributary to Twin Lakes and South Fork American River in Sec. 18, T. 10 N., R. 18 E., M. D. B. and M. For domestic purposes. Estimated cost, \$400.

SISKIYOU COUNTY—Permit 3974, Application 7300. William Wike, Sawyers Bar, Cal., September 8, 1932, for 2.50 c.f.s. from East Fork Eddy's Gulch, tributary to Eddy's Gulch, thence North Fork Salmon River in Section 15, T. 39 N., R. 11 W., M. D. B. and M. For mining and domestic purposes.

MONO COUNTY—Permit 3975, Application 7265. Helen Patterson, Bishop, Cal., September 10, 1932, for 200 gals. per day from Rock Creek, tributary to Owens River in Sec. 33, T. 4 S., R. 30 E., M. D. B. and M. For domestic purposes. Estimated cost, \$25.

DEL NORTE COUNTY—Permit 3976, Application 7242. U. S. Siskiyou National Forest of Grants Pass, Oregon, September 12, 1932, for 0.017 c.f.s. from unnamed stream, tributary to Middle Fork Smith River in Sec. 32, T. 18 N., R. 4 E., H. B. and M. For domestic uses.

DEL NORTE COUNTY—Permit 3977, Application 7243. U. S. Siskiyou National Forest, Grants Pass, Oregon, September 12, 1932, for 0.017 c.f.s. from unnamed spring, tributary to Smith River in Sec. 29, T. 17 N., R. 2 E., H. B. and M. For domestic purposes. Estimated cost, \$850.

Fast Work Opened Highways Damaged By Tehachapi Flood

(Continued from page 4)

road structure, causing the water to flow over the tracks and highway. The highway bridge, a rather fragile structure, was damaged seriously enough to make replacement necessary.

The water finally flowed out into the vineyards and fields of the San Joaquin Valley near Arvin. The bodies of fifteen people have been recovered although the exact loss of life will probably never be known as a large number of transients were apparently aboard the freight cars.

QUICK REPAIR WORK

Highway maintenance forces started repair work on the damaged road during the storm. By Saturday evening, October 1st, through travel was made possible by way of a detour using the Arvin road and a partial width road at Woodford. At intervals the next day the traffic was permitted to pass, drilling and blasting at Woodford interfering somewhat. Permanent repair to the highway is progressing without further traffic interruption.

The damage to the State road was very much less than that to the railroad. The quick repair of the highway, together with the temporary detours, proved a great benefit to the railroad and telegraph companies as it made the center of the damaged area quickly accessible and allowed repair work to commence at many points rather than a progressive attack from the ends.

The cost to the State including repair of the damaged road and bridges, installation of additional small drainage structures and temporary detours for restoring traffic will amount to about \$45,000.

A reconstruction of the Bakersfield-Mojave Route is programmed and surveys and plans are partially complete. This route has been under State maintenance for about a year, being constructed by Kern County and taken into the State secondary system August, 1931.

Prize Alibi

"Don't you work in my motor plant?"

"Yes, boss."

"Didn't I tell you to make a garden?"

"There it is, boss. I'm raising goldenrod for tires."
—*The Louisville Courier.*

Dams Now Building Total 11, with 160 Undergoing Repairs

(Continued from page 31)

DAMS

To date 812 applications have been received for approval of dams built prior to August 14, 1929; 98 for approval of plans for construction or enlargement and 361 for approval of plans for repair or alteration.

a. Applications Received for Approval of Plans for Construction or Enlargement of Dams.

Dam	Owner	County
Canyon Creek Gladhaven	H. L. Berkey Carrie A. Gladding	Sierra Placer

b. Applications Received for Approval of Plans for Repair or Alteration of Dams.

Dam	Owner	County
Dallas Warner	Modesto Irrigation District	Stanislaus
Grizzly Creek	Clover Valley Lumber Company	Plumas
Montague City Res.	Montague Water Conservation Dist.	Siskiyou
Lower Feeley	Pacific Gas & Electric Company	Nevada
Hart	E. C. and Kate Hart	Siskiyou

c. Plans Approved for Construction or Enlargement.

Dam	Owner	County
*McGowan †Gladhaven	First National Bank, Santa Ana Carrie A. Gladding	Tehama Placer

d. Plans Approved for Repair or Alteration.

Dam	Owner	County
Dry Canyon	City of Los Angeles	Los Angeles
Lake Herman	Benicia Water Company	Solano
Dennis Martin	A. Schilling	San Mateo
Railroad Canyon	Temescal Water Company	Riverside
Kennedy	Kennedy Mining & Milling Co.	Amador
Dallas Warner	Modesto Irrigation District	Stanislaus
Grizzly Creek	Clover Valley Lumber Company	Plumas
Montague City Res.	Montague Water Conservation Dist.	Siskiyou
L. Sherwood	L. Sherwood Country Club	Ventura
Lower Feeley	Pacific Gas & Electric Co.	Nevada

* Enlargement

† New Construction

There are 11 dams under construction on which frequent inspections are being made to assure adherence to the approved plans and specifications.

Inspections are being regularly made on approximately 160 dams which are under repair. Upon completion of this repair work certificates of approval will be issued.

Routine inspections of the remainder of the dams are made in accordance with the provision of the Dam Act providing for supervision over maintenance and operation.

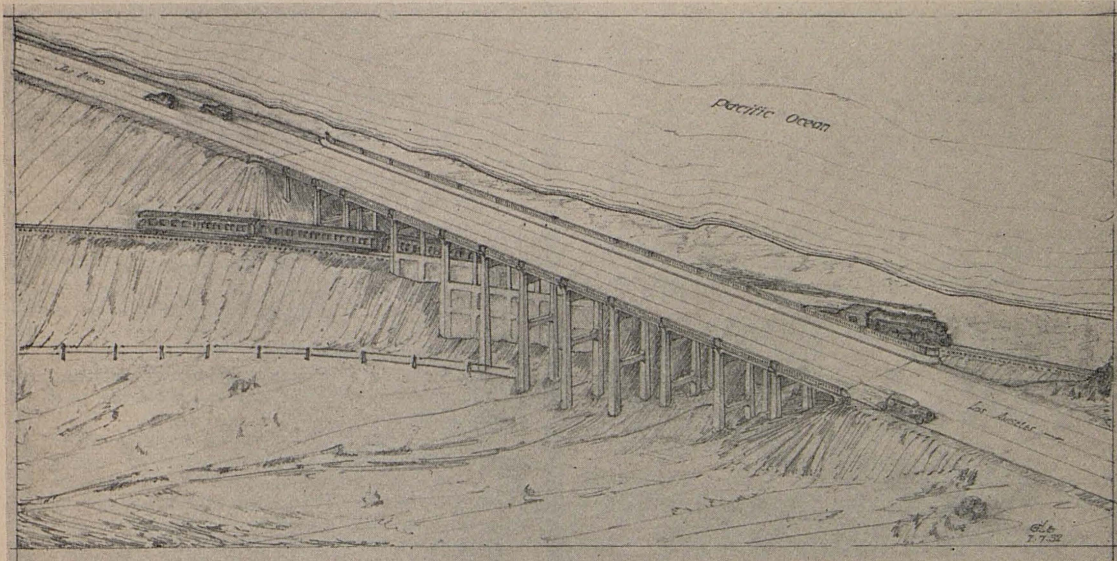
Sex a Difference

Man criticises woman for her extravagance, but she never wastes two dollars' worth of shot-gun shells in order to get a twenty-cent rabbit.—*Louisville Times.*

Nor uses twenty gallons of gasoline and pays \$25 boat hire to get where the fish aren't.—*Houston Post-Dispatch.*

Nor goes into a restaurant and buys a 25-cent meal and gives the waiter a 25-cent tip because he smiled at her.—*Florida Times-Union.*

Sorrento Overhead Involved Problems



ALL SKEWED are the two 58-foot girder spans over the railroad in the Sorrento Canyon grade separation structure. This arrangement is made necessary by the railroad route on a 3-degree curve intersecting the highway at an angle of 27 degrees, 30 minutes.

By M. J. DWYER, Assistant Bridge Designing Engineer

AN IMPORTANT improvement in alignment and grade will soon be realized by the motorists in the line change on the Coast Highway at Sorrento Canyon near Del Mar on Route 2, San Diego County, near the city limits of San Diego. Approximately 10 miles of winding roadway with several small radius curves and steep grades will be replaced by 9.4 miles of comparatively straight alignment and uniformly low grades.

At this location the highway crosses under the Atehison, Topeka & Santa Fe Railway through a subway which has inadequate approach grades and alignment. After a thorough consideration of the relocation it was found more feasible and economical to make an overhead crossing with an entirely new line. The present subway, however, will not be abandoned as it will serve the local travel in Sorrento Canyon and separate it from the through highway.

PROVISIONS FOR WIDENING

The new grade separation will be several thousand feet north of the present subway

and will consist of a reinforced concrete structure 550 feet long with a 42-foot width roadway and a 4-foot sidewalk.

The railway alignment at the point of intersection with the highway is located on a 3 degree curve. The angle of intersection of the highway with the railway is 27 degrees 30 minutes. This small angle of intersection lead to some difficult problems.

SKEWED SPANS

The structure directly over the railway tracks consists of two 58-foot skewed girder spans resting on six column bents. The remainder of the structure consists of 40-foot reinforced concrete girder spans resting on four column bents normal to the roadway.

The foundation material is of variable character and after considerable investigation it was found necessary to support the bents at the south end of the structure on concrete piles, but bents at the north end were supported on spread footings. The comparatively high bents is a structural feature that required careful study, making it necessary to design columns with a slight batter to obtain proper appearance.

Plans Approved in September for Dam Alterations, Repairs

APPLICATIONS FILED

Applications for approval of dams built prior to August 14, 1929, filed with the State Department of Public Works, Division of Water Resources, during the month of September, 1932.

LASSEN COUNTY—Boot Lake Dam No. 1226. Victor Christensen and F. R. Humphrey, Likely, owner; earth, 3 feet above streambed with a storage capacity of 700 acre-feet, situated on Boot Lake Creek, tributary to Red Rock Creek in Sec. 15, T. 37 N., R. 16 E., M. D. B. and M.

Applications for approval of plans and specifications for repair or alteration of dams filed with the State Department of Public Works, Division of Water Resources, during the month of September, 1932.

NEVADA COUNTY—Lower Feeley Lake Dam, No. 97-35. Pacific Gas and Electric Company, San Francisco, owner; earth and rock, situated on Fall Creek, tributary to South Yuba River in Sec. 29, T. 18 N., R. 12 E., M. D. B. and M.

SISKIYOU COUNTY—Hart Dam, No. 181. E. C. and Kate C. Hart, Montague, owner; earth, situated on Martin Creek, tributary to Little Shasta River in Sec. 19, T. 45 N., R. 4 W., M. D. B. and M.

KERN COUNTY—Diversion No. 1 Dam No. 104-2. Southern California Edison Company, Los Angeles, owner; gravity, situated on Kern River in Sec. 5, T. 28 S., R. 31 E., M. D. B. and M.

PLUMAS COUNTY—Grizzly Creek Dam No. 285. Clover Valley Lumber Company, Loyalton, owner; slab and buttress, situated on Grizzly Creek, tributary to Middle Fork Feather River in Sec. 20, T. 23 N., R. 14 E., M. D. B. and M.

SIERRA COUNTY—Fairplay Lower Dam No. 296-4. J. I. McCullough, El Paso, Texas, owner; earth, located in T. 20 N., R. 9 E., M. D. B. and M.

SAN BENITO COUNTY—Paicines Dam No. 652. San Benito Land and Water Company, Hollister, owner; earth, situated on tributary to Pajaro River.

PLANS APPROVED

Plans and specifications for the construction or enlargement of dams approved by the State Department of Public Works, Division of Water Resources, during the month of September, 1932.

PLACER COUNTY—Gladhaven Dam No. 327. Carrie A. Gladding, Lincoln, owner; buttress, 19 feet above streambed with a storage capacity of 200 acre-feet, situated on Coon Creek, tributary to Feather River in Sec. 21, T. 13 N., R. 6 E., M. D. B. and M. For storage purposes, for irrigation and domestic use.

SIERRA COUNTY—Canyon Creek Dam No. 293. H. L. Berkey, Tucson, Ariz., owner; rock crib, 15 feet above streambed with a storage capacity of 8 acre-feet, situated on Canyon Creek, tributary to North Fork Yuba River in Section 18, T. 21 N., R. 10 E., M. D. B. and M. For diversion purposes, for mining use.

MODOC COUNTY—J. L. Porter Dam No. 162. Pearl F. Porter, Alturas, owner; earth and rock, 22 feet above streambed with a storage capacity of 250 acre-feet, situated on tributary of Parker Creek in Sec. 12, T. 42 N., R. 13 E., M. D. B. and M. For storage purposes, for irrigation use.

Plans for the repair or alteration of dams approved by the State Department of Public Works, Division of Water Resources, during the month of September, 1932.

PLUMAS COUNTY—Grizzly Creek Dam No. 285. Clover Valley Lumber Company, Loyalton, owner; slab and buttress, situated on Grizzly Creek, tributary to Middle Fork Feather River in Sec. 20, T. 23 N., R. 14 E., M. D. B. and M.

SISKIYOU COUNTY—Montague City Reservoir No. 60-2. Montague Water Conservation District, Montague, owner; earth, located in Sec. 23, T. 45 N., R. 6 W., M. D. B. and M.

VENTURA COUNTY—Lake Sherwood Dam No. 765. Lake Sherwood Country Club, Los Angeles, owner; gravity, situated on Triunfo Creek, tributary to Malibu Creek, in Sec. 27, T. 1 N., R. 19 W., S. B. B. and M.

In Memoriam

Former associates were shocked during the past month to learn of the death of James M. Brockway, formerly with the Division of Water Resources from 1927 to 1931 as an Assistant Hydraulic Engineer. He was drowned on September 14th while at work on the Rio Grande River. Details of the accident are lacking, but it is reported that an outboard motorboat that he was piloting under flood conditions hit a snag and capsized.

Brockway left the employ of the Division in August, 1931, to accept a position with the International Water Commission at El Paso, Texas, and at the time of his death held a responsible position with headquarters at San Benito, Texas. He was a graduate of the University of California with the class of 1927 and had a varied experience in the hydraulic engineering field. While with the Division of Water Resources he was engaged on the work of the Sacramento-San Joaquin Water Supervisor.

"Jim's" conscientious work, winning smile and likeable personality had won for him a host of friends who feel most keenly his loss practically at the threshold of his career. It was only a few months ago that the announcements were received of Jim's marriage.

NEW MENTAL HOSPITAL MASTER PLAN ADOPTED FOR 6000 PATIENT CAPACITY

(Continued from page 15)

and concrete roof with clay tile covering and will therefore be fire and deterioration resisting throughout.

The amount of money at present available is \$1,000,000. About \$700,000 of this amount will be used for buildings, the remainder being required for roads and walks, sewage disposal, sewage collection, water development and distribution, gas, electric and telephone services, flood control, fire protection, ground lighting, interior furnishings and for equipment for dairy, laundry, bakery, kitchen and landscaping.

The total sum of \$7,000,000 will probably be required to complete the entire 6000-patient institution and the length of time involved in ultimate completion will of course depend on the demand for additional beds and the provision of funds.

The site being only five miles from the coast in a straight line, the climate is cool in summer and mild in winter which will make the new institution unique as having a somewhat more equable climate than any of the other six existing State mental hospitals.

PICTURESQUE SETTING

The natural contours of the building site itself and the relation to it of the surrounding hills are such as to provide a most picturesque setting for the buildings which as already stated will be located on rising ground and will be approached from the entrance lying on somewhat lower ground. These hills besides adding to the picturesqueness of the building group will provide effective protection against such winds and fogs as usually occur along the coast.

STATE OF CALIFORNIA

Department of Public Works

HEADQUARTERS: PUBLIC WORKS BUILDING, ELEVENTH AND P STS., SACRAMENTO

JAMES ROLPH, JR.-----Governor

EARL LEE KELLY-----Director

ERIC CULLENWARD-----Deputy Director

DIVISION OF HIGHWAYS

CALIFORNIA HIGHWAY COMMISSION

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 C. H. PURCELL, State Highway Engineer, Sacramento
 JOHN W. HOWE, Secretary
 HUGH K. McKEVITT, Attorney, San Francisco

HEADQUARTERS STAFF, SACRAMENTO

G. T. McCOY, Principal Assistant Engineer
 L. V. CAMPBELL, Office Engineer
 T. E. STANTON, Materials and Research Engineer
 FRED J. GRUMM, Engineer of Surveys and Plans
 C. S. POPE, Construction Engineer
 T. H. DENNIS, Maintenance Engineer
 F. W. PANHORST, Acting Bridge Engineer
 R. H. STALNAKER, Equipment Engineer
 E. R. HIGGINS, Comptroller

DISTRICT ENGINEERS

H. S. COMLY, District I, Eureka
 F. W. HASELWOOD, District II, Redding
 CHARLES H. WHITMORE, District III, Sacramento
 J. H. SKEGGS, District IV, San Francisco
 L. H. GIBSON, District V, San Luis Obispo
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 S. V. CORTELYOU, District VII, Los Angeles
 E. Q. SULLIVAN, District VIII, San Bernardino
 J. W. VICKREY (Acting), District IX, Bishop
 R. E. PIERCE, District X, Sacramento
 General Headquarters, Public Works Building,
 Eleventh and P Streets, Sacramento, California

DIVISION OF WATER RESOURCES

EDWARD HYATT, State Engineer, Chief of Division
 J. J. HALEY, Jr., Administrative Assistant
 HAROLD CONKLING, Deputy in Charge Water Rights
 A. D. EDMONSTON, Deputy in Charge Water
 Resources Investigation
 R. L. JONES, Deputy in Charge Flood Control and
 Reclamation

GEORGE W. HAWLEY, Deputy in Charge Dams
 SPENCER BURROUGHS, Attorney
 EVERETT N. BRYAN, Hydraulic Engineer, Water
 Rights
 A. N. BURCH, Irrigation Investigations
 H. M. STAFFORD, Sacramento-San Joaquin Water
 Supervisor
 GORDON ZANDER, Adjudication, Water Distribution
 KATHERINE A. FEENY, Chief Clerk
 MABEL PERRYMAN, Secretary

DIVISION OF ARCHITECTURE

GEO. B. McDOUGALL, State Architect, Chief of
 Division
 P. T. POAGE, Assistant Chief
 W. K. DANIELS, Administrative Assistant

HEADQUARTERS

H. W. DeHAVEN, Supervising Architectural Drafts-
 man
 C. H. KROMER, Principal Structural Engineer
 CARLETON PIERSON, Supervising Specification
 Writer
 C. E. BERG, Supervising Estimator Building Con-
 struction
 J. W. DUTTON, Principal Engineer, General Con-
 struction
 W. H. ROCKINGHAM, Principal Mechanical and
 Electrical Engineer

DIVISION OF CONTRACTS AND RIGHTS OF WAY

C. C. CARLETON, Chief
 FRANK B. DURKEE, General Right of Way Agent
 C. R. MONTGOMERY, General Right of Way Agent

DIVISION OF PORTS

Port of Eureka—William Clark, Sr., Surveyor
 Port of San Jose—Not appointed
 Port of San Diego—Edwin P. Sample

