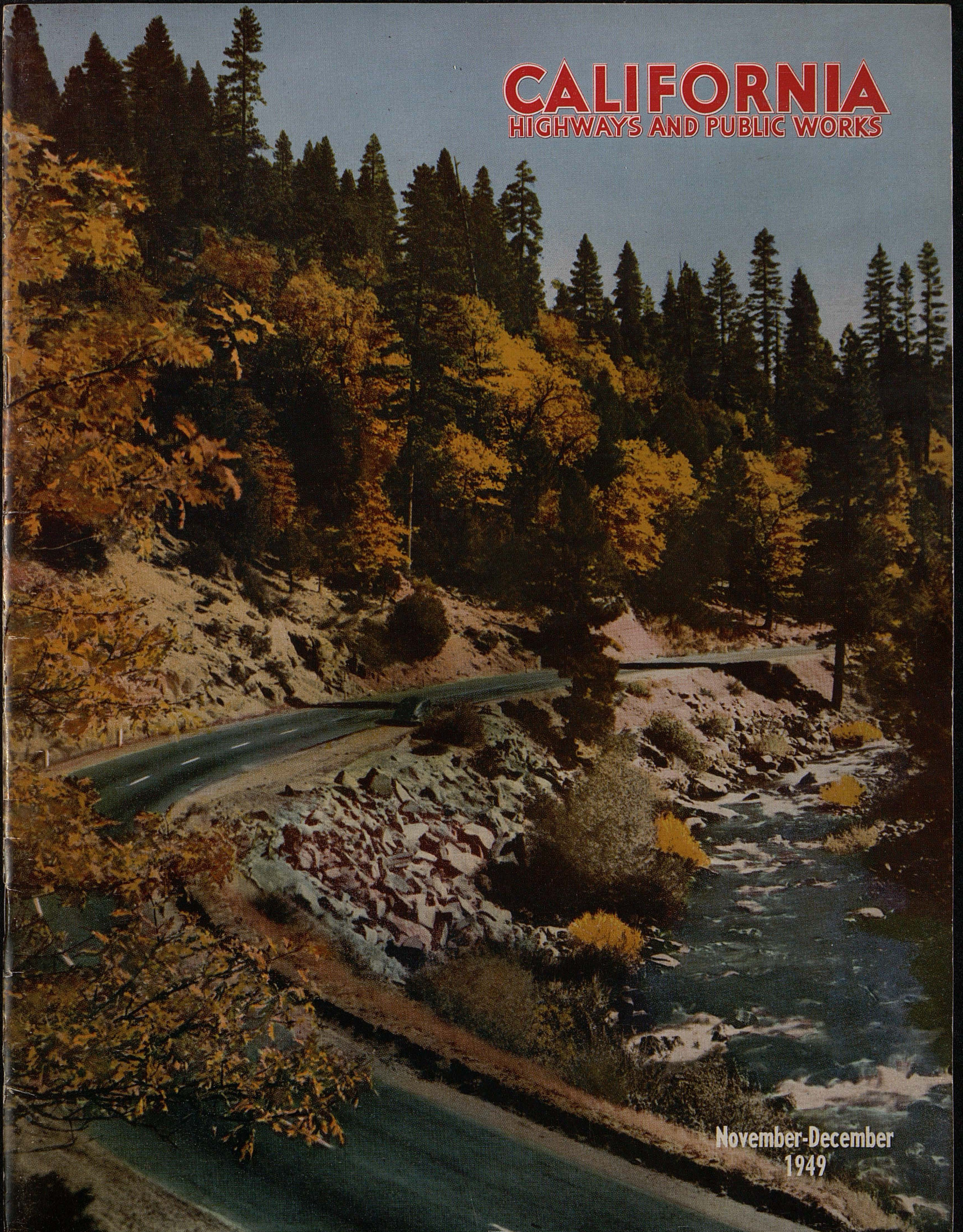


CALIFORNIA

HIGHWAYS AND PUBLIC WORKS



November-December
1949

inches

centimeters

Don Williams

Colors by Munsell Color Services Lab

D50 Illuminant, 2 degree observer

Density

Golden Thread

1	2	3	4	5	6	7	8	9	10	11 (A)	12	13	14	15
39.12	65.43	49.87	44.26	55.56	70.82	63.51	39.92	52.24	97.06	92.02	87.34	82.14	72.06	62.15
13.24	18.11	16.11	-13.80	9.82	-33.43	34.26	11.81	48.55	-0.40	-0.60	-0.75	-1.06	-1.19	-1.07
15.97	16.72	12.29	23.35	-24.49	3.35	39.92	46.97	18.51	1.13	0.23	0.21	0.43	0.23	0.19

16 (M)	17	18 (B)	19	20	21	22	23	24	25	26	27	28	29	30
49.25	38.62	28.86	16.19	8.29	3.44	31.41	72.46	72.95	29.37	54.91	43.96	82.74	52.79	50.87
-0.16	-0.18	0.54	-0.05	-0.81	0.23	20.98	-24.65	16.83	13.06	-36.91	55.00	3.45	59.95	-27.17
0.01	-0.04	0.69	0.73	0.19	0.49	-19.43	59.53	69.59	-49.49	38.77	38.61	67.23	-42.74	-29.46

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0.04	0.09	0.15	0.22	0.36	0.51

California Highways and Public Works

Official Journal of the Division of Highways,
Department of Public Works, State of California

CHARLES H. PURCELL
Director

GEORGE T. McCOY
State Highway Engineer

KENNETH C. ADAMS, Editor
HELEN HALSTED, Associate Editor

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	Page
Autumn Splashes Vivid Colors in the Sierra—This Photo Shows Scenic Section of U. S. 50 near Kyburz, El Dorado County	Cover
<small>Taken by Merritt R. Nickerson, Chief, Photographic Section, Department of Public Works</small>	
Santa Cruz Freeway Dedicated, Illustrated	1
F. A. S. Funds Build Three Tehama Spans, Illustrated	8
Public Contracts	9
<small>By C. R. Montgomery, Chief Counsel, Department of Public Works</small>	
Smith River Bridge, Illustrated	11
<small>By N. E. Spicklemire, Associate Bridge Engineer</small>	
Freshwater Lagoon, Illustrated	12
<small>By L. R. Redden, District Office Engineer</small>	
Enviably Record Made by Lester H. Gibson, Illustrated	15
Expansion Failures Corrected, Illustrated	17
Maxwell Bridge in Napa County Dedicated, Illustrated	18
<small>By R. P. O'Neill, Assistant County Engineer, Napa County</small>	
Traffic Count Shows 7.4 Percent Increase	21
<small>By George T. McCoy, State Highway Engineer</small>	
F. A. S. Project in Contra Costa County, Illustrated	22
<small>By J. W. Barkley, Contra Costa County Road Commissioner</small>	
Prison Labor Road Camps in California, Illustrated	24
<small>By G. A. Tilton, Jr., Supervising Highway Engineer</small>	
Federal Aid	28
<small>By C. H. Purcell, Director of Public Works</small>	
Boost for Freeways, Illustrated	29
<small>By Robert L. Bangs, Right of Way Agent</small>	
Folsom By-pass, Illustrated	34
<small>By Harvey A. Towne, Associate Highway Engineer</small>	
Erosion Control Methods in California, Illustrated	36
<small>By H. Dana Bowers, Supervising Landscape Architect</small>	
Pismo Beach Freeway, Illustrated	42
<small>By Lester H. Gibson, District Engineer</small>	
Resolutions Define Highway Policies	44
State Engineers Given Award of Merit, Illustrated	45
W. E. Peck Retires, Illustrated	46
Out of Mail Bag	50
Harbor Parkway Facts, Illustrated	52
Highway Bids and Awards	54
U. S. 99 Improved, Illustrated	57
Mobile Offices, Illustrated	62

Santa Cruz Freeway

Three Million Dollar Project Dedicated

WITH GOVERNOR EARL WARREN as their guest of honor, citizens of Santa Cruz County on November 4th celebrated the opening to traffic of the \$3,000,000 link of the Watsonville-Santa Cruz Freeway. They dedicated with appropriate ceremonies the section of the new highway from Rob Roy Junction to Morrissey Boulevard in Santa Cruz.

Some two hundred invited guests, including State, county and city officials, members of the chambers of commerce of the county, improvement clubs and civic leaders were tendered a luncheon at Deer Park Tavern at Rob Roy preceding the formal ribbon cutting by Mayors Sam C. McNeely of Santa Cruz, C. H. Baker of Watsonville, and Harlan P. Kessler of Capitola, who were assisted by Santa Cruz Fiesta Queen Vera Birchfield and Miss Watsonville, Lucille Matiasovich.

Governor Heads Speakers

The Governor headed a list of speakers which included State Highway Engineer George T. McCoy, Col. Jno. H. Skeggs, Assistant State Highway Engineer, San Francisco, who supervised the construction of the highway, and State Senator H. Ray Judah of Santa Cruz. Director of Public Works C. H. Purcell was prevented by illness from attending the dedication.

In a brief address, the theme of which was traffic safety, the Governor said:

"This beautiful freeway is another milestone in the development of a State Highway System that will relieve present congestion, eliminate serious accidents, facilitate traffic and make driving on our highways pleasant. We are proud of it because it will serve the people of Santa Cruz well. When eventually connected from Morrissey

Avenue to the Los Gatos Highway it will give the people of California in almost unlimited numbers the opportunity to enjoy with you of Santa Cruz the beauties and pleasurable activities of your lovely city.

To Extend Highway

"I wish that extension could be done today, but it cannot, because since the war the State has spent \$4,200,000 on highway construction in Santa Cruz County, \$3,000,000 of which was for this freeway. But it will be done as soon as your share of state highway funds will permit it. I hope it will be soon."

Governor Warren pointed out that if the four and one-half million motor vehicles now registered in California were placed bumper to bumper, they would fill six lanes of an imaginary highway from Santa Cruz to New

On speakers platform at Santa Cruz Freeway dedication. LEFT TO RIGHT—Governor Earl Warren, Col. Jno. H. Skeggs, Senator H. Ray Judah and State Highway Engineer George T. McCoy



York. The Governor deplored the fact that approximately 3,600 persons are killed and 90,000 injured annually on California highways.

Senator Judah, former Chairman of the State Highway Commission, described highway needs in the southern part of Santa Cruz County, and urged complete realignment and modification of the highway routes between Santa Cruz and Boulder Creek, and between Boulder Creek and State Route 42 north of Waterman Gap.

Freeways Necessary

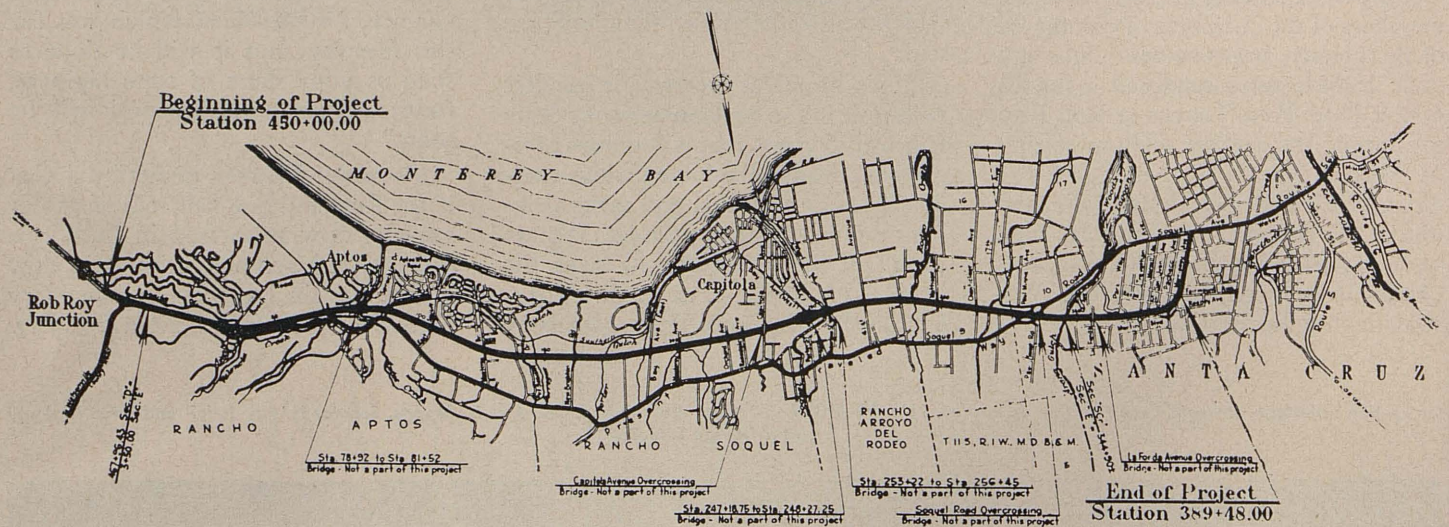
"At the present, and for a considerable number of years into the future, there will be controversial conflicts between the California highway commission and groups of citizens, business-

contract in Santa Cruz. Prior to advertising the project, the State had obtained options on natural gravel deposits at Soquel Creek. The contractor was quick to see the advantages of using this material and the lower costs obtainable were reflected in his bid. Approximately 90,000 tons of imported borrow, 109,000 tons of crusher run base and 50,000 tons of plant-mixed surfacing were produced from this source.

In general, the freeway design consists of a 12-foot inner and an 11-foot outer lane in each direction. The entire project is divided by a median strip varying from 6 feet in curbed areas to 32 feet in the open sections. Eight-foot plant-mixed outer shoulders and 2-foot plant-mixed inner

drainage, the contractor was required to place approximately 14,500 lineal feet of culvert pipe, ranging from 12 inches to 48 inches in diameter. Approximately 6,285 lineal feet of 8-inch P.M.P. was placed to control sub-surface drainage.

Highway lighting was provided at all major intersections and overcrossings and a highway signal and lighting system was installed at the Morrissey Boulevard-Soquel Avenue intersection. All excavation and embankment slopes on this project were blanketed with approximately 3 inches of selected top soil into which straw mulch cover material was incorporated. Slopes were then seeded with western rye grass to control erosion. Some landscape planting is proposed for next year.



men, taxpayers, revolving around the location and construction of freeways.

The man who is a critic of freeway construction today, based on selfish reasons or for his personal or political gratification, will, in my opinion, a few years from now feel very much ashamed of himself when he begins to feel—through personal experience in many cases—the value of driving with safety and speed."

Music for the celebration was furnished by the high school bands of Watsonville and Santa Cruz, which won praise from Governor Warren.

Low Cost Aggregates

Low cost production of aggregates was a feature of the N. M. Ball Sons

shoulders were constructed throughout with 3-foot plant-mixed ditches and paved dikes as required. In placing these shoulders the contractor used a Murphy all-purpose spreader equipped with a job-designed and constructed side extension that placed the shoulder and the side ditch or dike paving in one operation.

Roadway Excavation

The roadway excavation on this contract was approximately 807,500 cubic yards including approximately 26,000 cubic yards of unsuitable material removed below grade and an additional 26,000 cubic yards of selected material placed in the sub-excavated areas. In order to properly care for surface

Morrissey Avenue

At the entrance to Santa Cruz it was necessary to reconstruct Morrissey Avenue to a four-lane divided street to properly provide for the freeway traffic. This improvement was accomplished by narrowing an existing wide dividing strip to a 14-foot curbed width, placing 9 inches of crusher run base in the widened portion and a 3-inch plant-mixed surface over the entire area.

This newly completed route provides a saving of approximately four-tenths of a mile in distance between Rob Roy Junction and Santa Cruz and the total curvature has been reduced by approximately 914 degrees with an

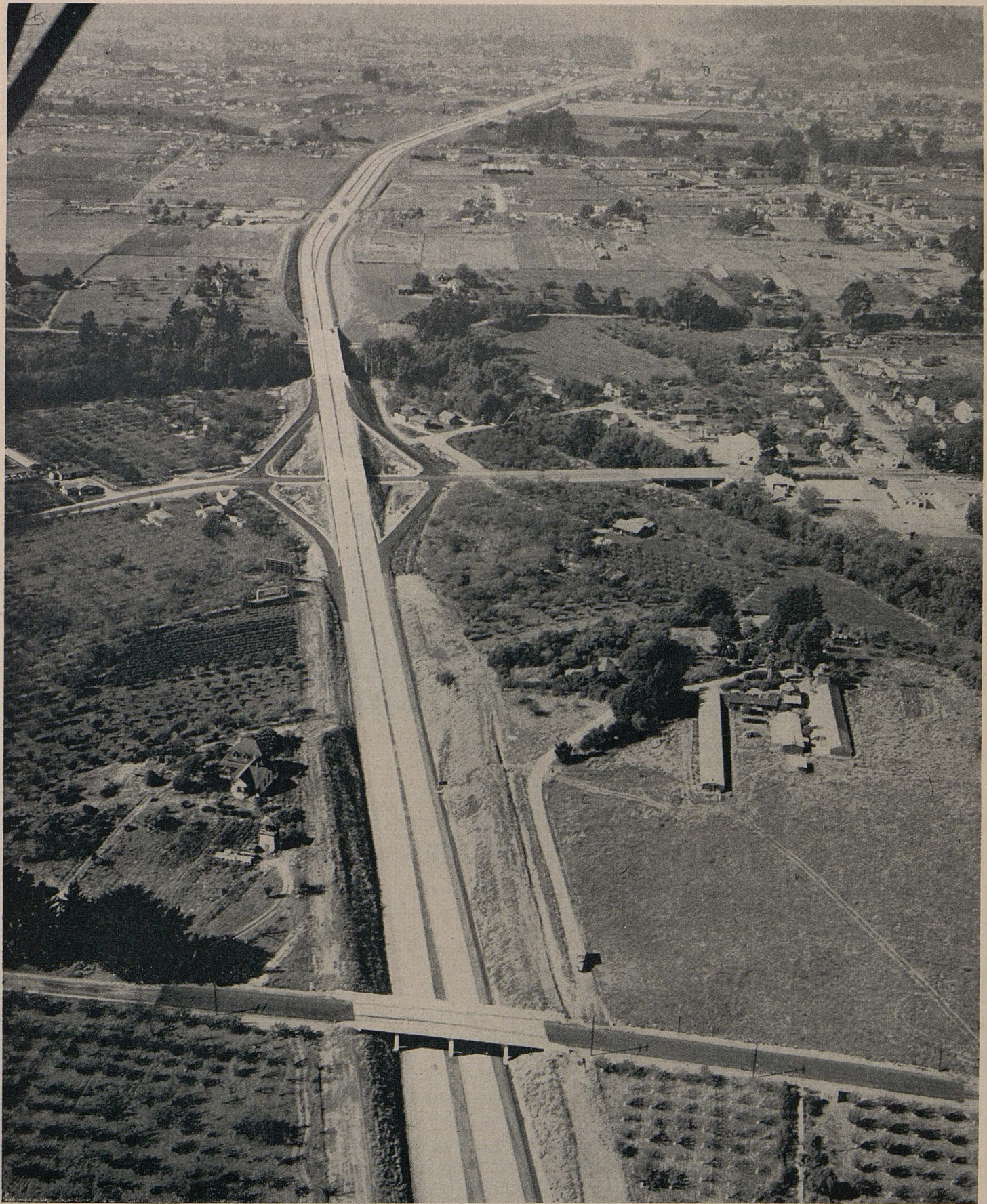
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Aptos Creek Bridge looking toward South Aptos Railroad Underpass with North Aptos Underpass in the foreground. Town of Aptos in left center
and Public Works



This aerial photograph shows the Soquel Road overcrossing and Paul Sweet Road interchange



Capitola overcrossing looking toward Bay Avenue undercrossing and Soquel Creek Bridge



Governor Earl Warren poses with drum majorettes and members of Santa Cruz and Watsonville High School Bands

Santa Cruz Freeway

Continued from page 2 . . .

increase in minimum radius curvature of from 300 feet on the old route to 2,000 feet on the new.

As a measure of the service to be expected from this improved facility, the latest 16-hour traffic counts taken on July 17 and July 18, 1949, show a Sunday traffic of 20,633 vehicles and a Monday count of 15,094 vehicles. These counts expand to a total estimated vehicles per 24-hour day of 23,314 for Sunday and 17,055 for Monday.

The work was done under the general direction of Jno. H. Skeggs, Assistant State Highway Engineer. A. Walsh was the Resident Engineer in charge of all field work.

New Santa Cruz Freeway Typical Of Progress Being Made in State

State Highway Engineer George T. McCoy delivered the following address at the dedication of the new freeway between Rob Roy Junction and Santa Cruz.

TRANSPORTATION has always been one of the bases of the economy of a nation. In the present era, highway transport is a vital phase of complete trans-

portation. In California, with its great distances and its varied terrain, this fact is particularly true. The economy of the State rests to a very considerable degree upon the adequacy of highway facilities and the main arteries of such facilities are incorporated in the State Highway System.

While we take pride in the comprehensive network of state routes which bind California into a unit we are, nevertheless, completely aware of the inadequacies of the State Highway System. The greatest problem confronting state highway officials today

is provision of highways which are adequate for the ever increasing volumes of traffic.

Before the war, state highway development was lagging behind the needs of traffic. Automotive advances were so rapid and constant between 1920 and 1940 that the slower processes of highway construction fell behind. The rate of obsolescence in construction standards rose constantly with accompanying increases in congestion. At the outbreak of the war California had a population of about 6½ million and a total motor vehicle registration of less than 3 million. Today, the population is well over 10 million and motor vehicle registration is nearly 4½ million.

Postwar Program

The crowded condition of California highways today is evidence of these increases in population, cars and trucks. Throughout the past decade, efforts of the state highway organization have been concentrated upon providing facilities to care for the ever mounting traffic volumes. During the war, federal curtailment of construction presented the opportunity for preparation of plans and acquisition of right of way for a large postwar highway development program. With the close of hostilities, this program was immediately put under way, financed with accumulated state funds and postwar federal aid apportionments. This postwar highway construction program, which was of unprecedented proportions, is now a matter of history, all projects having been completed.

In order to continue this postwar rate of progress in providing more adequate traffic facilities, the 1947 State Legislature, at the instance of Governor Warren, passed the Collier-Burns Act which increased and correlated the sorely needed highway revenue at the three levels of government—state, county, and city. The Collier-Burns Act, however, went much farther than mere increase in revenue. For the first time in California highway history, statutory provision was made for long-time planning in highway development.

Freeway Construction

With the impetus given to state highway construction by the postwar pro-

Freeway Highlights

On the 7.65-mile section of the Santa Cruz freeway project between Rob Roy Junction and Morrissey Avenue in Santa Cruz, the first project was for clearing, fencing and construction of eight major structures with a limited amount of grading for structure approaches, and was awarded to Earl W. Heple, of San Jose, in September 1947. This work was completed in May of 1949 at a cost of \$1,448,000.

The second project was awarded to N. M. Ball Sons, of Berkeley, in April, 1948, for grading and paving, and was completed in November of this year at a cost of \$1,324,000.

The third project was a contract for illuminating important intersection roads and was awarded to Granite Construction Company of Watsonville in September of 1948 and completed in August, 1949, at a cost of \$23,000.

The general design of the roadway is four-lane, with division strip varying from six feet in curbed areas to 32 feet in open sections.

The traveled way consists of 11-foot outer and 12-foot inner lanes, with 8-foot improved outside shoulders and 2-foot improved inside shoulders.

The surfacing is 3 inches of plant-mix and 6 inches of crusher run base placed over imported borrow. The imported borrow has a minimum thickness of 6 inches, varying as the quality of the basement soils indicated.

Twenty-four hour traffic projections made in July, 1949, show this route to carry a Sunday traffic of 23,314 vehicles and a Monday count of 17,055 vehicles.

A fourth contract for some landscape work within the limits of this project is programmed for next year at an estimated cost of \$15,000.

This portion of the freeway project terminates at Morrissey Avenue, where a temporary connection to the existing highway route has been made by development of Morrissey Avenue into a four-lane divided street.

Following is a summary of the cost of the various units of this work:

Length—7.65 miles.

Minimum width of right of way—200 feet.

Cost of right of way.....	\$915,000
Major structures and limited grading (Heple contract).....	1,448,000
Grading and paving (N. M. Ball contract).....	1,324,000
Lighting (Granite Construction Co. contract).....	23,000
Preliminary and construction engineering.....	480,000

Total..... \$4,190,000

Cost per mile—\$547,700. Financed by gas tax funds and federal aid funds.

gram, the Division of Highways has been able to maintain the preparation of plans and right of way acquisition on a schedule one to two years ahead of construction budgets.

This important link of freeway along the shore of the Pacific between Watsonville and Santa Cruz which we are dedicating today is typical of the progress being made by the State in meeting the traffic needs of the State Highway System under the widened scope of the Collier-Burns Act.

Quite naturally, the policy of the department is to plan improvements in the priority of traffic congestion, but at the same time holding to an over-all

development of the State Highway System throughout the State. In accomplishing this end, construction of freeway facilities in the urban areas of San Francisco Bay, Los Angeles and San Diego have been preeminent. At the same time consideration has been given to arterial development extending into rural areas from urban centers. Much progress is being accomplished along this line on such routes as U. S. 101, U. S. 99, U. S. 40, U. S. 50, U. S. 60 and other connecting arteries.

One of First Projects

One of the first projects scheduled for freeway development under the

... Continued on page 48

F. A. S. Funds Built Three Tehama Spans

By CHARLES L. SWEET
Senior Bridge Engineer

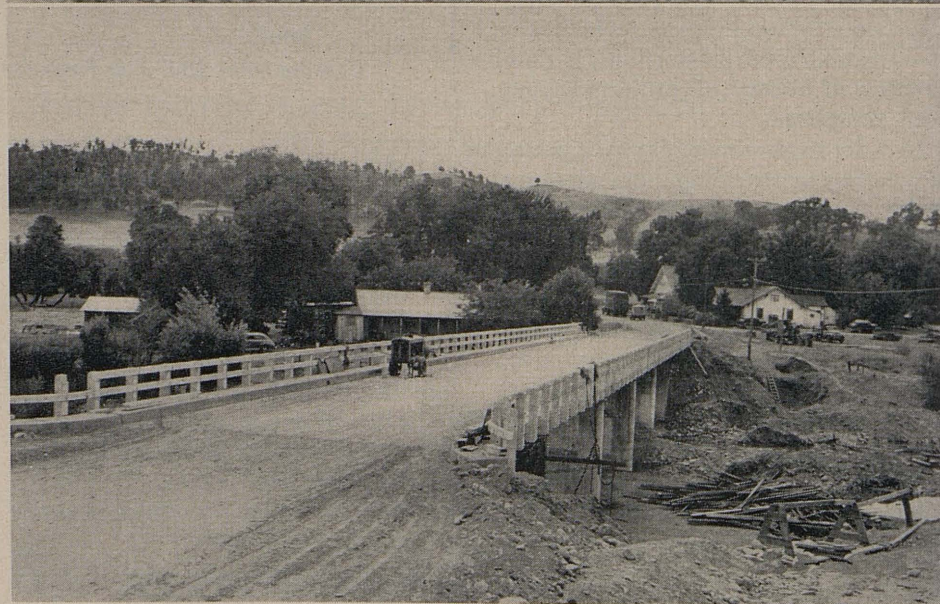
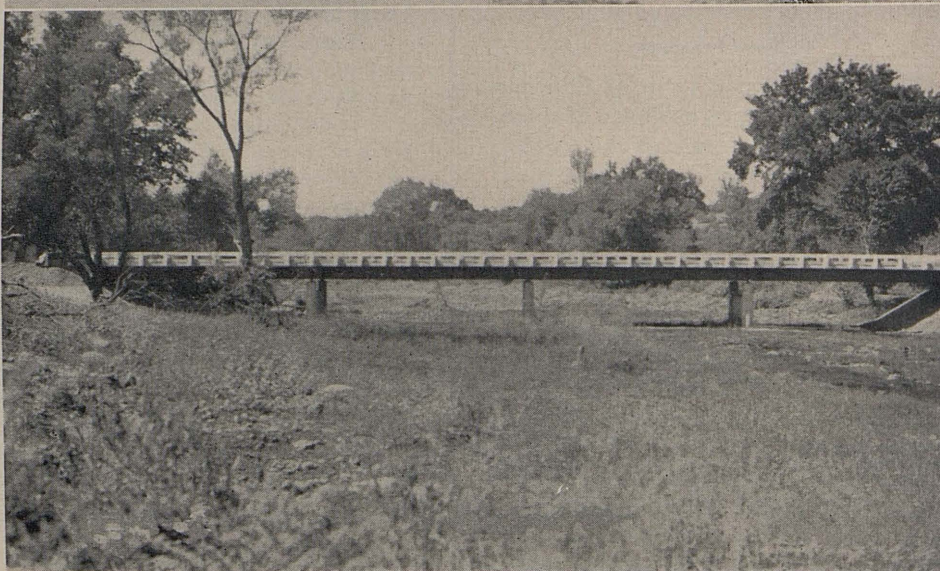
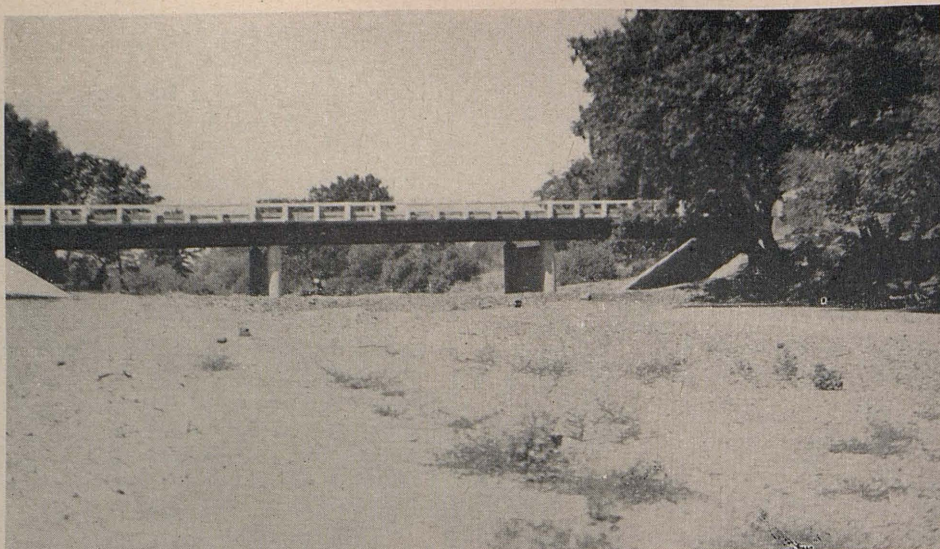
UNDER THE SECOND Federal Aid Secondary bridge project which the Bridge Department of the Division of Highways has administered in Tehama County, three more bridges have been completed. Last year two antiquated steel truss bridges were replaced with new structures of modern design and load capacity. This year three more crossings have been brought up to date. In all cases the local alignment has been materially improved.

About 15 years ago when Tehama County requested the Bridge Department to make an examination of its steel truss bridges, its county road system had nearly 30 light steel truss bridges. These were all of ancient vintage, having been for the most part built around the turn of the century. They were characteristically light steel trusses of varied designs with light timber floor systems and timber trestle approaches. The widths were very inadequate for present-day traffic.

The last three bridges, now completed, are across Reeds Creek near Red Bluff, across Thomes Creek at Paskenta, and across Paynes Creek at Dales Station. These structures were built about 1890 and varied in length from 140 feet for the Reeds Creek Bridge to 235 feet across the bridge at Thomes Creek.

For a total contract price of \$280,000 the three bridges were replaced with 50-foot steel stringer spans having 24-foot roadways and vastly improved alignments. The piers were founded on spread footings and concrete slope paving protects the fills at the abutments from scouring by the streams.

The work was financed from Federal Aid Secondary, State and Chapter 20 Funds. The O'Connor Brothers of Red Bluff were the general contractors. The contract was administered by the Division of Highways Bridge Department with J. H. Horn as Resident Engineer.



UPPER—Reeds Creek Bridge. CENTER—Paynes Creek Bridge. LOWER—Thomes Creek Bridge at Paskenta, showing wreckage of old span on right

Public Contracts

California Law and Court
Decisions Are Summarized

By C. R. MONTGOMERY, Chief Counsel, Department of Public Works

Following is a summary of a talk delivered by Mr. Montgomery at a joint meeting of the County Supervisors Association of California and the County Road Commissioners of California.

ONE OF THE THINGS in which we must all basically be interested is the validity of our contracts for the construction of public works. Certainly, there is good cause for public officers to be concerned as to the legality of such contracts involving, as they do, large sums of money, in the light of the extremely strict rule laid down by the California courts as to personal liability for expenditures under illegal contracts.

As early as 1862 the Supreme Court of this State laid down the rule that a contract made in disregard of a law requiring competitive bidding is absolutely void. The court said that not only could the contractor not enforce the contract, but he could not recover for the reasonable value of the work done and the materials furnished.

Zottman v. San Francisco (1862),
20 Cal. 96.

Right of Taxpayer

In

Mock v. City of Santa Rosa (1899),
126 Cal. 330,

the right of a taxpayer to maintain an action against public officials to compel the repayment by them out of personal funds of moneys spent under an illegal contract, was established. A judgment against the members of a city council for \$165,000 with a credit in the amount of the value of certain water works built under an illegal contract and turned over to the city, was affirmed.

Later cases demonstrated that the plaintiff taxpayer in the Mock case did

not ask for as much as he could have obtained for the city treasury.

In 1915 the Supreme Court in the case of

Osburn v. Stone,
170 Cal. 480,

laid down the proposition that a taxpayer can compel the repayment by public officials into the city treasury of all moneys paid out under an invalid contract without credit for the benefits received by the city thereunder. In that case, among other allegations of illegality, we again find a failure to take competitive bids.

Rule of Accountability

In

County of Shasta v. Moody (1925),
90 Cal. App. 519,

one of the supervisors did certain printing work and sold stationery and other supplies to the county during his term of office. The county sued for the full amount paid out and recovered it, \$5,755.96, plus a 20 percent penalty. This judgment was affirmed, the District Court of Appeal holding that it was not necessary for the county to offer to restore the benefits received from the defendant's work.

While the Shasta County case is not a case of an illegal construction contract, it is one of a line of authorities establishing this strict rule of accountability and is accordingly included in this discussion. The same is true of

Mines v. Del Valle (1927),
201 Cal. 273,

in which officers of the Department of Water and Power of the City of Los Angeles were held accountable personally for moneys expended in advertising or propagandizing a proposed bond issue. In the case last cited the court said that the good faith and honest intention of the public officials was no defense whatsoever.

Illegal Contracts

The latest of these cases is

Miller v. McKinnon (1942),
20 Cal. (2d) 83.

In the Miller case an SRA contract made by Santa Clara County without competitive bidding was involved. It was again held by the Supreme Court that a taxpayer has a right to recover, both from the contractor and from the board of supervisors, as individuals, moneys paid out under an illegal contract.

The rule which we have been discussing is an exceedingly harsh one. It may be of interest to consider the reasoning which has led the courts to adopt a principle of individual responsibility irrespective of the honesty and good faith of the officers. The reasoning of the court is perhaps best set out in

Osburn v. Stone, *supra*,

wherein the Supreme Court stated the contentions for the defendants and disposed of them (at page 483 of the reported opinion) as follows:

Supreme Court Decision

"The argument here advanced by respondent is that the city council had general jurisdiction over and general power to do all the things complained of and that 'the lower court properly held that it would become utterly impossible to induce good and responsible men to serve the public in an official capacity if the courts of this state should sanction an action of this kind by which it is sought to declare a public official's private property forfeited when he has done no wrong, and there is no showing that the taxpayers of the city have not received full value for every cent of money expended. It would, therefore, be an absolute contravention of sound public policy to deprive cities of the public services, in an official capac-

ity, of their responsible citizens of substance who might, at any time, be made the victims of such an outrageous action as this at the instance of some spiteful and politically aggrieved person.' There is a modicum of truth in this, but only a modicum. The converse of the argument is that the powers of municipal officers are well defined. Their modes of procedure in all matters of expenditure are pointed out with particularity. They are given by law a legal adviser, and, if not, are fully empowered to employ one. There is no occasion whatsoever for their taking any step without such advice. There is no reason for their ever making any illegal expenditure of the public's moneys. To countenance the making by these officials of an illegal expenditure in one case, is to open wide the door for like expenditures in every case. And even if it can be truly said that in a specific instance the citizens and taxpayers have received the benefit of the expenditure, this by no means answers the objection that the expenditure itself was illegal. Let us use but one illustration. Charters usually call for competitive bidding on contracts involving the expenditure of moneys over a fixed amount. Assume that such a contract is let by the council without the required competitive bidding; assume further that the contract has been properly performed, who shall say that the price at which the contract was so let was the lowest reasonable price that could have been obtained if bids had been called for, and who will not at once say that to permit this is to open wide the door to favoritisms of all kinds, the very prevention of which was one of the important purposes of the law?"

Caution Urged

The presumption that every one knows the law is about as far removed from actual fact as any presumption made by the law. Numerous five-to-four decisions by the highest court in the land demonstrate that every one does not know what the law is. The responsibility of counsel for public officers handling large sums of money on construction contracts is admittedly

great when it is remembered how disastrous the consequences of an error as to the law could be to the officers whom they represent. The lesson that we can learn from these cases is one of caution. The courts are very strict in their enforcement of competitive bidding statutes.

Reams v. Cooley (1915),
171 Cal. 150.

For instance, in

Ertle v. Leary (1896),
114 Cal. 238,

the supervisors called for bids on plans and specifications to be prepared and furnished by the bidder as a part of his bid. This was held to be illegal, as there could be no competition with each bidder bidding on a different plan.

Competitive Bidding Required

In

Swasey v. County of Shasta (1903),
141 Cal. 383,

a statute requiring competitive bidding on public works was held applicable to a fence, the court holding that since competitive bidding is a salutary practice, the word "building" would be interpreted as including "fence".

In the Santa Clara County case of *Miller vs. McKinnon*, supra, the court held that bunkers, hoists and other works for producing gravel from a county quarry were buildings, so as to require competitive bidding under a like statute.

In

Cowell Lime & Cement Co. v. Williamson (1920), 182 Cal. 691,

it was held that a competitive bidding statute was applicable to cement purchased by the county and furnished by it to its highway contractor. These cases indicate the liberal application which the courts will give to competitive bidding statutes and the strictness of the courts in requiring compliance with the statutes.

The obvious thing which we can learn from these cases is to err on the side of caution. I cannot agree with the reasoning in the Osburn case that since the public officials are given a legal adviser there is no reason for their ever making any illegal expenditure of the public moneys. However, the advisability of an officer's consulting his

legal adviser is indicated just as plainly as the necessity for conservative opinion is indicated to the lawyer. In other words, in cases of doubt, call for bids.

Splitting Jobs

Before leaving the subject of competitive bidding, the subject of splitting jobs so as to come under the amount requiring competitive bidding should be discussed.

In

Miller v. McKinnon, supra,

Mr. Justice Carter stated that on the trial of the case the defendants could offer proof that the labor and materials were furnished on more than one job, each job being of an amount not to require competitive bidding, but the learned justice followed with this statement (20 Cal. (2d) 94):

"It must be true that the salutary public policy declared by that section (Section 4041.18 Political Code, now 25450 to 25463, inclusive, Government Code) may not be thwarted by the device of splitting a job into many items, each calling for an expenditure below the prescribed amount in excess of which competitive bidding is required."

An interesting case on this point is

Brown v. Bozeman (1934),
138 Cal. App. 133.

Case of School Trustees

In that case the officers of a school district started out to make certain minor improvements on the school grounds. Once they started improving the grounds one thing led to another, so that finally, under various small contracts, they had spent on the various improvements a total of \$8,714. No competitive bids were taken, although the School Code required competitive bids for contracts over \$500. Each of the contracts was under \$500. It was held that there was no showing of any intention on the part of the school trustees at any one time to construct all of these improvements—rather, that the evidence indicated that each job was decided upon independently and not as a part of one general scheme. The judgment against the trustees was reversed.

The subject of splitting is an interesting one, as it is often necessary, by

... Continued on page 59

Smith River Bridge

*New Span Replaces One
Constructed Back in 1914*

By N. E. SPICKLEMIRE, Associate Bridge Engineer

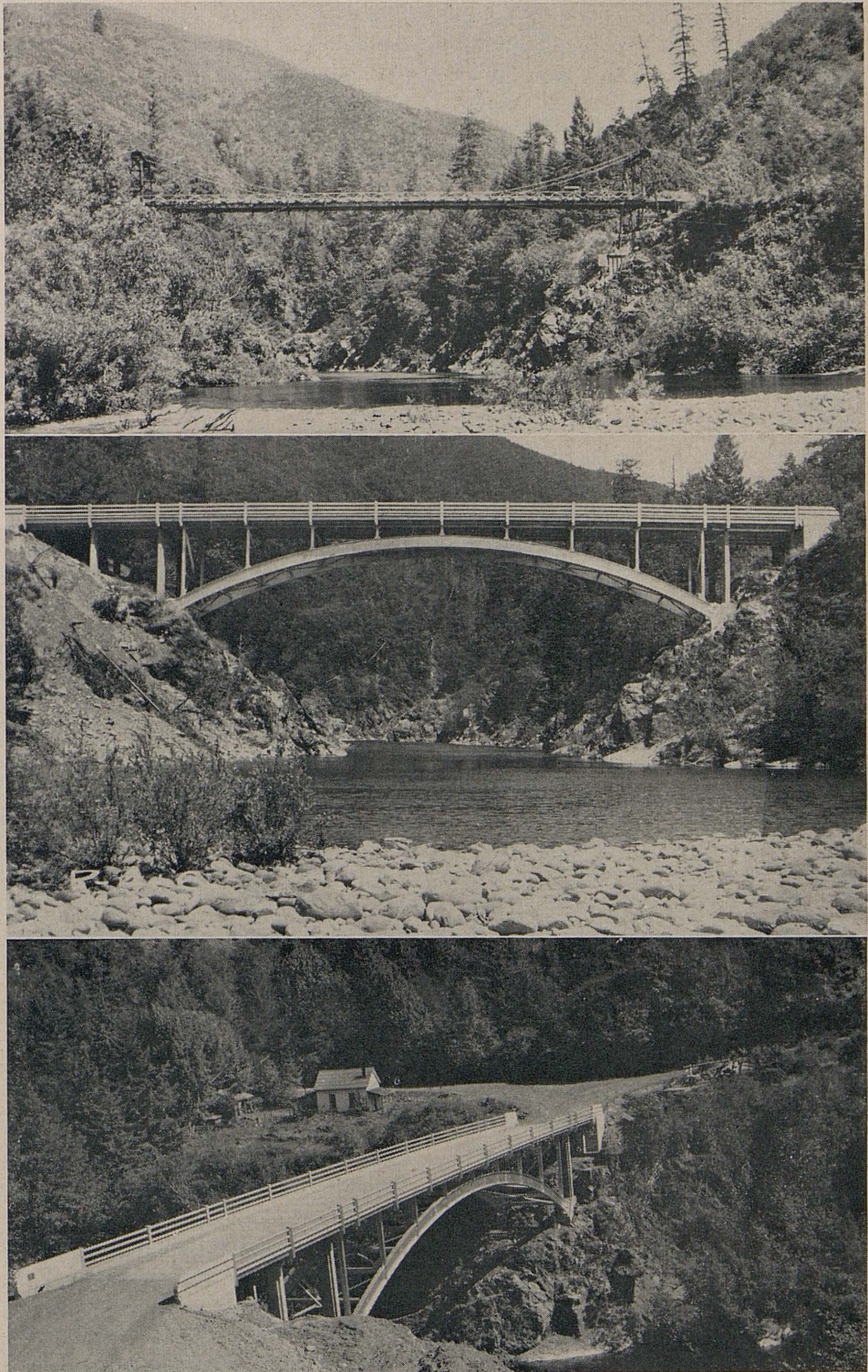
THE RECENT OPENING to traffic of the new bridge across the South Fork of the Smith River in Del Norte County marks the completion of the first step in the modernization of what is known locally as the South Fork Road. This county road originates on State Route 1 (U. S. Sign Route 199) at a point some 12 miles northeasterly from Crescent City, and crosses both the Main Branch and the South Fork of the Smith River at points about one-quarter of a mile above the confluence of the two streams.

From the south end of the new bridge the road runs along the southerly bank of the south fork a distance of some 12 miles. The first six miles of the road is moderately improved and maintained by the county, and beyond this, adequate trails extend some 20 miles, much used by inveterate fishermen and hardy nimrods packing into the "back country." Contemplated future extension of the road, together with general improvements throughout the entire length, will give easy access to the extensive timber and recreational area in the east central portion of the county.

Better Access to Park

The old Crescent City-Grants Pass stage road branches off from the South Fork Road at the south end of the new bridge and meanders in a general southwesterly direction, traversing the areas of giant redwoods in Mill Creek State Park, and rejoins State Route 1 (U. S. Sign Route 101) about one mile south of Crescent City. This road is presently being improved with the construction of a new concrete bridge across Mill Creek and the installation of numerous culverts to replace the existing unsafe timber bridges on the minor drainage channels. These improvements, in conjunction with the new South Fork Bridge, will no doubt make the redwoods more inviting to the numerous tourists who visit the park annually.

... Continued on page 49



UPPER—Old suspension bridge across South Fork of Smith River. CENTER AND LOWER—Views of recently completed new Smith River span

Freshwater Lagoon

Excavation and Fill Work Are Features of Humboldt Project

By L. R. REDDEN, District Office Engineer

THE FRESHWATER LAGOON grading project in Humboldt County,* involving realignment of a section of U. S. 101 across a sandspit 4,500 feet long, 40 miles north of Eureka, which is nearing completion, has included several features of unusual interest: the excavation of some 800,000 cubic yards of grading, the construction of embankments across marshy ground, the stripping of unsuitable material from large areas, the stabilization of fill foundations—and the unexpected encountering of an old Indian burial ground.

The burial ground was discovered on the north slope of Lookout Point, a landmark on the job and the site of a 220-foot high cut. Scarcely had pioneering of haul roads begun when bulldozers unearthed some human remains. Inquiry and mode of interment established the remains as Indian in origin. As indications were that more remains would be uncovered, all local people of Indian descent were contacted, and their approval obtained to the removal and reinterment of all remains found.

Old Burial Ground

All told, partial remains of 21 skeletons, including 21 skulls, were unearthed. They had been buried in a row, usually with a slab of redwood bark for a covering. Some were buried face down, an early custom among the local Indians in interring a person defeated in battle. Rather few primitive artifacts were found; they generally consisted of a few bone spoons, stone mortars and pestles, and stone cutting or stabbing weapons. One skull, much larger than the rest was found, possibly indicating the presence of a stranger to the local tribe, who may have been slain in battle.

The burial ground was estimated to have been in disuse for some 50 to 60 years.

After clearing with local health au-

thorities, the remains were placed in wooden boxes and reinterred within the right of way outside of construction limits.

Heavy Excavation

Grading of the roadway was done almost entirely by carryall scrapers towed by track-laying tractors for short hauls and by rubber-tired tractors for long hauls. The latter were particularly useful in moving some 235,000 cubic yards of material from the cut at Lookout Point for distances between 1,500 feet and 6,000 feet, all on level grade.

The 376,000-cubic yard, 220-foot high cut at Lookout Point, excavated on 1:1 slopes, was designed with benches to provide greater stability. The first bench was 60 feet above roadway grade; the two successive benches were 120 feet and 180 feet above grade. Width of benches was 25 feet.

Free Moisture Problem

As the excavation of the cut developed, considerable free moisture began to show up in the material, which was a graphitic schist. Thought was given as to the feasibility of removal of the free water, which, if allowed to remain, might over-saturate the material in the cut bank and possibly cause a major slide.

After much consideration it was decided to drill numerous near-horizontal holes, called "horizontal drains," on a draining grade into the face of the cut banks to tap water-bearing pockets or strata, insert a perforated metal pipe to prevent cave-ins, permit the water to drain out, and so provide a comparatively dry, stable shell or zone 100 to 200 feet thick on the face of the cut.

Horizontal Drain

The horizontal drain installation was made by the State's Headquarters Laboratory forces between July 5th and November 2d, the "dry" period of the year. Twenty-three holes were drilled, and an average of 130 feet of two-inch perforated black pipe was installed per

hole, with a maximum of 207 feet in one hole. Of the 23 holes drilled, enough water to produce a flow was encountered in 22. Flow per hole has varied from a rate of 21,500 gallons per day to zero. Following completion of a hole, the flow, in some instances, would drop off gradually; in others it would drop off very rapidly.

Examples of these are:

Hole 1		Hole 21	
Aug. 15	165 gpd	Oct. 27 10 a.m.	21,500 gpd
Sept. 1	130 gpd	Oct. 27 12 noon	10,000 gpd
Sept. 26	100 gpd	Oct. 27 4 p.m.	5,500 gpd
Oct. 31	50 gpd	Oct. 28 8 a.m.	2,150 gpd
		Oct. 31	720 gpd
		Nov. 2	720 gpd

Flowing Holes

The record of flow in Hole 21 indicates that a water pocket was tapped, which rapidly relieved itself; the ensuing flow indicates that a water-bearing strata was also tapped by the same hole.

Holes were drilled just above the floor of all benches and two to three feet above finished grade of the highway, in order to dewater the entire cut. It was observed, in general, that as flow began in holes at lower levels, the flow in completed holes at higher levels noticeably decreased, indicating that the same stratum or pocket of water was being tapped.

Of the 22 originally flowing holes, eight are now dry (early November), although it is likely that they will flow again when percolating waters from winter rains reach them. At the present time the 14 wet holes are flowing at a total rate of 4,450 gpd.

Road in Fill

North of Lookout Point the project traverses low-lying bottom land for 6,000 feet, throughout which the road is in continuous fill which varies from 0 to 13 feet in depth, and averages 8. Some 4,000 feet of the fill falls in wet, swampy, unstable ground, where firm bottom is as much as 40 feet below ground surface. It was anticipated, in design, that the weight of the fill would force some of the water upward from the underlying foundation.

* Historical and design features of the Freshwater Lagoon project were discussed in the March-April, 1949, issue of *California Highways and Public Works*.



UPPER—Construction operations in progress just northerly of Stone Lagoon Summit. The new location through rugged country can be discerned in the distance descending to the sand spit, which can be seen at the extreme upper right edge of the photograph. LOWER—Grading operations at Stone Lagoon Summit at the south end of the project. The new location departs from the old highway at this point, the existing road being in the immediate foreground

To permit the escape of such water, which would reduce the amount of moisture in the foundation, and so increase stability, a designed blanket of sand two feet thick, increased during construction to five feet at some locations, was spread on the original ground. The sand, 40,200 cubic yards, was hauled from a nearby beach by carryall, deposited on previously placed sand (to prevent bogging of equipment), and shoved ahead into place on the original ground by dozer.

An average of 2,500 cubic yards of sand was placed per day by seven carryalls.

It was anticipated during design that, as the height of the fill increased, the increasing weight would continually cause some settlement of the fill and its foundation and force water from the underlying foundation, and so eventually increase the foundation's stability. If the water should not escape fast enough, consistent with the continually increasing weight of fill, failure of the fill could result. A check

upon settlement of the fill was observed by the sinking of settlement platforms built at ground level prior to placing any fill. The escape of water could be measured by pressure gauges buried in the foundation. Lack of escape of water and increasing height of fill would result in increased pressure.

Accordingly, the fill was placed at a specified maximum rate: not more than one foot in 24 hours, nor more than three feet in one week. Should these rates not permit proper consoli-



UPPER—View of completed 220-foot-high cut at Lookout Point near the north end of the project. This point was the location of the ancient Indian burial ground unearthed during construction operations. In the foreground is the equalizer culvert to control the water elevation in Freshwater Lagoon to the right. LOWER—View of new location along the sand spit with Freshwater Lagoon on right and Pacific Ocean on left. In the far distance is Lookout Point. The old highway can be seen at upper right

dation and stabilization of the foundation material, as determined from water pressures and platform settlements, the engineer could temporarily suspend further placing of fill, with a specified total maximum time of 20 days for all suspensions. Actually, it was necessary to suspend operations four times, for a total of only four days.

Three-foot Fill Above Grade

In order, prior to surfacing operations, to "pre-settle" that portion of the

fill north of Lookout Point where settlement was to be expected or was occurring, the fill was constructed a maximum of three feet above finished grade. It was expected that such an overload would bring the permanent part of the fill more nearly to ultimate settlement, thereby eliminating future restoration of grade and surfacing. The overload is to remain in place until the spring of 1950, when it is to be removed, just prior to surfacing operations.

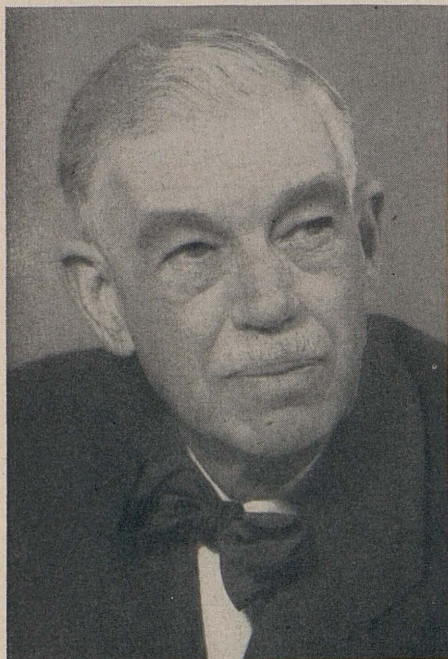
With the fill completed, settlement has been continuing as was anticipated, although occurring at a decelerating rate. In the 39 days preceding October 10th total settlement at one of the two platforms was 0.25 foot. On that date, 140 days after the start of fill constructing, the total settlement had reached 2.68 feet. At the second platform, 300 feet away, total settlement was 2.54 feet.

... Continued on page 47

Enviably Record

*Lester H. Gibson, Pioneer Road Builder,
Retires After 37 Years of State Service*

TO HONOR his completion of more than 37½ years' service to the State of California, over 300 Division of Highways employees from all parts of California gathered at the Santa Maria Club in Santa Maria, November 30, 1949, at a



LESTER H. GIBSON—1949

dinner party for Lester H. Gibson, retiring District Engineer of District V, Division of Highways, State of California.

Mr. Gibson's retirement, effective December 1, 1949, brought to a close exactly 31 years of continuous service in the position of District Engineer, with headquarters at San Luis Obispo. During that period he guided the development of all state highways in San Luis Obispo, Santa Barbara, Monterey, and San Benito Counties

from the early highway pioneering days to the current era of modern design and practice. He has served under all of the State Highway Engineers which include A. B. Fletcher, R. M. Morton, C. H. Purcell and G. T. McCoy.

Native of Massachusetts

A native of Clinton, Massachusetts, Mr. Gibson attended public schools there and Dartmouth College at Hanover, New Hampshire. His professional career in engineering began with two and a half years as rodman, draftsman, and instrument man for the Metropolitan Water and Sewerage Board of the State of Massachusetts. This work was in connection with the water supply for the City of Boston and involved aqueduct construction, reservoir stripping, and relocation of roads affected by the large Wachusett Reservoir project.

Long months of work in the water tunnels proving detrimental to his health, Mr. Gibson left New England in 1904 and came to California where he started as instrument man, draftsman, and chief of party for the City of Pasadena, being appointed Deputy City Engineer in 1907 by City Engineer S. J.

Van Ornum. He continued in this capacity until April, 1912, resigning then to accept appointment as Road Engineer for the State of California, Department of Engineering, under W. F. McClure, who was then State Engineer.



LESTER H. GIBSON—1913

Pioneer Road Builder

Mr. Gibson's duties in his first year of state service placed him in charge of maintenance and construction for the first system of state roads to be taken over from various counties between 1897 and 1910 by legislative action. There were approximately 500 miles of roads in this first system, most being trans-Sierra mileage that followed the old routes of the emi-

U. S. 99 in Shasta County looked like this in 1915. This old photo shows Mr. Gibson's car stalled in the mud. He is the man with the shovel at right of car



grant trails and included the historic freight and stage roads developed in the early mining days of California and Nevada.

Constructed during this year was the section of highway at Lake Tahoe, in Placer and El Dorado Counties, between McKinney's Camp and Tallac, opening travel for the first time along the west side of the lake from the north to south ends. Also constructed in 1912 was a section of road between the South Fork of the Trinity River and Mad River, making possible for the first time travel between Eureka in Humboldt County and Red Bluff in Tehama County.

Mr. Gibson considers his experience in 1912 on these roads of early California history to be one of the most interesting in his career. These roads, it might be noted, did not come under the jurisdiction of the California Highway Commission until 1917.

Promoted by Fletcher

In May of 1913, State Highway Engineer Fletcher appointed Mr. Gibson to the position of Second Assistant Highway Engineer in the Division of Highways. His duties were essentially those of a chief construction engineer representing Sacramento Headquarters throughout the entire State. Thus, during more than five years of constant traveling in all parts of California, Mr. Gibson had the opportunity of playing an important role in the gradual transition of existing dirt roads to the more modern all-weather pavements.

In the late autumn of 1918, W. C. Howe, Division Engineer of District V at San Luis Obispo, resigned to enter private practice, and State Highway Engineer Fletcher offered the position to Mr. Gibson. Although he had been enjoying his current assignment, the advantage of being able to settle down and establish a permanent home influenced his decision to accept the San Luis Obispo post, and accordingly on December 1, 1918, he began his 31-year term as District Engineer.

Important Work

Under the direction of the State Highway Engineer, Mr. Gibson was responsible for the location, design, right of way acquisition, construction, and maintenance of the more than 1,000



UPPER—This is U. S. 101 in Ventura County in 1916. Mr. Gibson is again stalled in the mud. LOWER—Pick and shovel crews and mule drawn equipment built highways for Mr. Gibson in 1916. This photo was taken on U. S. 99 in Butte County

miles of state highway located in this important district.

With four major army posts, numerous air fields, and many coast installations located in District V during World War II, Mr. Gibson directed the location, design, and construction of more than \$9,000,000 of federally financed access roads to these military installations.

Under Mr. Gibson's guidance, District V grew from an organization of only 61 employees in December, 1918, to its present strength of more than 375. But in retiring, with no further plans other than "gardening, golf, and fishing," Mr. Gibson leaves behind him more than mere statistics, for such en-

gineering achievements as the Santa Barbara Freeway, the spectacular coast highway from San Simeon to Carmel, and the many miles of heavy duty military roads, and numerous other major projects that materialized under his guidance and direction, remain as useful monuments of this pioneer road-builder's service to the State of California.

ETERNAL VERITY

"Rashness and haste make all things insecure." This observation, made 2,000 years ago by Cicero, should be kept well in mind by today's automobile drivers, for the majority of highway fatalities are due to "rashness and haste."

Expansion Failures Corrected

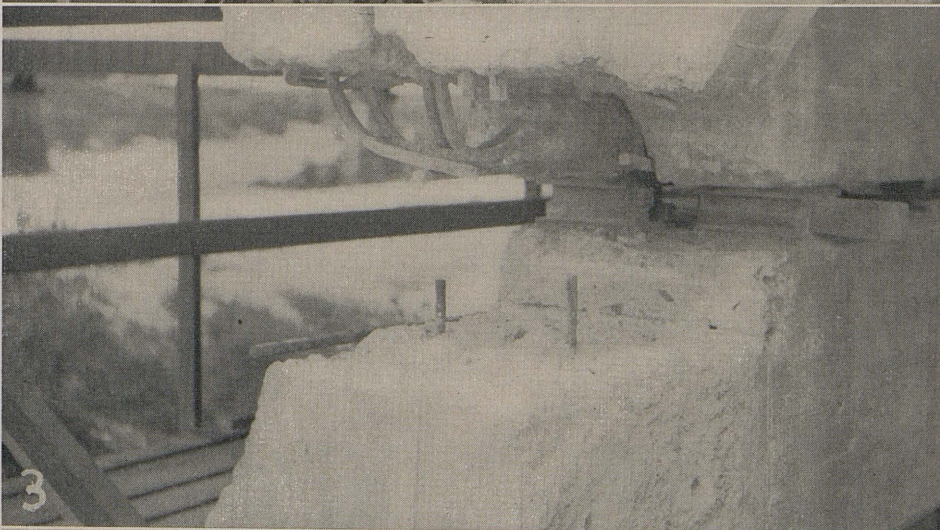
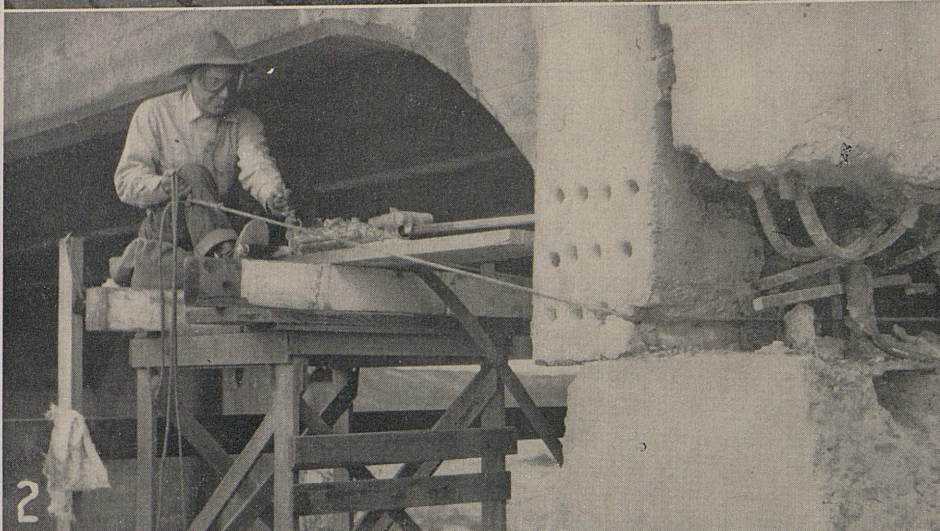
INADEQUATE PROVISION for expansion in early day concrete girder bridges was a common occurrence. In the instance under consideration the bridge was built with steel plates set on steel to provide for the expansion of a heavy concrete girder bridge of 50-foot spans. The steel plates froze together and did not function as intended. As a result the continual expanding and contracting of the girders shattered the concrete cap supporting the expansion base plates, as shown in *Photograph No. 1*.

The restoration necessary was to rebuild the cap and at the same time provide positive expansion facilities. In this case the rocker type of expansion was selected.

The work that was done consisted of shoring the superstructure by placing steel wedges between the diaphragms and the intermediate portions of the cap, removing the shattered concrete and the frozen steel plate expansion assembly under each girder as shown in *Photographs 2 and 3*, constructing forms and replacing the concrete cap, inserting new cold rolled steel rocker assemblies under each girder, thence reforming the girder haunches and portions of the diaphragms and ramming new concrete in place above the rocker plates.

In order to prevent shrinkage in the rammed concrete the following mix was used: One cubic foot of graded combined concrete aggregate, 21 pounds of cement and three pounds of Embeco (15 percent of cement content). See *Photograph 4* for completed job.

Micrometer readings taken during the removal of the shoring wedges showed the settlement of the superstructure to be less than 0.01 inch. Traffic was carried over the bridge during construction.



Maxwell Bridge

Napa County Proudly Dedicates
New Structure on F. A. S. Route 776

By R. P. O'NEILL, Assistant County Engineer, Napa County

NAPA COUNTY'S latest addition to its federal aid secondary road system, the new bridge across the Napa River on F. A. S. Route 776, was formally opened to traffic on October 1, 1949. Thomas Maxwell, former Chairman of the Board of Supervisors, in whose honor the span was named, cut the ribbon across the new bridge as a climax to dedicatory ceremonies. The opening of F. A. S. Route 776 will relieve congested traffic in the City of Napa. It completes a long-range plan started many years ago by the Napa County Board of Supervisors. It was only the unselfish cooperation of all board members that made possible the new route to by-pass Napa, Maxwell said in a brief address.

The Napa River divides the City of Napa on a roughly north-south line. There are but two river crossings within the corporate limits of the city, only one of which serves as a main artery, it being State Sign Route 29 which connects U. S. 101 (Redwood Highway) and U. S. 40 (Lincoln Highway). Route 29 enters Napa from the south on the west side of the river and progresses through Napa along Third Street, crosses the river and leaves in a southerly direction on the east side of the river. State Sign Route 37 between Napa and Winters enters the city from the northeast, and State Sign Route 29 from Lake County enters from the northwest. Both discharge their traffic on Third Street.

Wartime development caused the construction of large federal housing subdivisions both on the eastern and western limits of the city, all of which added to the congestion on Third Street, the main thoroughfare to and from work and into the business district for shopping. Wartime and post-wartime industrial development south of the city with its great increase in employment further added to the traffic problem. Prior to the opening

of the new route it was not unusual to see traffic backed up for half a mile at the junction of Route 8 entering the city from the southeast and Third Street. The writer has on numerous occasions spent a half hour traversing the last half-mile into town.

Traffic surveys by the county engineer's office indicated a river crossing south of Napa, allowing Sign Route 29 to by-pass the city, was the proper solution to the problem. By this means the principal trucking through the city—hay and grain to the dairy and poultry centers in the coast counties, and redwood products for the central valley would not need to enter the congested area in Napa. Furthermore the local traffic to and from the industrial plants south of town could be dispersed on three major north and south streets, connecting with the by-pass, instead of all being funneled into Third Street.

Funds, as always, were a problem. However, the board in 1945 voted an assessment to finance the cost of a fixed span bridge with a clearance of 35 feet at mean high high water, and in May of 1946 made application to the U. S. Engineers for permission to construct such a structure. Strenuous objections on the part of shipping interest caused the board to withdraw its application and consider a movable bridge, which, with its additional cost, necessitated a special assessment for another year.

In December, 1946, an application was made for a vertical lift span bridge with a minimum clearance of 25 feet at mean high high water, and a maximum clearance of 60 feet with the lift span raised. This would allow 90 percent of the water-borne traffic to pass up the river without opening the span and would reduce operating cost by permitting a more liberal call agreement for serving navigation. Permission to construct this type of bridge

was granted by the Secretary of War on March 10, 1947, and plans were pushed to a speedy conclusion.

It was felt that, inasmuch as the bridge construction was primarily one in which only a bridge contractor was interested, it would be well to advertise for separate bids on the bridges and on the road approaches. Successful bidder for the structure across the Napa River, and a small fixed span bridge across Cayetano Creek was Erickson, Phillips and Weisberg of Oakland.

The bridge across the Napa River consists of a 132-foot through truss vertical lift span with Irving type open steel decking. The approach spans have a concrete deck on steel girders supported on reinforced concrete abutments, bents and piers and the complete structure has an over-all length of 414 feet, with a clear width of 26 feet between curbs and 2½ feet sidewalks. The Cayetano Creek Bridge has a reinforced concrete deck on reinforced concrete abutments and bents and is 62 feet overall. Total cost of constructing the two structures was \$354,244.19, exclusive of engineering.

The road approaches and the stub connection on South Jefferson Street, the main local traffic lateral, were constructed by A. Teichert & Son, Inc., of Sacramento.

It was deemed advisable to construct the approaches by stage construction since it was entirely new location and the basement soils and fill material left much to be desired. A 38-foot roadway section was constructed with a top lift of from six inches to two and one-half feet of select material, in both cut and fill sections, depending on the basement soil and fill material; and six inches of crusher run base 28 feet wide. A Class "B" Double seal coat was placed on the C. R. B. pending the





This view of the Maxwell Bridge is from the south or downstream side of Napa River

placing of the ultimate pavement, three inches of asphaltic concrete surfacing.

The stub connection consisted of a 40-foot roadway section between curbs, with from six inches to two feet of select material, six inches of crusher run base and three inches of asphaltic concrete surfacing.

The total cost of constructing the approaches and the stub connection was \$114,619.73 exclusive of engineering.

As previously stated, financing of the project was probably as great a problem as all others combined. Preliminary engineering was financed by the postwar planning grants, provided by the State Legislature supplemented by county funds. Rights of way were financed by county funds. Construction costs on the two bridges were financed by funds made available by Chapter 20 of the Statutes of 1946, which were matched with the funds raised by the special assessments previously mentioned; the road approaches and stub connection were financed by funds made available by the Federal Aid Highway Act of 1944 and state matching funds provided by the County Highway Aid Act of 1945.

Construction engineering on both of the contracts was performed by county personnel, under direction of E. P. Ball, County Engineer and Road Commis-

sioner. R. P. O'Neill was Resident Engineer on both the bridge and road jobs, with C. H. Smith, Assistant Resident Engineer.

A. O. Erickson, senior member of the firm of Erickson, Phillips and Weisberg, was General Superintendent on the bridge construction; R. F. Armstrong, supervised the steel fabrication and erection for Moore Dry Dock Company, subcontractors, on the structural steel and the road contractor was represented by Chas. A. Coyle.

"The people of Napa County are to be congratulated on their sound thinking, planning and excellent execution of this project," State Highway Engineer George T. McCoy said.

FAVORITE MAGAZINE

DR. KATHARINE L. WHITTEN
Palo Alto, California

MR. KENNETH C. ADAMS

DEAR SIR: Your *California Highways* is my favorite magazine. It keeps me in touch with the whole State, most of which I have seen during the early days of the automobile. It is on my office table and is in constant use. Thank you.

KATHARINE L. WHITTEN

Highway Engineer Is Author of a History On Old Locomotives

Engineers of the Division of Highways frequently are called upon to write articles not only for *California Highways and Public Works* but for newspapers, engineering magazines and other publications. Their subjects always are highways.

Now comes Frederic Shaw, who is on the staff of Assistant State Highway Engineer Jno. H. Skeggs, San Francisco, with a book dealing with the history of eight Pacific Coast narrow gauge railroads and the locomotives that operated on them. The volume is titled "Oil Lamps and Iron Ponies—A Chronicle of the Narrow Gauges." Comprising 208 pages of 65,000 words, profusely illustrated, the book represents 20 years of research by the author and three years of work by Shaw and his collaborators, Clement Fisher, Jr., Assistant City Passenger Agent of the Santa Fe in San Francisco, and George H. Harlan, naval architect, Fort Mason. The publishers are Bay Books Limited, San Francisco.

Traffic Count

Travel on State Highways This Year Increased 7.4 Percent

By G. T. McCOY State Highway Engineer

THE ANNUAL state-wide traffic count taken on Sunday and Monday, July 17th and 18th, shows an increase of 7.4 percent over the immediately preceding annual count of 1948. While the 1948 count revealed a much greater rate of increase over 1947 in freight vehicles than in passenger cars, this year's count shows that passenger car traffic has increased at a considerably greater rate than has that of freight vehicles. All route groups show appreciable gains. The Sunday traffic increased at very much the same rate for all groups, while Monday traffic shows the largest increases on the main north and south and the recreational routes, with lesser

increases on the interstate connections and the laterals between inland and coast.

No change was made from the regular procedure of previous years in the manner of taking the count. Actual recording covers the 16-hour period from 6 a.m. to 10 p.m. for both Sunday and Monday, totals being shown for each hour. At selected representative stations, counts are also continued for the entire 24-hour period and are extended to record each of the seven days of the week. Traffic is segregated into the following vehicle classifications: California passenger cars, out-of-state passenger cars, busses, pickups,

two-axle commercial units, three-axle units, four-axle units, five-axle units, and six-or-more-axle units.

These comparisons for the various route groups are as follows:

PERCENT GAIN OR LOSS FOR 1949 COUNT AS COMPARED WITH 1948

	Sunday	Monday
All routes	+ 9.74	+ 6.96
Main north and south routes	+ 10.57	+ 8.36
Interstate connections	+ 9.01	+ 3.64
Laterals between inland and coast	+ 8.93	+ 4.96
Recreational routes	+ 8.29	+ 8.50

The gain or loss of traffic volume for State Highway Routes 1 to 80, inclusive, which constitute the basis for the foregoing summary, is shown in the following tabulation:

Route	Termini	1949 Percent gain or loss				Route	Termini	1949 Percent gain or loss			
		Sunday Gain	Loss	Monday Gain	Loss			Sunday Gain	Loss	Monday Gain	Loss
1.	Sausalito-Oregon Line	18.13		14.29		43.	Rt. 60 at Newport Beach-Rt. 31 near Victorville	11.72		3.73	
2.	Mexico Line-San Francisco	10.92		7.25		44.	Boulder Creek-Redwood Park	13.66		2.15	
3.	Sacramento-Oregon Line	2.26		3.51		45.	Rt. 7, Willows-Rt. 3 near Biggs	2.70		10.02	
4.	Los Angeles-Sacramento	6.03		8.56		46.	Rt. 1 near Klamath-Rt. 3 near Cray		.09	12.12	
5.	Santa Cruz Jct. Rt. 65 near Mokelumne Hill	8.88		6.51		47.	Rt. 7, Orland-Rt. 29 near Morgan	5.34		1.32	
6.	Napa-Sacramento via Winters	13.68		6.02		48.	Rt. 1 N. of Cloverdale-Rt. 56 near Albion	7.17		2.52	
7.	Crockett-Red Bluff	17.20		4.79		49.	Napa-Rt. 15 near Sweet Hollow Summit	6.51		1.52	
8.	Ignacio-Cordelia via Napa	16.44		14.02		50.	Sacramento-Rt. 15 near Wilbur Springs	8.99		6.41	
9.	Rt. 2 near Montalvo-San Bernardino	6.19		3.87		51.	Rt. 8 at Shellville-Sebastopol		7.0	3.88	
10.	Rt. 2 at San Lucas-Sequoia National Park	9.67		6.34		52.	Alto-Tiburon		23.88		14.32
11.	Rt. 75 near Antioch-Nevada Line via Placerville	21.83		16.98		53.	Rt. 7 at Fairfield-Rt. 4 near Lodi via Rio Vista	12.26		14.22	
12.	San Diego-El Centro	15.67		5.09		54.	Rt. 11 at Perkins-Rt. 65 at Central House	8.83		2.45	
13.	Rt. 4 at Salida-Rt. 23 at Sonora Jct.	14.72		3.89		55.	Rt. 5 near Glenwood-San Francisco	4.84		17.53	
14.	Albany-Martinez	10.64		3.17		56.	Rt. 2 at Las Cruces-Rt. 1 near Fernbridge	8.13		11.88	
15.	Rt. 1 near Calpella-Rt. 37 near Cisco	7.41		6.70		57.	Rt. 2 near Santa Maria-Rt. 23 near Freeman via Bakersfield	9.50		6.23	
16.	Hopland-Lakeport	1.89		8.05		58.	Rt. 2 near Santa Margarita-Arizona Line near Topock via Mojave and Barstow	5.77		4.84	
17.	Rt. 3 at Roseville-Rt. 15, Nevada City	13.46		6.10		59.	Rt. 4 at Gorman-Rt. 43 at Lake Arrowhead	7.62			6.26
18.	Rt. 4 at Merced-Yosemite National Park	9.65		5.12		60.	Rt. 2 at Serra-Rt. 2 at El Rio	5.61		6.51	
19.	Rt. 2 at Fullerton-Rt. 26 at Beaumont	13.11		9.61		61.	Rt. 4 S. of Glendale-Rt. 59 near Phelan	3.77		2.16	
20.	Rt. 1 near Arcata-Rt. 83 at Park Boundary	0.48			9.09	62.	Rt. 171 at Northam-Rt. 61 near Crystal Lake	10.44		15.50	
21.	Rt. 3 near Richvale-Rt. 29 near Chilcoot via Quincy	11.26		9.22		63.	Big Pine-Nevada State Line		21.48	29.63	
22.	Rt. 56, Castroville-Rt. 29 via Hollister	25.89		15.86		64.	Rt. 2 at San Juan Capistrano-Blythe		1.06		4.54
23.	Rt. 4 at Tunnel Sta.-Rt. 11, Alpine Jct.	13.25		13.39		65.	Rt. 18 near Mariposa-Auburn	7.71		3.78	
24.	Rt. 4 near Lodi-Nevada State Line	13.94		7.58		66.	Rt. 5 near Mossdale-Rt. 13 near Oakdale	23.17		14.96	
25.	Rt. 37 at Colfax-Rt. 83 near Sattley	18.26		24.55		67.	Pajaro River-Rt. 2 near San Benito River Bridge	11.95			10.88
26.	Los Angeles-Mexico via San Bernardino	3.15			7.53	68.	San Jose-San Francisco	28.07		24.71	
27.	El Centro-Yuma	0.29			7.53	69.	Rt. 5 at Warm Springs-Rt. 1, San Rafael	7.36		5.73	
28.	Redding-Nevada Line via Alturas	7.72		9.60		70.	Ukiah-Talmage	14.79		25.46	
29.	Peanut-Nevada Line near Purdy's	6.85		5.47		71.	Crescent City-Oregon Line	19.91		20.38	
31.	Colton-Nevada State Line	2.05			2.33	72.	Weed-Oregon Line	8.18		11.77	
32.	Rt. 56, Watsonville-Rt. 4 near Califa	11.70		8.73		73.	Rt. 29 near Johnstonville-Oregon Line	13.98		12.20	
33.	Rt. 56, near Cambria-Rt. 4 near Famoso	20.78		7.40		74.	Napa Wye-Cordelia via Vallejo and Benicia	8.25		12.75	
34.	Rt. 4 at Galt-Rt. 23 at Pickett's Jct.	2.84			9.54	75.	Oakland-Jct. Rt. 65 at Altaville	8.63		6.14	
35.	Rt. 1 at Alton-Rt. 20 at Douglas City		.85	8.27		76.	Rt. 125 at Shaw Ave.-Nevada State Line near Benton	20.70		20.97	
37.	Auburn-Truckee	15.59		2.39		77.	San Diego-Los Angeles via Pomona	6.71		1.26	
38.	Rt. 11 at Mays-Nevada Line via Truckee River	20.98		19.08		78.	Rt. 12 near Descanso-Rt. 19 near March Field	9.19			.67
39.	Rt. 38 at Tahoe City-Nevada State Line		11.20	10.22		79.	Rt. 2, Ventura-Rt. 4 at Castaic	4.01			4.56
40.	Rt. 13 near Montezuma-Rt. 76 at Benton	9.82		19.93		80.	Rt. 51, Rincon Creek-Rt. 2 near Zaca	4.60		5.09	
41.	Rt. 5 near Tracy-Kings River Canyon via Fresno	15.51		10.91							
42.	Redwood Park-Los Gatos	5.38		19.77							

F. A. S. Project

Contra Costa Completes
Crow Canyon Road Job *

By J. W. BARKLEY, Contra Costa County Road Commissioner

THE SECOND major postwar highway project to be undertaken by Contra Costa County in cooperation with the California Division of Highways and the Public Roads Administration under the federal aid secondary program was the construction of the easterly portion of FAS Route 801. Known as the Crow Canyon Road, this link in the secondary system joins State Highway Route 5 just east of Hayward and State Highway Route 107 near San Ramon. In addition to local traffic the agricultural and residential areas of central Contra Costa County and the industrial and marketing centers of the Bay area are served by this route.

This project required the cooperation of Alameda and Contra Costa Counties because the county line fell on a summit through which a deep cut was made. About 1,000 feet of the project is in Alameda County.

Curves Eliminated

The section of road replaced was 2.6 miles in length, had 975 degrees of curvature with curve radii from 110

* EDITOR'S NOTE: This is a federal aid secondary county road project. All engineering by county staff.

feet to 573 feet, and a maximum grade of 5 percent. Sight distances were low and the width inadequate for the heavy commercial traffic which used the road.

The new road is 1.8 miles in length, has 66 degrees of curvature with 2,000 foot curve radii, and has a maximum 7 percent grade. Sight distances are provided for high-speed traffic, and 22 feet of pavement is flanked by 7-foot shoulders through the job. Surfacing consists of 0.67 foot of Portland cement concrete on the 7 percent grade, and 0.20 foot of plant-mixed surfacing over 0.66 foot of crusher-run and imported borrow base on the balance of the job. Imported borrow and selected material courses are continuous.

The new road enters State Highway Route 107 about one-quarter of a mile south of the former location at San Ramon. This resulted in an improved junction and also reduced the length of the new line.

Drainage structures include 160 feet of 120-inch and 100 feet of 180-inch field assembled plate culvert, and 1,000 feet of corrugated metal pipe.

Primarily the job consisted of a cut 1,900 feet in length with a maximum depth of 85 feet through the summit,

and an embankment 2,300 feet in length with a maximum height of 40 feet, a mile of light construction, drainage structures, and surfacing.

The contract was awarded to Louis Biasotti and Son, Inc., of Stockton, and work began on the 27th of July, 1948.

Slide Problems

Rain during the middle of December prevented the continuance of full-scale operations and started movement of what was later to develop into a major slide area in the summit cut. During the winter and spring no work was done on the job because the slides continued to move and it had been decided to reslope and bench the entire cut when the movements stopped.

On the side where the major slides occurred it was necessary to roughly parallel the slippage planes with the slope, while the opposite bank was unloaded by benching to lessen the crushing and squeezing of the lower strata. It is doubtful that any but the most elaborate core-drill sampling and laboratory testing could have accurately predicted the conditions found in this cut.

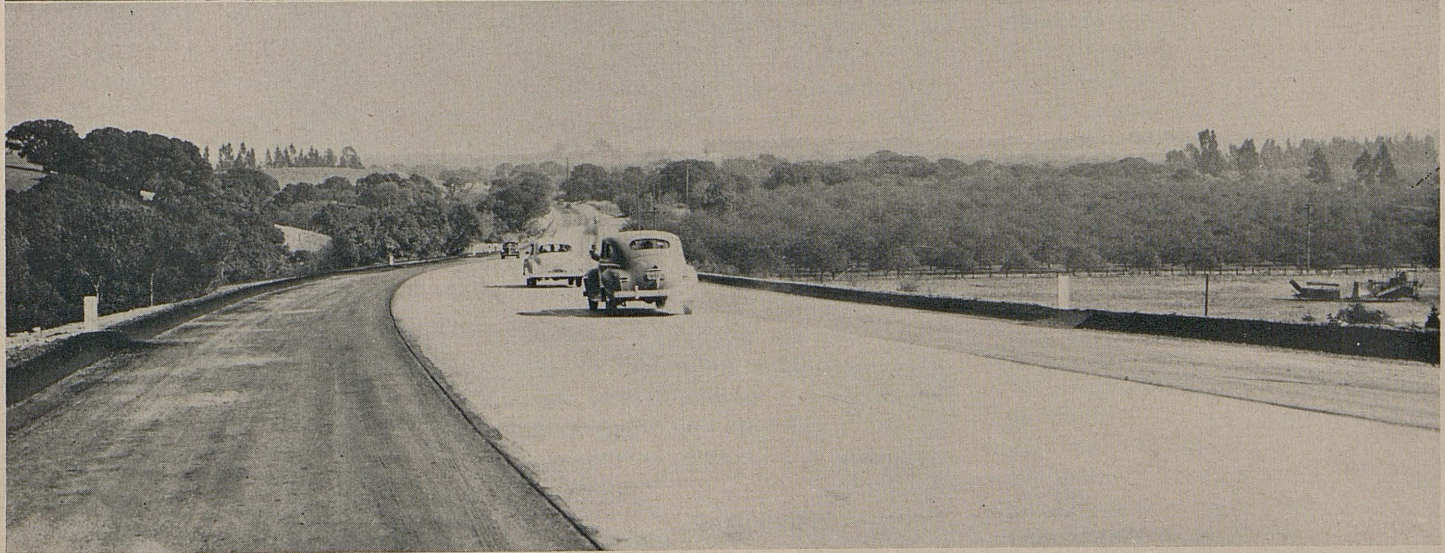
Work was resumed in May, 1949, and it was first necessary to remove the slide material and bench the summit cut. This involved moving about 60,000 cubic yards, or one-third as much material, as was in the original cut.

The project was completed on October 7, 1949.

Engineering work was handled by the county's engineering staff under the direction of J. W. Barkley, County Road Commissioner. Project Superintendent for the contractor was A. J. Vercruyssen, and W. C. Dalton was Resident Engineer for Contra Costa County.

This photo looking at summit cut on new Crow Canyon Road shows section of terrain through which new highway passes





Sections of completed Crow Canyon Road. The center photo is a view of summit cut, where slides develop

Prison Labor

*Story of Highway Road Camps
In the State of California*

By G. A. TILTON, JR., Supervising Highway Engineer

This is the fifth article in a series appearing in *California Highways and Public Works*, recording the history, legislation and administration of State Highway Prison Road Camps in California over the past 34 years. The four previous articles include:

- (1) History and Legislation—March-April issue
- (2) Organization—May-June issue
- (3) Camp Layouts—July-August issue
- (4) Feeding and Nutritional Accounting—September-October issue

The following article covers "Custody, Care and Welfare" of road camp inmates.

CALIFORNIA'S highway prison road camps are essentially honor camps established primarily for the purpose of affording a selected group of prisoners an opportunity to prepare themselves both physically and psychologically for the inevitable problem of returning to a diffident society. Inmates assigned to these camps must not only have good prison behavior records to their credit but they must also be judged as minimum custodial risks who may be expected to benefit most from the relative freedom of the camps and construction activities to which they are assigned.

Plans for the care and welfare of prisoners are designed to help them during this transitory period from prison to civilian life by providing work opportunities under healthful conditions that are not unlike the conditions they will face when released from custody. Being paid a wage for their work, inmates are able to accumulate funds to help tide them over the immediate period following their reentry into a free society.

No Armed Guards

In keeping with the spirit of the honor camp system, correctional officers responsible for the custody and discipline of road camp inmates do not carry firearms nor are firearms permitted in the camp or in the vicinity of inmates working on construction.

During off-duty periods in daylight hours and on Sundays and holidays, inmates are permitted to circulate

freely within limited camp areas marked by "Off-Limit" signs. No attempt is made to build restricting fences around the camp other than that sufficient to keep cattle, horses and other animals from entering the campgrounds. A gate maintained in the fence at the entrance road to the camp is kept closed and locked only at night.

Road Camps Simulate Free Construction Camps

Efforts are made to simulate free construction camps and eliminate prison "atmosphere" insofar as consistent with Department of Corrections regulations. Correctional officers wear uniforms but prisoners do not wear distinctive clothing and are not required to conform to rigid daily regimentation.

Free employees supervising inmates on construction work and camp activities are instructed to treat the men fairly and firmly, and under no circumstance are they permitted to use abusive language or assert an overbearing attitude toward inmates or fraternize with them.

Inmates are privileged to discuss their personal problems with the camp superintendent or correctional officers at any time with the expectation of receiving a just and courteous consideration.*

* See article on "Organization" in May-June, 1949, issue of *California Highways and Public Works* for detail data on duties of correctional officers and camp superintendents.

Eight-hour Day, Six-day Week

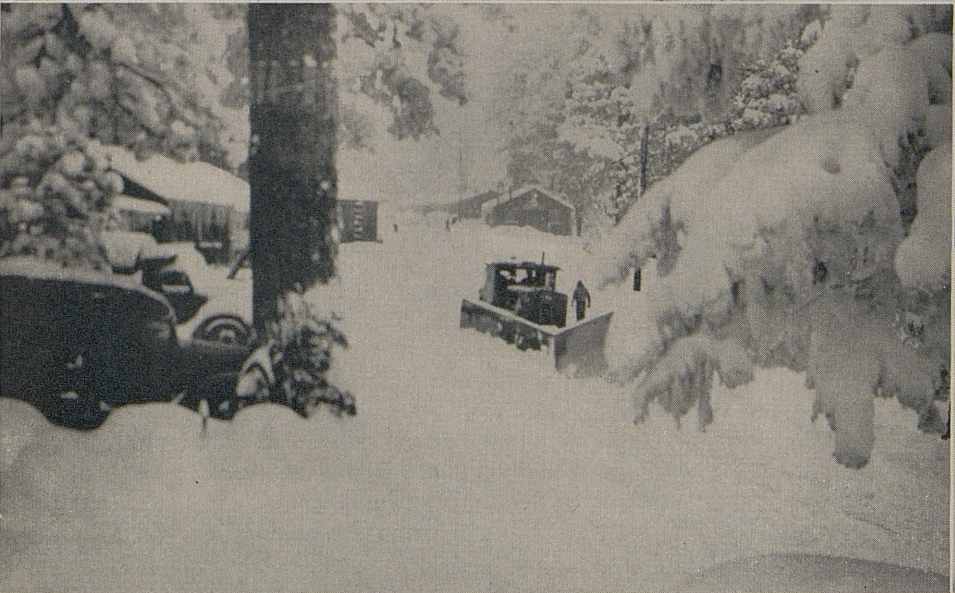
Experience over the many years of prison road camp operation in California indicates that it is essential to keep prisoners occupied and busy as much of the time as possible. To this end the camps are operated on an eight-hour, six-day week basis—holidays and Sundays excepted. Records indicate that the majority of attempts to escape occur on holidays and Sundays and particularly when there are two consecutive idle days with inmates confined to the campgrounds.

Escapes

In spite of the careful selection of inmates by the Department of Corrections' classification methods and the many benefits of road camp assignments, a few men are bound to attempt to escape. A study of past records shows that the percentage of escapes varies approximately with economic conditions—the percentage rising during prosperous times and decreasing in depression times.

For many years prisoners were released to civilian life directly from the road camps until it was noted that there was an increasing tendency for inmates to escape within a few weeks, and in some cases within a few days, of their release dates, indicating the intense pressure they are under as the time for release approaches.

This situation was relieved by the present Department of Corrections' administration by returning all in-



Snow conditions at Angeles Crest road camp No. 37 in Los Angeles County. UPPER LEFT AND RIGHT—A 12-foot depth of snow is indicated by views of tank in center of each photograph. LEFT—Before heavy snowfall. RIGHT—After heavy snowfall with top of tank just visible. CENTER LEFT—Free family quarters near Camp 37. CENTER RIGHT—Camp equipment shop. LOWER LEFT—Removing snow from road through camp. LOWER RIGHT—Clearing snow to office entrance

mates to prison at least one month before their release dates, during which time they are required to attend pre-parole classes consisting of briefing and refresher courses on behavior and what to expect when they are returned to society.

For the 13-year period from 1936 to the present writing 7,044 prisoners have been assigned to highway road camps of which 124 or 1.8 percent have escaped—most of these being captured after comparatively short periods of freedom.

Camp Commissary

A commissary is operated in each camp for the sole purpose of dispensing supplies to the camp inmates, including clothing, shoes, bedding, toilet articles, tobacco and miscellaneous items for personal use that are necessary to the care and welfare of the men. These items are priced and sold to inmates at cost and become their personal property which may be taken with them when they leave camp or returned to the commissary for credit.

In accordance with statutes controlling the operation of prison road camps the cost of commissary merchandise issued for the personal use of inmates is charged to their individual accounts.

To avoid competition with merchants in the vicinity of camps, commissary stock is not sold to free camp personnel.

Close Control Over Commissary Issues

One of the important objectives of road camp administration is to build up and conserve inmates' savings for the time when they are released from custody. In order to conserve savings, commissary drawings are limited to the following specified monthly amounts, after initial outfitting, depending on the status of the inmate's account:

- (a) Inmates with a deficit \$5 per month
 - (b) Inmates with a credit under \$25... 8 per month
 - (c) Inmates with a credit between \$25 and \$50 9 per month
 - (d) Inmates with a credit over \$50... 11 per month
- Such items as cigarettes and candy are limited to definite monthly amounts regardless of credit balances.

Medical Attention

A camp hospital is maintained in each road camp for the purpose of emergency treatment of injuries and minor physical disturbances.

Superintendent Must Be Student Of Human Nature

Superintendents of prison road camps must not only be qualified to direct large highway construction operations efficiently, but they must also be fitted temperamentally to handle the many specialized inmate problems of a road camp.

The following incident is cited as an example of the need for a camp superintendent's understanding of inmate psychology:

Shortly after arrival in an isolated road camp late one night during a severe winter storm, the author was engaged in discussing camp problems with the superintendent in his quarters when a knock was heard at the door. Upon opening the door an inmate was observed standing in the rain and wind, fully outfitted with rain clothes and carrying his bag and belongings ready to leave the camp. He asked permission to talk to the superintendent and was invited to enter the room.

The inmate took one look at the writer and immediately broke down and cried in a plaintive and hysterical voice that he had been in prison 12 years, 152 days, and was due out on parole 10 hours ago, and that he didn't see why he had to stay in camp another minute.

It appeared that a San Quentin guard was scheduled to arrive in camp that day with the inmate's release papers and he thought the late arrival could be none other than the prison guard with his papers and he was prepared to leave the camp in the middle of the night—storm or no storm.*

The inmate's disappointment that the author was not the prison guard with his release papers caused hysteria, which only the superintendent's sympathetic understanding and tactful handling could finally allay, which no doubt prevented more serious consequences. Release papers arrived the following day.

* At that time prisoners were released on parole directly from the camp.

In the case of injuries, sickness or dental work that it is anticipated will incapacitate an inmate for a short time only, he is taken to a physician in the nearest local town for treatment and returned to camp. In the more serious cases of expected longer duration inmates are transferred direct to the prison for treatment.

The cost of medical attention for illness or injuries not attributable to assigned work tasks is chargeable to the inmates' individual accounts up to the time they are returned to prison. Expense of medical treatment in the case of a man who is injured on the work is borne by the camp fund and is not charged to his account.

"Lay-ins" Discouraged

One of the constant problems of road camp administration is the control of "lay-ins." Inmates are required to work while in the camps and failure to perform assigned work tasks diligently is sufficient cause for their return to prison and possible disciplinary action.

Whenever an inmate finds it necessary to stay in camp during work periods due to sickness, injury, or for any other reasons he must first request permission of the camp supervisor and convince him that the need to "lay-in" is justified.

Those men who feign sickness or prove to be questionable "lay-in" repeaters are returned to prison.

Miscellaneous Camp Services

Each camp has a shoe repair shop and tailor shop for the sole use of the inmates.

The service of a barber shop, manned by an inmate, is extended to free camp personnel for which a charge is made and credited to the Prisoner's Camp Fund.

Recreational and Educational Activities

Recreational activities of the prisoners in the camps are supervised by correctional officers and financed by the Department of Corrections. A recreational building is provided in each camp for boxing, wrestling and other indoor games as well as moving pictures—the latter being shown at regular periods. Baseball is the favorite outdoor sport of inmates—second choice being horseshoes.

Road camp inmates may take approved correspondence courses and are extended educational privileges that can be carried on while in camp. Each camp has a library maintained by the Department of Corrections.

Arrangements for religious services in the camps are made through the prison chaplains as may be required by each camp.

Road Camp Quota Small Percentage of Total Prison Population

The presently established quota of prisoners in road camps is 325, which is a comparatively small percentage of the 11,000 prison population now

under jurisdiction of the Department of Corrections in California.

Inmates for the two Southern California camps are furnished through the California Institution for Men at Chino and inmates for the two Northern California camps are supplied through the San Quentin Prison.

Cooperation of Custodial Agency and Production Agency Necessary to Success of Camps

Under present statutes the custody, care and welfare of road camp inmates is administered cooperatively by the Department of Corrections and the State Division of Highways, the former being responsible for custody,

discipline, transportation, education and recreational activities of the inmates, and the latter being responsible for care and welfare, including feeding, clothing, housing and general camp maintenance.

This dual control requires the closest kind of cooperation between the two state agencies involved and the success of the camps in recent years is sufficient evidence of continued harmonious relations.

The sixth article in this series, covering accounting of inmate earnings, will appear in the next issue of California Highways and Public Works.
—EDITOR.



Road camps provide an opportunity for a selected group of prisoners to gradually prepare themselves, both physically and psychologically, for return to society from prison confinement—so well depicted in the above photograph of 5,500 inmates gathered in San Quentin Prison's mess hall to witness a New Year's show in 1939

Federal Aid

Review of History of
U. S. Highway Allocations

By C. H. PURCELL, Director of Public Works

THE GOOD ROADS movement of 1890 in California finally crystallized into action with the passage by the Legislature of the State Highway Act of March 22, 1909, which provided for an \$18,000,000 bond issue to finance a highway construction program.

The California Highway Commission was organized in 1911, seven district offices were established, and on August 7, 1912, construction began on State Highway Contract No. 1.

The original bond issue was expended on the State Highway System without federal assistance.

U. S. Participates

The Federal Government became an active participant in highway construction in California with the passage of the Federal Aid Road Act which became law on July 11, 1916. This act appropriated \$75,000,000 to be spent in a five-year period throughout the United States.

The act prescribed a formula for distributing funds among the states—a formula employing as apportioning ratios (each with identical weight): the percentage relations of the area, population, and post-road mileage of each state to the total area, population, and post-road mileage of the United States. California was apportioned \$2,282,727.19 under this act. Another important provision was that which made the aid available only to the states with a state highway department adequately constituted to cooperate with the federal agency and to assume responsibility for the construction to be undertaken. Administration of the act was placed under the Secretary of Agriculture, acting through the organization that is now the Bureau of Public Roads.

Defects of Omission

As enlarged highway programs were being planned by the states, two out-

standing defects of omission in the federal aid legislation became apparent: (1) The law permitted the combined federal and state funds to be expended for improvement of almost any rural road and the pieces of the roads proposed for improvement in some of the states were so scattered as to defy any expectation of a connected improvement. (2) Some states provided no funds on their own for maintenance, and were dependent upon subsequent action of the state for preservation of the roads built.

Both of these defects were corrected by the Federal Aid Highway Act of 1921. This act established the federal aid highway system by requiring state highway departments, with the approval of Federal authorities, to designate a system of the principal interstate and intercounty roads, limited in extent to 7 percent of the total mileage of rural roads then existing, and restricting to this designated system the expenditure of all federal aid appropriations. The legislation also strengthened the federal policy as to maintenance of highways completed with federal aid, placing full responsibility upon the State and providing that after appropriate notice, needed maintenance might be done under direct federal supervision and the cost paid with federal funds available to the State.

Sound in Principal

The Federal Highway Act of 1921 was so sound in principal that it has served as the basic law for governing the federal aid program for over a quarter of a century.

California was apportioned approximately \$141,000,000 of federal funds from 1917 to 1943 for all types of federal aid. In addition approximately \$37,000,000 of federal funds were expended by California for military access roads and flight strips constructed during World War II.

In 1944 as the prospects of victory grew stronger the Federal Government enacted legislation authorizing a postwar highway improvement pro-

... Continued on page 64

In Memoriam

FREDERICK N. GRANT

Frederick N. Grant, Assistant Highway Engineer, passed away in San Diego, October 9, 1949, after an illness of one week.

Fred, as he was known to all, was born June 27, 1888, in Athens, Georgia. He attended school in Georgia and was graduated from the University of Georgia in 1908 with an electrical engineering major.

He was a veteran of World War I, and served as a corporal in the Army Engineers.

In 1919 he started his engineering career as an instrument man with the Arizona Highway Department. He continued with that state in various capacities, including Resident Engineer, Maintenance Engineer, District Engineer and in 1939 became Deputy State Engineer, which position he held until 1944. In June, 1944, he was employed at District XI headquarters in San Diego as squad leader and served until his untimely death.

Fred was a member of the American Society of Civil Engineers and all with whom he came in contact benefited by his wide experience and knowledge of highway work.

His friends and fellow workers extend their sympathy to his daughter, Mrs. Mary Knoll of Phoenix, Arizona.

Boost for Freeways

Factual Study Shows They Increase Property Values

By ROBERT L. BANGS, Right of Way Agent

WITH THE ADVENT of freeway construction within the State, it has been incumbent upon the Division of Highways, Department of Public Works, to carry on throughout the State of California extensive studies to determine the effect, on property values, of the construction of freeways.

Section 14, Article I, of the California Constitution states: "Private property shall not be taken or damaged for public use without just compensation." In protecting the people of the State, both as owners of the state freeway system and as private property owners, the measure of damage or the measure of just compensation had to be determined.

When the division started these studies, no former experience existed to apply as a measure of damage or probable damage. The only solutions of this question had to be acquired through factual evidence.

Sales Analyses

This article presents one of the group of sales analyses at various locations throughout the State in furtherance of our investigation along these lines. This study involves the area abutting on and adjacent to U. S. Highway 99 (State Route 4), from the south city limits of Fresno southerly to the town of Fowler, a distance of 9½ miles.

U. S. 99 is the major highway traversing the entire State from north to south, and at present is carrying 30,000 cars daily through the area under study. Since there were a sufficient number of sales within this area, the study has been made of the actual effect on real property values caused by the realignment and conversion of the existing highway to a freeway, substantiated by sales records and investigations.

Careful Study of Surveys

Conclusions were based on the sale of 18 parcels adjacent to the freeway, and 23 parcels not abutting on the free-

way, but in the immediate vicinity. These are the total number of sales made within the time studied, which covered the period from 1946 to 1949. They are not selected sales or hand-picked sales for study purposes, but all the sales. As the indicated sale price obtained by an examination of the recorded deed does not always convey the complete elements of the transaction, each sale was verified by interviews with the individual grantors or grantees. They were then plotted out and charted suitably so that accurate studies could be made placing them on a comparative basis, with proper allowances for location and time intervals.

To make a fair evaluation of the data compiled, the external factors were taken into consideration, such as the over-all increase in real estate prices during the years 1946 to 1949.

Important Factor

One important factor which affected the price structure was the change of use pattern obviously accelerated by the completion of freeway facilities and furthered by the passing of a zoning ordinance in Fresno County.

The freeway was opened on January 31, 1948. Following this, the county zoned the area between south city limits of Fresno at Church Avenue to two miles southerly, adjacent to the freeway, for light and heavy industry. It is pertinent to note here that similar to other like sections throughout the State, although the zoning covered a rather broad area along U. S. 99, the sharp rise in values is evident only in those properties adjoining the freeway.

Increase in Value

To best exemplify the process by which these properties were studied, we refer to the parcel marked "A" on Page 31. This parcel is an irregularly shaped portion, lying west of the freeway and fronting on East Avenue without any direct access to the free-

way. The original holding, of which this portion was a part, had an indicated market value on May 6, 1946, of \$2,300 per acre and the requirements of the State were purchased at this price. The remaining portion shown in the illustration, sold January 16, 1947, at a rate of \$7,000 per acre. This difference of \$4,700 per acre accrued to the property in less than a one-year period.

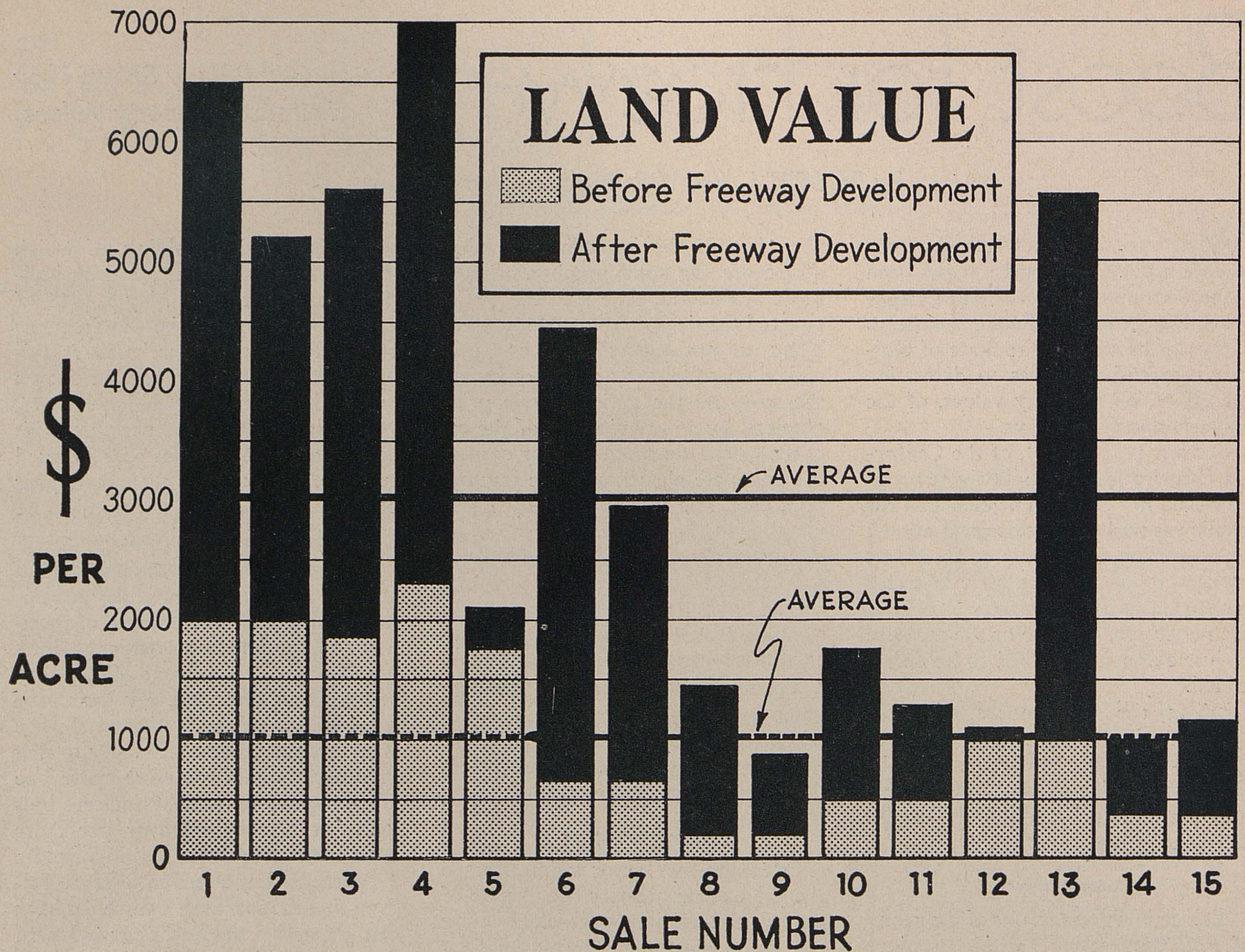
Freeway Benefits Property

This section of land was classified in 1946 as irrigated farm lands, but enjoyed a higher value because of proximity to Fresno and potential business use. Without the advent of highway construction on a freeway basis, it is reasonable to assume that the price structure would react similarly to that of other lands in the same class. The U. S. Department of Agriculture bulletin on "Average Dollar per Acre Sales from 1946 to 1949," indicated a 17 percent decrease. It therefore follows that the increase in value has been due primarily to the construction of freeway facilities and their acceleration of the change in land use pattern.

Another Typical Example

The improvement shown in the illustration is the recently erected concrete office and sales building of the Kenworth Truck Company, one of the group of new improvements which have been constructed subsequent to the opening of the freeway.

The parcel shown as "B" in the illustration is another typical example. It is a 20-acre rectangular parcel formerly used for agricultural purposes, its northeast corner immediately westerly of and adjacent to the East Avenue freeway intersection. Construction plans required a 30-foot strip of land off this corner, together with access rights for 100 feet along East Avenue. The remaining property continued to front on East Avenue with no direct access to the freeway. The indicated



THE ABOVE sales chart, with property descriptive matter, is an analysis of 15 parcels of land. These properties were all vacant at the time of sale which preceded the construction of the Fresno freeway, and have subsequently been sold and improved.

Because they were vacant, adjustments did not have to be made for any existing improvements. The highway construction was instrumental in changing their land use classification and the time interval between the two sales was not of sufficient length to require adjustment for other market increases or decreases.

- Sale 1. 2.78 acres. Immediately west of junction, Church Avenue and freeway. Access only to Church Avenue. Unimproved at time of sale, now has large new truck sales and service buildings.
- Sale 2. 2.78 acres. West of junction of Church Avenue and freeway and immediately west of Sale No. 1. Access only to Church Avenue. Vacant at time of sale, as now.
- Sale 3. 1.75 acres. Northeast corner of intersection of Jensen Avenue and freeway. Access to Jensen Avenue and to former state highway on east. Vacant at sale, now has large modern farm equipment sales and service building.
- Sale 4. .86 acres. Southwest corner East Avenue and freeway. Access only to East Avenue. Vacant at sale, now has new masonry office and garage building. See illustration A.
- Sale 5. 10 acres. Northwest corner East Avenue and freeway. Access only to East Avenue. Vacant at sale, now improved with large concrete foundry building, two corrugated metal sheds. See illustration B.

- Sale 6. 2.7 acres. Southerly of Jensen Avenue and between freeway and former highway. Vacant at sale and still vacant.
- Sale 7. 4.7 acres. North of Orange Avenue between freeway and former highway. Access to former highway and Orange Avenue. Vacant at sale, now improved with large truck-trailer sales buildings.
- Sale 8. 12.9 acres. East of Orange Avenue abutting freeway. Access through narrow strip to Orange Avenue. Vacant at sale. Presently vacant. See property sketch.
- Sale 9. 4.8 acres. East side of Orange Avenue near corner of Annadale Avenue. Does not abut freeway. Access to Orange. Vacant at sale, now has small office building and storage building for construction equipment. See property sketch.
- Sale 10. 8.56 acres. West of freeway near Calwa Overpass. Access to Cedar Avenue by narrow strip of land. Vacant at sale, now has metal building and fuel storage tanks.

- Sale 11. 3.22 acres. Immediately west of freeway, near Calwa Overpass. Access to Cedar Avenue. Vacant at sale. Very large masonry warehouse and concrete grain elevator constructed since.
- Sale 12. 12.3 acres. Immediately west of freeway at Calwa Overpass. Access to Cedar Avenue. Vacant at sale. Large metal warehouse and office for fertilizer company constructed since.
- Sale 13. 4.5 acres. Northwest of junction of Chestnut Avenue and freeway. Access to outer highway and freeway at grade crossing. Vacant at sale. Now improved with large first class major company truck service station.
- Sale 14. 6.4 acres. South of Central Avenue, west side freeway. Access to outer highway. Vacant at sale. Since improved with sheet metal shop building.
- Sale 15. 12 acres. South of Central Avenue, west side freeway. Access to outer highway. Vacant at sale. Now is large drive-in theater. See illustration.

market value in February, 1946, was \$1,000 per acre. The eighteen-hundredths of an acre required for the highway construction was acquired through an action in eminent domain, resulting in an award of \$350, which sum included the jury's estimate of damages by reason of the freeway construction.

Effect of Freeway

In 1946, following the acquisition of the right of way for the freeway, but before the construction of the freeway, the owner conveyed 10 acres of his remaining holding for \$2,100 per acre, a figure doubling the indicated market value of the land prior to the development of the plans for freeway con-

struction. The Valley Foundry Company, purchaser of the property, erected a large concrete machine shop on the parcel. Mr. Leon S. Peters, president of this company, has stated that the development of the freeway has definitely increased the value of this property.

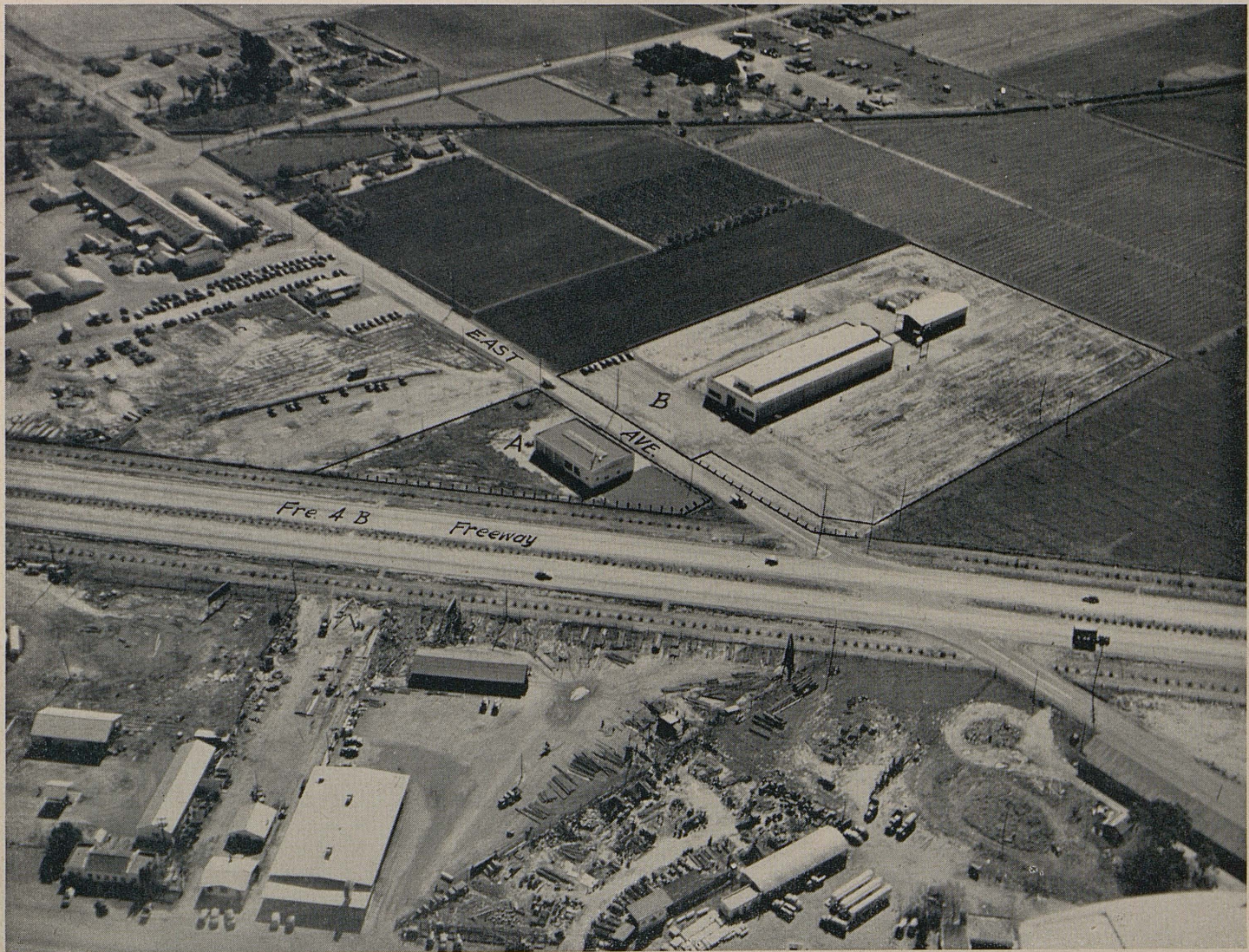
To further illustrate the land activity in this area, we are including a sketch, *Page 32*, which, prior to acquisition, was a rectangular parcel of unimproved land containing approximately 20 acres. Proposed construction plans necessitated acquisition of a 180-foot strip off the northeast corner. The State's acquisition was completed in June, 1944, at an indicated market

value of \$200 per acre. Subsequent to the opening of the freeway, the easterly 12.9 acres of the remaining property having its only access by way of an easement to Orange Avenue which, in turn, connects with the freeway, sold for a price of \$1,430 per acre.

Sales Follow Pattern

This analysis can be continued parcel by parcel, and the sales will all follow the same ascending land value pattern. The three above parcels are typical examples which will be repeated in essence throughout the entire number of sales that have taken place since the development of the freeway. The results of our study showed that in not

This aerial photograph shows, (A) southwest corner of East Avenue and freeway, with access only to East Avenue. This property was vacant at time of sale and now has a new masonry office and garage building. The northwest corner of East Avenue and freeway, marked (B), has access only to East Avenue, was vacant at sale, and now is improved with large concrete foundry building and two corrugated metal structures



one instance has the property sold for a lesser sum per acre than the indicated market value of the same property prior to the freeway construction. Increased values range from \$100 per acre to \$4,700 per acre, or an over-all average of a 200 percent increase, which is obviously in excess of any normal increase for a like period for comparable properties not having the benefit of freeway influence.

Gross Sales Compared

To supplement our study on property transfers, all factual data on gross sales of retail outlets were assembled. This method of study compared the gross sales of each business formerly operating on the conventional highway to the gross sales for like periods on the identical business after the opening of the freeway. The resultant figure was, in turn, compared with the percentage of increase or decrease in the same business class for the like period in the county as a whole.

This study involved 41 establishments now operating on the outer highway system through the towns of Fowler and Malaga. The following percentage

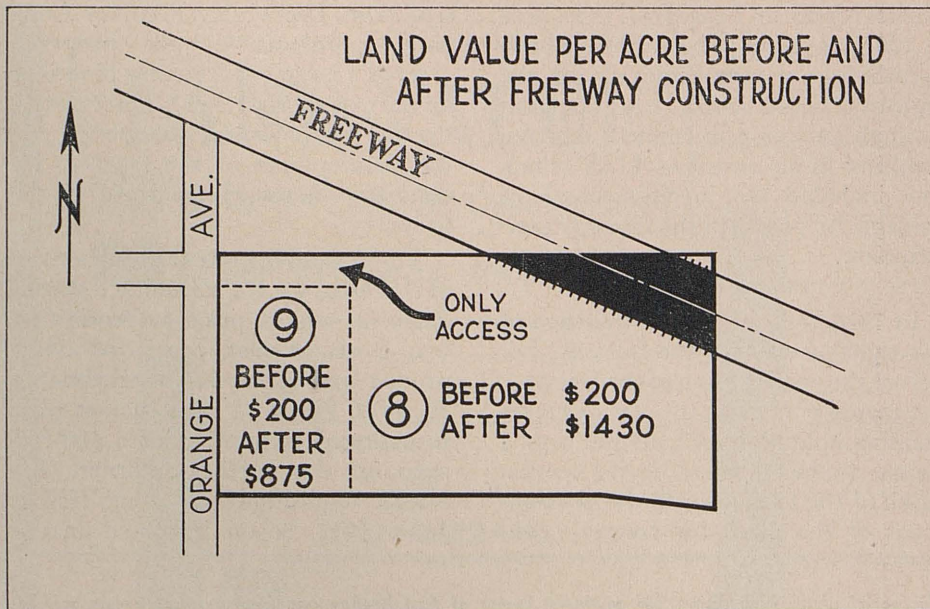
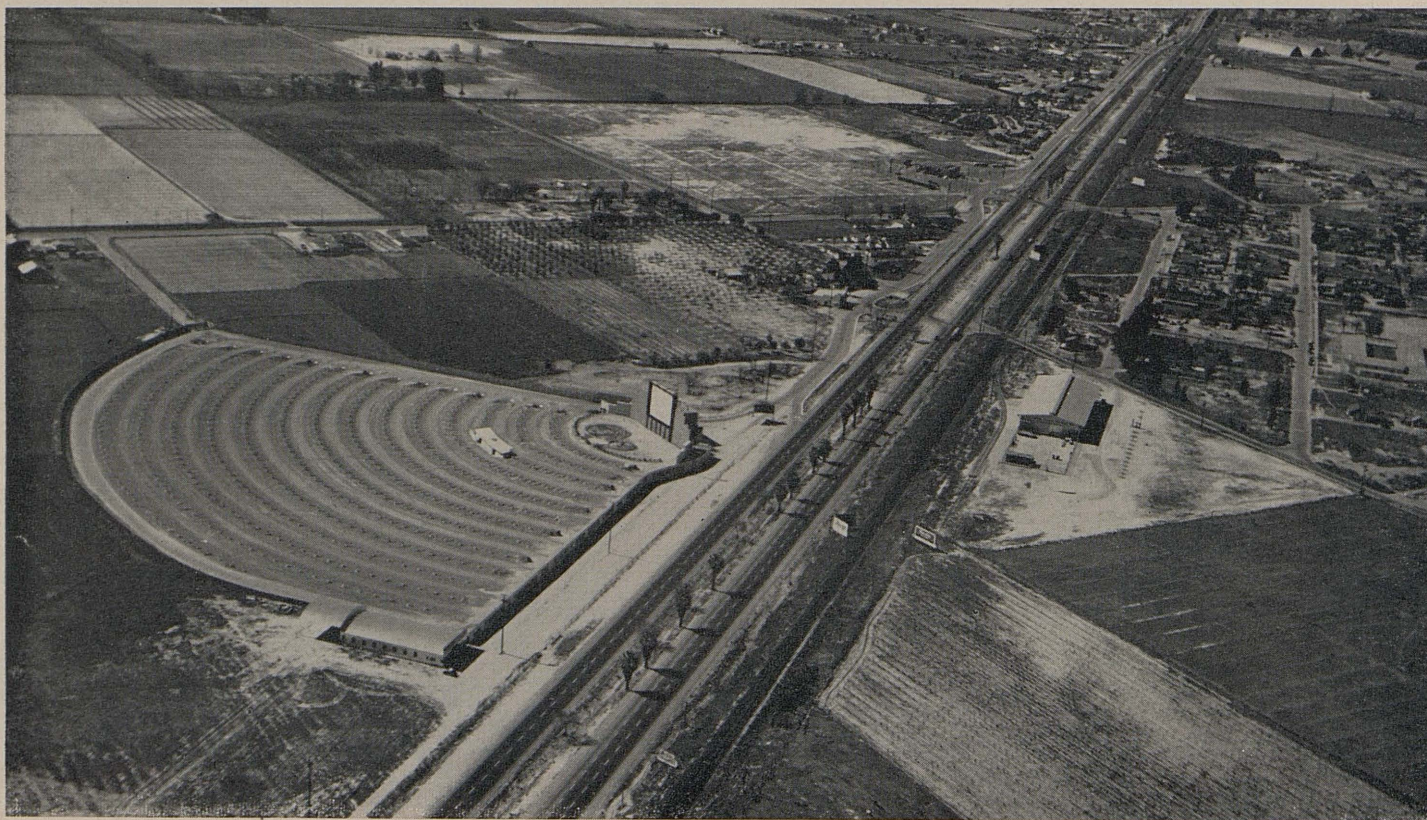


figure is being submitted with the knowledge that the accuracy of this method increases in proportion to the length of time it is possible to make such study. The longer period tends to diminish the percentage importance of abnormal increase or decrease of some one business venture to the average.

Volume of Business Increases

From the studies this far, the results indicate that the volume of business transacted by owners abutting on the freeway shows an over-all 42.2 percent increase, as against a 5.1 percent increase for the like businesses in the county.

This aerial view shows the property south of Central Avenue on west side of freeway with access to outer highway. It was vacant at time of sale and now is the location of a large drive-in theater



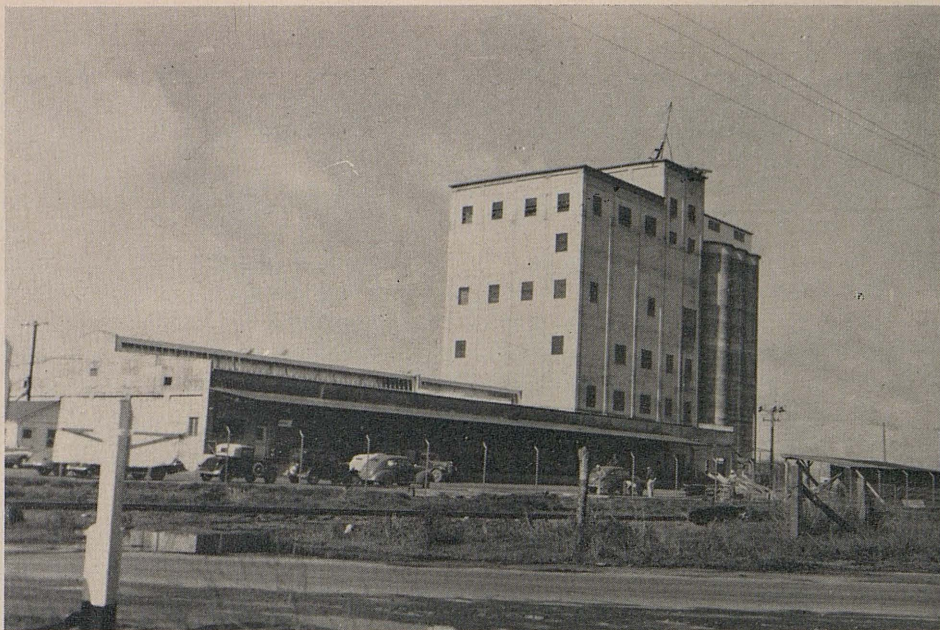
It is our conclusion from the various studies, that the predominant effect of freeway construction through this section is the change of land use pattern clearly shown by improvements worth approximately a million dollars which have been constructed since the opening of the freeway. Not one of these improvements has direct access to the freeway, but is reached by county roads, or by way of the outer highway system.

These improvements include a large drive-in theater, two truck service stations, a poultry producer's warehouse, three truck sales and service buildings, industrial welding and sheet metal shop, foundry and machine shop, warehouse for fertilizer products, and several smaller structures of the restaurant and salesroom type. (See Page 32.)

Substantial business organizations have been the first to see the economic advantages of locations adjacent to the freeways. A list of the companies and the monetary expenditure in improvements along the area under study is imposing and indicates the soundness of the development since the freeway construction.

Reasons for Development

The reasons for this development are self-evident and have been repeatedly stated by businessmen throughout the State, namely, the smooth, safe, unin-



Large concrete office and warehouse structure of the San Joaquin Valley Poultry Producers' Association was constructed upon one of the parcels investigated subsequent to development of the freeway

errupted flow of traffic between termini; the safety and convenience of the outer highway system for the normal activities of business; and the advantages of a permanent location which the restriction of access and the development of the outer highway guarantees. This type of substantial development tends to stabilize land values at a higher level. This, in turn, benefits the entire community by guaranteeing

to the county, through its tax collecting authorities, a sound tax structure.

Compare this with the usual substandard development so often encountered on the conventional highway. Often upon completion of a conventional highway or shortly thereafter, there cropped up within the 50-foot strip abutting the highway, a low-class group of merchandising establishments catering to the wants of the traveling motorist. These structures were generally built on the outlying area of a town or city, just beyond the city limits so that they would not be subject to the building restrictions enforced within the incorporated areas. The turnover in this type of business has always been extremely high, and the life extremely short.

Again, looking at the aerial photographs and the list of improvements built subsequent to the freeway development, there remains little room for doubt of the increased value of the land and the increased value to the community by reason of restricted highway access and freeway construction.

From time to time we hope to present similar studies that have been completed or that are now being carried on. In this way we can further present the factual evidence which we have developed in order to determine just compensation.

This large truck-service station was constructed upon one of the investigated properties subsequent to the freeway development. This station is located on the outer highway



Folsom By-pass

New Link in Improvement
Of U. S. 50 Opened to Traffic

By HARVEY A. TOWNE, Associate Highway Engineer

LATE IN OCTOBER of this year, construction operations were completed and traffic was routed over another section of modernized road on transcontinental route U. S. 50, which is known locally as the Sacramento-Placerville-Lake Tahoe Highway.

The newly improved section is located about 13 miles east of Sacramento and extends from a point about one mile west of Nimbus to one-fourth mile east of the Southern Pacific railroad crossing near White Rock, the total length being about 7.3 miles. The routing is on new alignment which by-passes the town of Folsom and is about 2.9 miles shorter than the old road.

Alignment Improved

The relocation improves the alignment and grades, which were particularly poor in Folsom, and reduces the number of railroad grade crossings. The new alignment has only four curves, with a minimum radius of curvature of 3,000 feet, and the maximum grade rate is 4 percent. On the old alignment, there were grade crossings at three spur tracks and two main line locations on the Placerville branch of the Southern Pacific. On the new alignment, the only remaining grade crossing is over the main line near the

beginning of the project, where a channelized divided highway facility has been provided. Near the end of the project, where the main line is crossed again, a separation structure was constructed.

While construction activity in connection with transportation facilities is nothing new in this area, Folsom being an important station on both the Lake Tahoe wagon road and the early railroad, the type of equipment now used is considerably different from that used 100 years or so ago. Huge carryall scrapers have replaced the horsedrawn equipment of that era and the percentage of work done by hand has been reduced to a minimum.

Interesting Mining Operations

An interesting glimpse of the lengths to which men went in their pursuit of gold during the past century was furnished by the character of the area through which a large portion of this project passes. Most of the area had been worked by dredgers which left large piles of stone tailings in their wake, but one section had been encountered which was too hard for the dredgers to handle.

While excavating for the road in this section, seven hidden chambers were encountered which were 10 to 15 feet in diameter and had interconnecting passageways about two feet in diameter.

Some of these passageways extended for several miles. It is understood that this excavation was done by hand by Chinese labor some time in the sixties. While such an operation probably would be heartily condemned by present day safety engineers, it is interesting to note that the last chamber encountered, which was below subgrade, did not cave in until many pieces of heavy construction equipment had passed over it.

Not many uses can be found for the piles of tailings left by dredgers behind their mining operations, but they did make good selected material for use under the surfacing placed on this section of road.

The design section for this section of road, which is two lane throughout most of its length, consisted of a 22-inch x 0.25-inch layer of plant-mixed surfacing over a 23-inch x 0.5-inch crusher run base, under which was a layer of selected material varying in thickness up to 1.25 feet. Sufficient right of way width was obtained to provide for future development to a four-lane divided section if and when it becomes necessary.

The contractor for the project, which will cost about \$690,000, was the George Pollock Company of Sacramento and the writer was the Resident Engineer for the State.

ARBA-AASHO GROUP LAUNCHES STUDIES

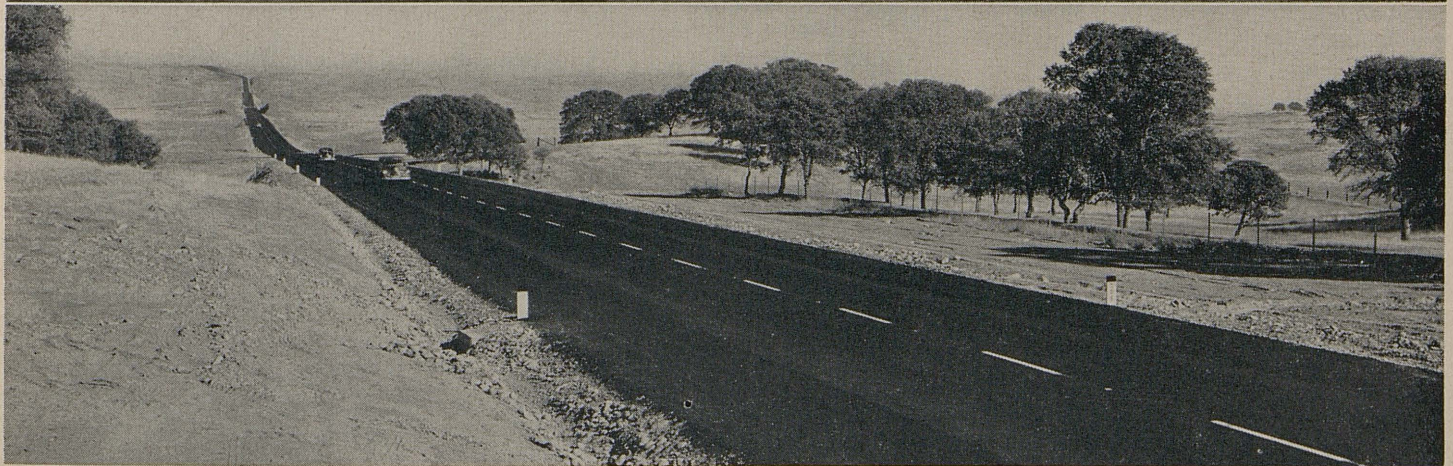
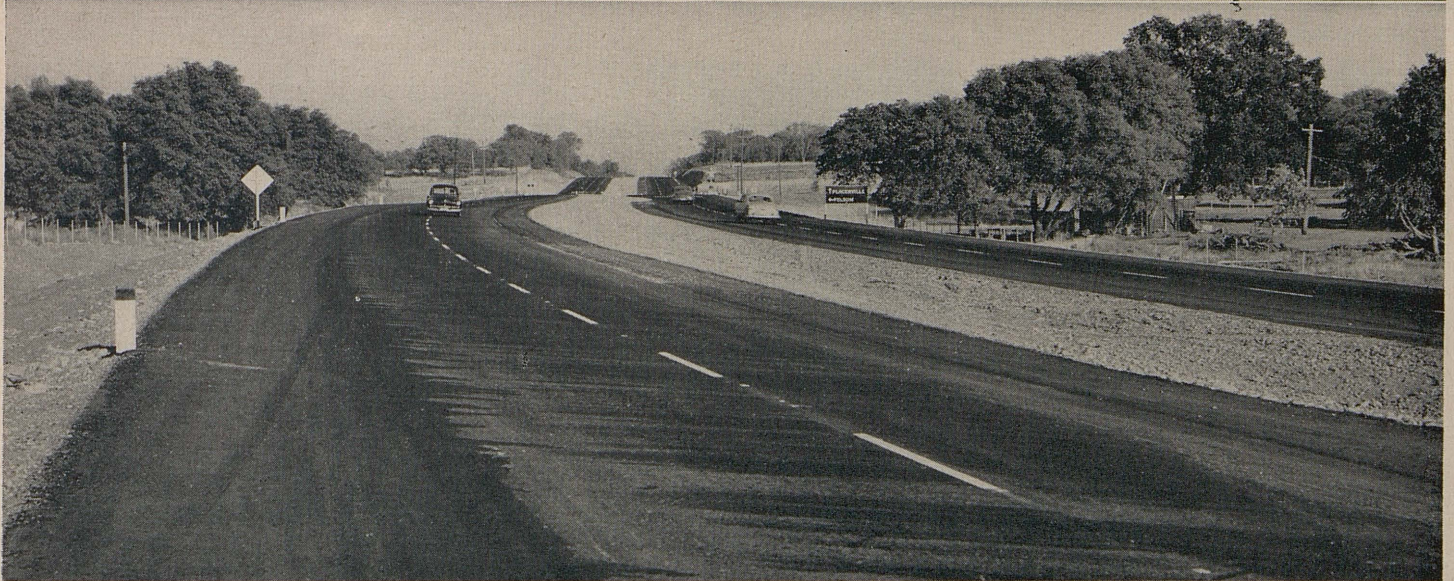
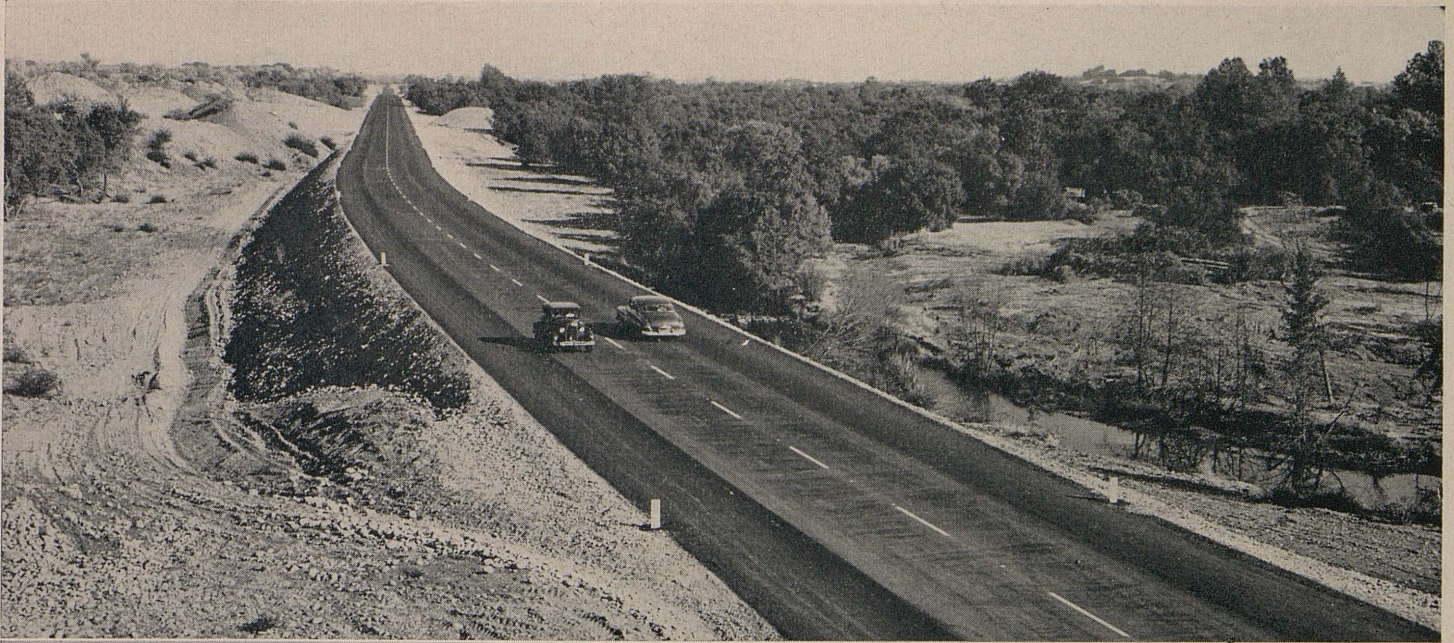
INITIATION of a seven-point program of studies to be made jointly by the two organizations was completed at the first meeting of the Committee on Cooperation recently revitalized by the American Road Builders' Association and the American Association of State Highway Officials.

Keyed to the country's war-deteriorated highway system and efforts to

speed highway work lagging behind post-war increased automotive transportation, the program of studies, decided upon at a meeting the committee held during the AASHO annual meeting in San Antonio, Texas, October 10th-15th, will be undertaken under the general plan for consideration of projects of mutual interest.

Representing ARBA were: H. G. Sours, Joseph D. Bonness, Alan Buck, Julien R. Steelman, Taylor G. Soper, and Burton F. Miller.

Representing AASHO were: C. M. Hathaway, G. T. McCoy, Richard H. Wilson, Chas. M. Zeigler, Lawrence S. Tuttle, H. A. Radizowski, C. W. Phillips, and A. C. Clark.



UPPER—Looking east on new alignment, showing highway through dredger tailings with Alder Creek on right. CENTER—Divided highway in vicinity of Alder Creek crossing. LOWER—Showing 8,000-foot tangent alignment

Erosion Control

Methods Used on California
State Highways Discussed

By H. DANA BOWERS, Supervising Landscape Architect

California, a wrinkled ribbon of land more than 800 miles long lying between the high Sierras and the Pacific Ocean, stretches from the humid forested zone characteristic of the Pacific Northwest to arid northern Mexico, and ranges in elevation from below sea level to more than 10,000 feet. Climatic variations are extreme, as might be expected, and erosion control problems vary correspondingly. Many different types of control have, therefore, been found to be necessary.

The purpose of this series of articles is to discuss the variable factors associated with erosion which affect California roadsides, review the development of erosion control methods by the State Division of Highways, and describe erosion control processes now being employed with reasonable success to stabilize slopes on California state highways. This first installment deals with factors and problems associated with erosion.

It is felt that at least a few of the methods which have proved effective in California may be modified to suit conditions in other regions. Consequently, descriptions have been made as complete and are illustrated as fully as possible in order to permit duplication of these methods by nontechnical personnel.

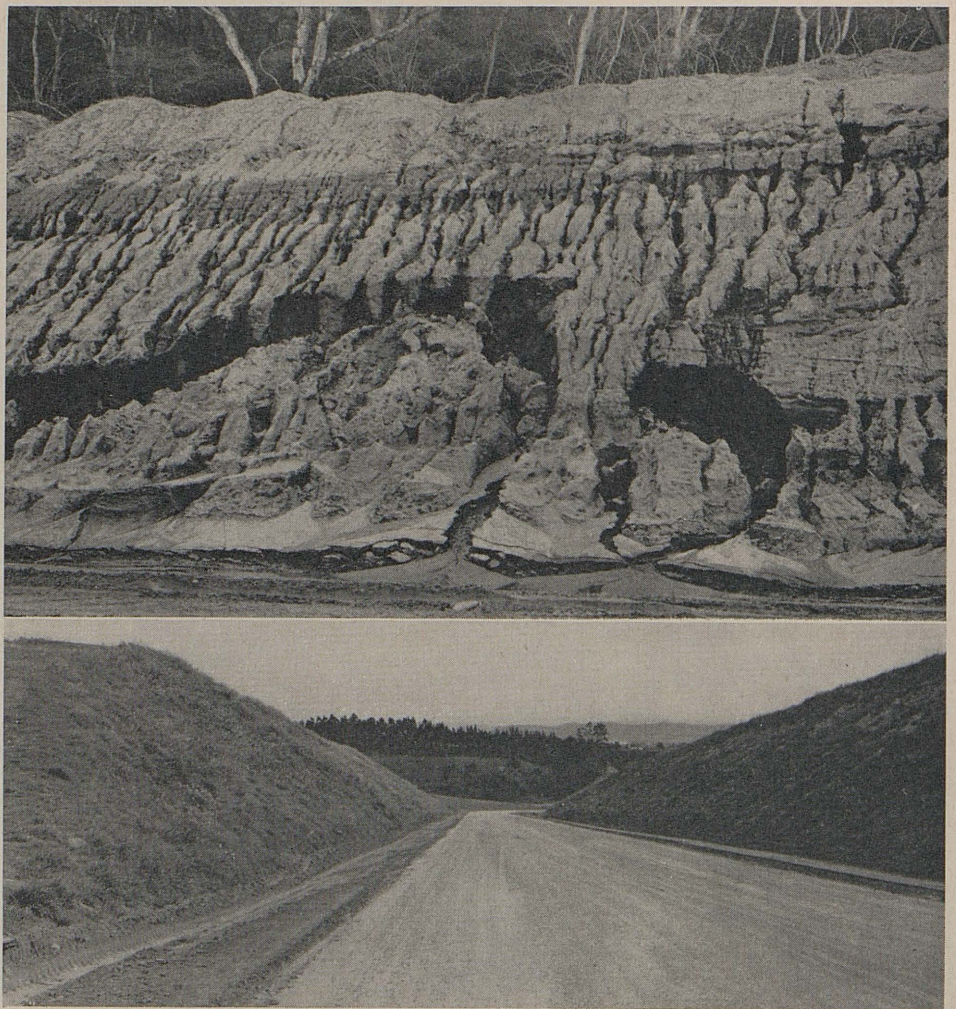
The erosion problem on agricultural lands is another matter entirely, since this phase of the subject is adequately treated in publications of the Soil Conservation Service we will consider here only erosion as it directly affects roadsides.

CALIFORNIA climate has been the inspiration for so many clever remarks that its true nature is not widely understood. Perhaps a short discussion of the general climatic pattern and the extreme variations from the average which modify that pattern will be of value in explaining why California problems in erosion control are somewhat different from those encountered elsewhere.

Generally speaking, rain normally falls only during the late fall, winter and early spring months, with the greater part of the yearly total coming in the form of rains of high intensity during the months of December, January, and February. March and October may or may not be wet. Little or no rain falls from April to September.

Daytime temperatures during the dry summer range from moderate (average about 85 degrees) in the coastal areas and in the mountains at elevations above approximately 3,000 feet to high (average 95 degrees to 100 degrees) in the interior valleys. Humidity is low, except on the immediate coast, where fogs are general during July and August from Santa Barbara northward.

The yearly rainfall total varies strikingly from one section of the State to another. Highest rainfall figures are found in the vicinity of Crescent City in the northwest corner of the State, where the 20-year average is 72 inches



UPPER—Erosion caused by high-intensity storm during construction on untreated cut slope near Watsonville. Topsoil windrowed at top of slope. LOWER—Successfully stabilized cut slopes, same soil and locality as above, as they appear one year later. Treatment consisted of topsoil, straw and seed

per year, and yearly totals sometimes exceed 100 inches. Lowest figures are found in the southeast corner of the State in the Imperial Valley (Brawley, 2.44 inches per year) and the southern end of the San Joaquin Valley (Bakersfield, 5.71 inches per year). In general, the northern part of the State receives an ample supply of rain, the quantity decreasing rapidly in the interior valleys as we move southward, and more slowly along the coast and in the Sierras (San Francisco, 23 inches; Sacramento, 19 inches; Tahoe, 31 inches).

This tendency is modified as the Tehachapi Range is crossed and the entire Southern California area receives relatively light rainfall (San Diego, 10



Redwood trees and luxuriant undergrowth characteristic of the north coastal section of the State where yearly rainfall totals are high (Near Dyerville, Humboldt County)



Joshua trees (*Yucca brevifolia*) and sparse undergrowth characteristic of the southeast section of the State. Yearly rainfall totals here range from 2½ inches to 5 inches

inches; Los Angeles, 15 inches) except in the higher mountains, where the yearly totals are much greater. Mount Wilson, for example, receives 31 inches of rain per year, while Pasadena, at its base, receives 18 inches.

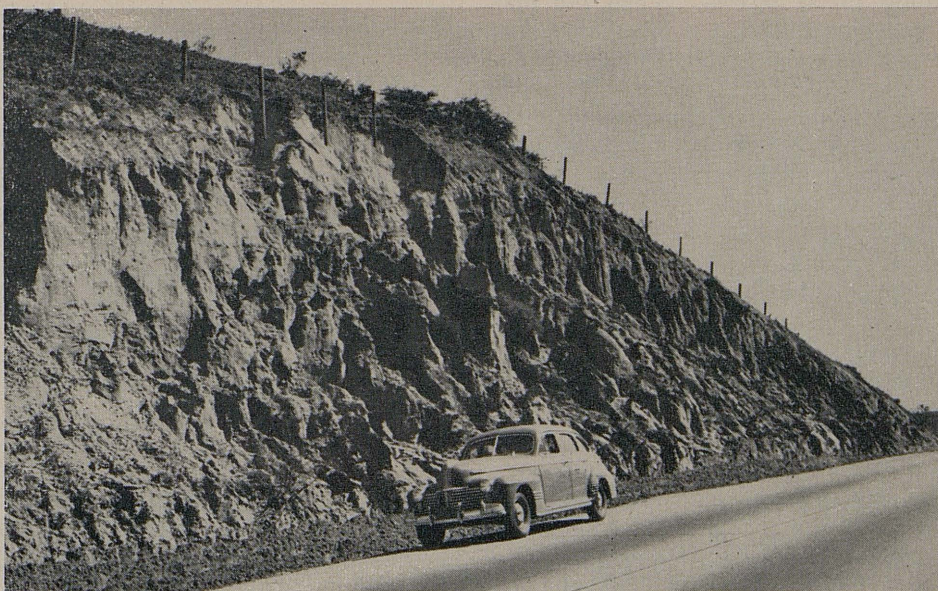
Rainfall Intensity

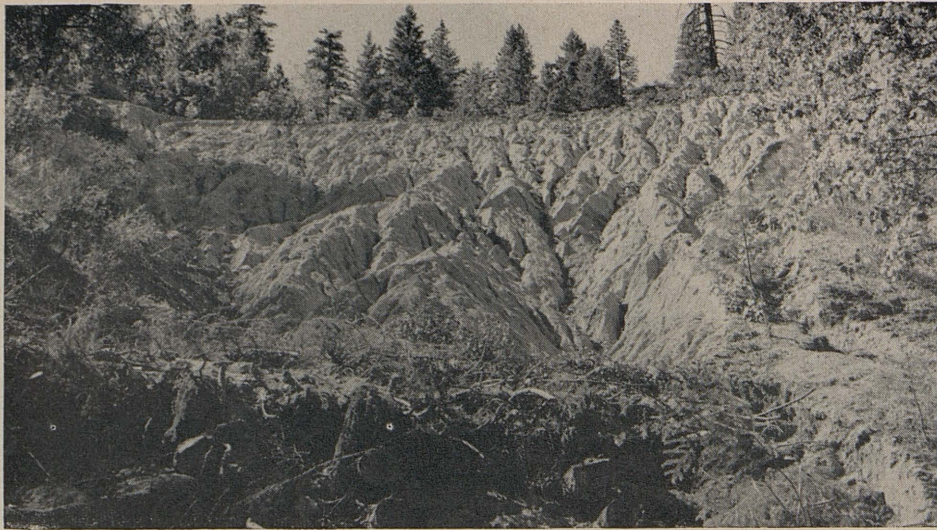
It should be mentioned here that rainfall intensity in the mountains of Southern California is considerably higher than the yearly rainfall average might suggest. The influence of lower temperature and higher altitude of the mountains upon the warm moist air and clouds which drift inland from the Pacific Ocean results in the concentration of precipitation within a relatively small area. An intensity record for the North American continent of 1.02 inches during a one-minute period is held by Opid's Camp near Mount Wil-

son. Localized summer and fall thunderstorms also occur occasionally, and though they may contribute little to the annual rainfall total, serious erosion is often caused because of their high intensity.

The "unusual" nature of California weather is manifested in frequent deviations from the normal. Some years, the summer drought continues until December or even January. Occasionally, little or no rain falls after January or February, and at other times a period of fair rainfall in fall will be followed by one or two months of rainless weather, after which there may be late spring rains.

Highly erosive soil near Salinas. Note loss of soil above fence line. Sloughed material bladed off traveled way must be hauled away by truck





Roadway fill slope composed of disintegrated granite material after high-intensity rains. (Between Redding and Weaverville, Shasta County)

Vegetation Growth

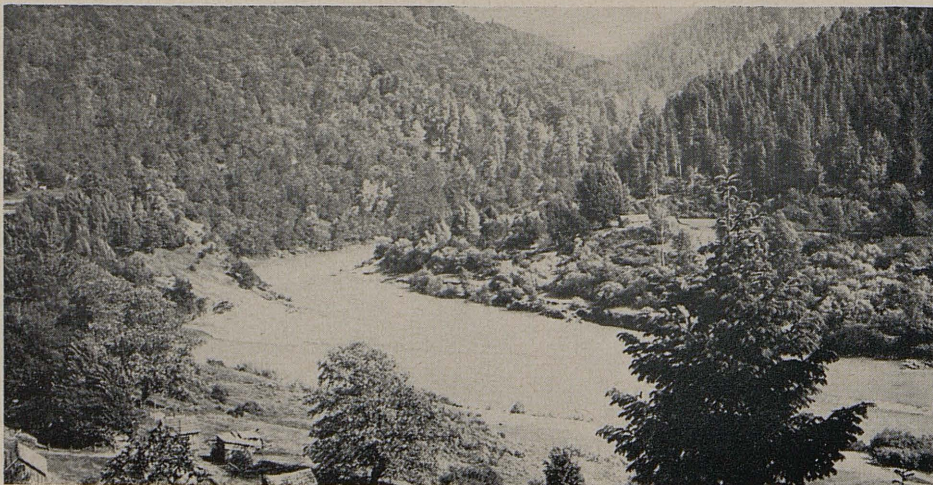
Since soil moisture is depleted during the dry summer, growth of annual vegetation follows the rainfall pattern. The growing season starts with the first rain of the season, whether it comes in October or January, continues through the winter and spring, and all but the most drought-resistant plants die when soil moisture is no longer available. A light early rain, which starts the growth of annuals, followed by a dry period, sometimes results in the premature death of the first plants. A second crop then germinates after the next rain.

From an erosion control standpoint, these weather variations leave something to be desired. When the first



A naturally stabilized slope. No active erosion here

Nature covers eroded slopes with vegetation, but it is not a quick process. (Junction of the Trinity and Klamath Rivers, Humboldt County)



rain of the season is moderate in intensity and deposits sufficient moisture to germinate seed and keep it growing, there is a good chance that an adequate vegetative cover will be established before the heavy rains come. But if the first rain of the season is late and heavy, the protection offered by the dead remnants of the previous season's growth is often inadequate, unless an ample root mat has been formed, and soil loss takes place.

On rural highways, establishment of a protective growth by artificially sprinkling the slopes has been attempted during dry years. This method, however, is not now considered practical for any but newly constructed slopes, and then only when conditions are such that subsurface

moisture is present to augment the shallow penetration obtainable by sprinkling.

EROSIVE SOIL TYPES

In 1937, the United States Department of Agriculture recognized 259 distinct soil types as occurring in the agricultural sections of the State. As more comprehensive soil surveys are made, there is no doubt that many additional soil series will be classified, making the extreme complexity of the erosion control problem more evident.

Most soils in the coastal portions of California are derived from material which is itself sedimentary in origin. Ancient ocean beds and river channels,

raised high above the present sea level long ages ago, have been exposed to the elements and have eroded, forming new sedimentary deposits. These newer deposits erode still more readily, and after the erosion and deposition process has been repeated several times, the material becomes extremely susceptible to displacement by running water.

Erosive Materials

The readiness with which sedimentary material erodes depends upon the extent to which consolidation or compaction, and, later, disintegration have



Extensive cut and fill area exposed to erosive forces by construction of this high-standard mountain road. Compare with old road at lower right. (Near San Marcos Pass above Santa Barbara)



Adjacent property affected by debris from eroded highway drainage ditch. (On Coast Route, south of Half Moon Bay, San Mateo County)

taken place. Recently deposited, poorly consolidated sediments, examples of which are found in the Salinas-Watsonville area, are extremely erosive. As a rule, other sedimentary materials, such as shale and sandstone, are less subject to erosion except when poorly consolidated or disintegrated, but are often troublesome from a control standpoint.

Material derived from igneous and metamorphic rocks, such as granites and gneisses, is also highly erosive. Such material is commonly referred to as "disintegrated granite." Since this material occurs in mountain areas where rainfall intensities are severe, erosion control measures required for control must be elaborate and thorough.

EROSION ON UNDISTURBED SLOPES

When considering the problem of soil loss on highway cut and fill slopes, the absence of accelerated erosion on undisturbed steep surfaces, invites speculation. On the natural slope a cover of vegetation which breaks the force of falling raindrops, a litter of twigs, grasses and leafmold or forest duff, which retard the runoff of surplus water, and the presence of a coating of moderately compacted topsoil, appear to be the prime factors which differentiate disturbed and undisturbed slopes.

The angle of slope and the composition of subsoil may be identical, yet the disturbed slope loses large quanti-

Iron pipe stakes and fencing fail to prevent slip out. Inadequate downdrains and resultant overlapping of the berm surface runoff contributed to failure. (Crest Drive, San Bernardino County)



ties of soil with every rain while the natural and undisturbed slope remains unaffected. The obvious thing to do, then, is to endeavor to duplicate on the artificial slope the conditions which prevent damage on the natural slope. That, however, is not always a simple matter.

Natural Slope

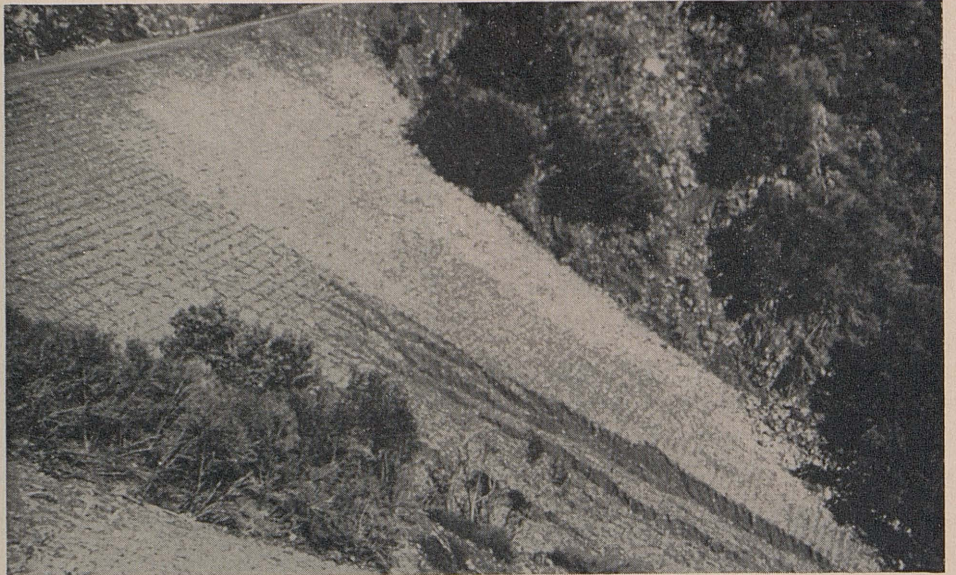
The natural slope which we see protected so effectively has attained its condition of equilibrium only after a period of many years' exposure to the elements. If the slope was first formed by rapid cutting action of a stream, or, perhaps, by sliding earth or even volcanic action, it was subject to the same violent erosive forces as our highway slope is today, and gullied just as badly. Very slowly, however, a few wind-blown seeds found lodging places on the gullied slope and grew into stunted plants which helped catch more seeds. Gradually, during seasons of moderate rainfall and ideal conditions, vegetation spread, and as it increased in density, more and more leaves and twigs fell to the earth to act as tiny dams to prevent soil loss and to do their part toward development of humus and topsoil. Eventually, the slope became completely stabilized; but note that it took many years and that many tons of soil eroded from the slope before soil loss became negligible.

Nature Must Be Helped

Unfortunately, we cannot wait many years for unassisted nature to heal the wounds we have made in the earth. Soil which has eroded from new banks affects our highways adversely, and even though it may be true that eventually the slopes will stabilize themselves, the maintenance cost in the meantime, which can be charged directly or indirectly to soil loss, is often excessive. Nature must be given a helping hand if we are to expect rapid stabilization.

DEVELOPMENT OF EROSION CONTROL PROBLEM

As long as man was content to jog along on his horse or in his wagon taking it as a matter of course that he must spend many hours in traveling a few miles, roads were built over the easiest terrain. When the early road-



An early experiment in wattle spacing. Wattles widely spaced on left half of slope, closely spaced on right half. (Angeles Crest Highway, Los Angeles County)

builders encountered a hill, they built their road straight over the hill or went around it. Excavation was kept to a minimum since the speed of vehicles of that day was slow, and cuts and fills constructed by hand or horse labor were costly. Erosion took place, but people considered ruts, washouts, and slides as unavoidable evils, and if a road became impassable, they either went around the bad place or stayed at home. If the road was badly damaged, it was often cheaper to build a new road entirely than to repair the old one. There was plenty of land, and the investment in the old road was not great. Nobody thought much about erosion, except during the rainy season, and even then the rain was blamed for the difficulties rather than the road-builders.

All Year Roads

Came the day, however, when people began to demand "All Year Roads." Satisfying the demand meant that a considerably greater investment had to be made in the existing road. Culverts, drainage ditches, improved subgrade, bridges and eventually hard-surfaced pavement, added to the cost. The demand for improved alignment to keep pace with modern automotive transportation and speed resulted in the construction of deeper cuts and higher fills. It was no longer cheaper to build a new road than to repair the existing one. So erosion became a problem.

The problem was treated in the obvious way. If soil washed onto the pavement, it was scraped off, or hauled and dumped over the nearest fill slopes. If gullies developed in drainage ditches or fill slopes to the point where the pavement was threatened, they were filled up with loosely dumped soil. It was a race with Nature, an attempt to repair damage as fast as it occurred. Many of the gullies were washed out anew each year, growing larger each time. Areas from which soil washed onto the pavement deposited more and more soil with each storm. True, some of the troublesome areas were "cured" in time, but for the most part it was a losing race.

Roadside Appearance Suffers

In addition to the danger to traffic and the roadway, due to the effects of erosion, the appearance of the roadside suffered. Adjacent property was affected by concentrated or diverted water and the deposition of eroded debris, and many damage claims resulted. The cost to the public in loss of life and property due to accidents in which erosion damage was a factor, is incalculable.

Needless to say, as the alignment of highways improved, slopes and fills became higher, with a resultant increase in maintenance costs due to erosion damage. It was fully realized that

some method must be developed to prevent this costly damage, prevention being proverbially better and cheaper than cure, but information on proven procedures was lacking and funds for experimental work were difficult to obtain. It was not until the depression period (in the '30's) that it was possible to get manpower and money for large-scale experimental projects. By this time, various agencies were developing control methods which looked good but which, for the most part, had not been tested under sufficiently varied conditions. A number of methods were tried and, of these, some showed considerable promise.

Forest Service Methods

Methods developed by the Forest Service, and described in Mr. Charles J. Kraebel's circular, "Erosion Control on Mountain Roads," and methods suggested by Soil Conservation Service publications and the Public Roads Administration were tested and modified by the California Division of Highways with varying results. Further experimental work has been done since that time, and the methods described herein represent the most successful of the many procedures which have been tested. It is not to be expected that these methods will be the final answer to the slope stabilization problem. Since climate, rainfall and soil character vary so widely throughout California, no one method can possibly fit all conditions without modification.

Experimental work is continuing, however, and it is hoped that methods will soon be developed which can be relied upon to give adequate control under extremely adverse conditions.

... To Be Continued

ACKNOWLEDGMENTS

Grateful acknowledgment is hereby made to the many persons who, by their suggestions and encouragement, have contributed to the preparation of this booklet.

Special acknowledgment is due Mr. Chas. C. Morris, Division Engineer of the Public Roads Administration, for suggesting that a publication describing our erosion control methods would be of interest to others faced with similar problems; and later for his review and suggested improvements in the manuscript. Also to Mr. Wilbur H. Simonson, Chief, Roadside Section, Public Roads Administration; Mr. C. J. Kraebel, Division of Forest Influences, U. S. Forest Service; Mr.



Damage on 1½:1 fill slope seeded to barley. No straw mulch was used. The soil is of a sandy and highly erosive nature

J. S. Horton, San Dimas Experimental Forest, U. S. Forest Service; Professor Joseph Kittredge, Professor of Forestry, Forest Influences, University of California; and Mr. C. H. Gleason, Forester, U. S. Forest Service, for their valuable suggestions and constructive criticism; and to L. S. Manning, Associate Landscape Architect, California Division of Highways, for his compilation of this manuscript.

H. DANA BOWERS

ARDENT READER

ONTARIO, CALIFORNIA
MR. KENNETH C. ADAMS, Editor
California Highways and Public Works

DEAR SIR: I would hate to miss your magazine and hope to be on the future mailing list. It is the only magazine that does not get slighted when it arrives.

Working all over the State I am familiar with most of all the places. I have a very complete file going several years back.

Respectfully yours,

D. H. NELSON

CULVERT PRACTICE

STATE OF MARYLAND
STATE ROADS COMMISSION

BALTIMORE 3, MARYLAND
November 2, 1949

MR. G. A. TILTON, JR.
Assistant Construction Engineer
Department of Public Works
Sacramento, California

DEAR MR. TILTON: Thank you for your copy of *California Culvert Practice* which you recently sent at my request.

I find this publication one of the most complete and informative of any that I have reviewed on this subject. Your Highway Department is to be congratulated on the thoroughness in which this subject has been treated.

Thanking you again for your assistance and with kindest regards.

Very truly yours,

(Signed)

P. C. COOPER
Research Engineer

Pismo Beach Project *Freeway Utilizes All Of Existing Pavement*

By L. H. GIBSON, District Engineer *

THE RECENT COMPLETION of the project from Pismo Beach north to Miles Station has added another five miles of four-lane divided freeway to increase further the rapidly enlarging traffic capacity of the Coast Highway, U. S. 101, in San Luis Obispo County.

San Francisco-Los Angeles motorists are particularly familiar with this scenic stretch of highway as it provides an excellent view of the beautiful Pacific between Pismo Beach and the summit of Ontario Grade, approximately four miles north. Northbound from Ontario Grade, the route turns inland and no further view of the ocean is afforded between there and Golden Gate Bridge. Conversely, southbound motorists enjoy their first vista of the ocean upon topping Ontario Grade but leave it when turning inland at Pismo Beach for the next 64 miles.

* Mr. Gibson wrote this article prior to his retirement on December 1, 1949.

Old Highway Utilized

The scenic qualities of this section of highway were not, of course, of major importance in assigning the project an early priority for conversion from a narrow, conventional two-lane highway to a modern, limited-access freeway. Limited capacity of the existing 20-foot pavement, however, was of prime consideration in postwar planning, and other factors including the ribbon development of the Shell Beach area with its inherent accident frequency, and the slow-down characteristics of Ontario Grade, particularly in relation to heavy truck traffic.

Desiring, at the same time, to protect the State's investment in the existing road, a design ultimately was chosen which has made use of the entire length of the existing highway. From the city limits of Pismo Beach to approximately one mile north, the

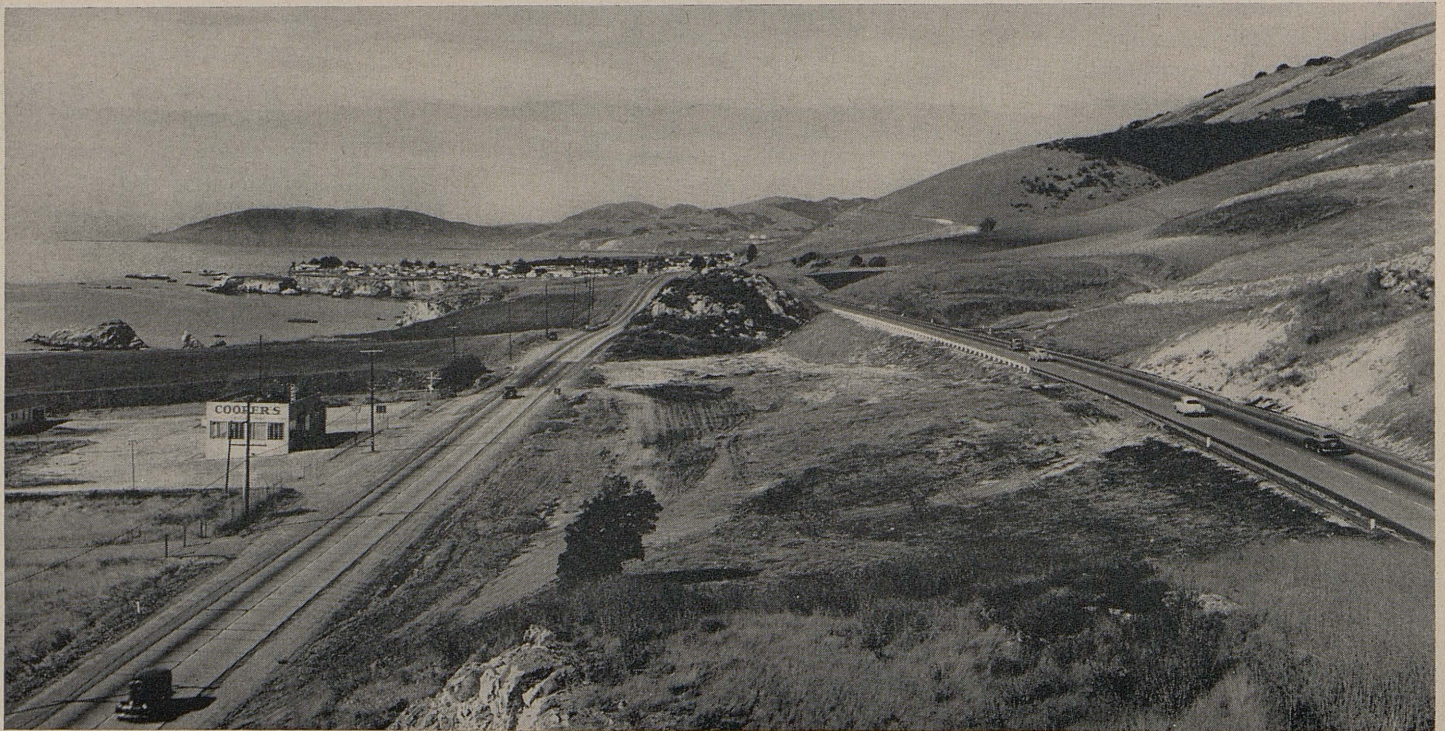
existing pavement has been utilized for southbound lanes, with two new lanes being constructed to the east for northbound traffic.

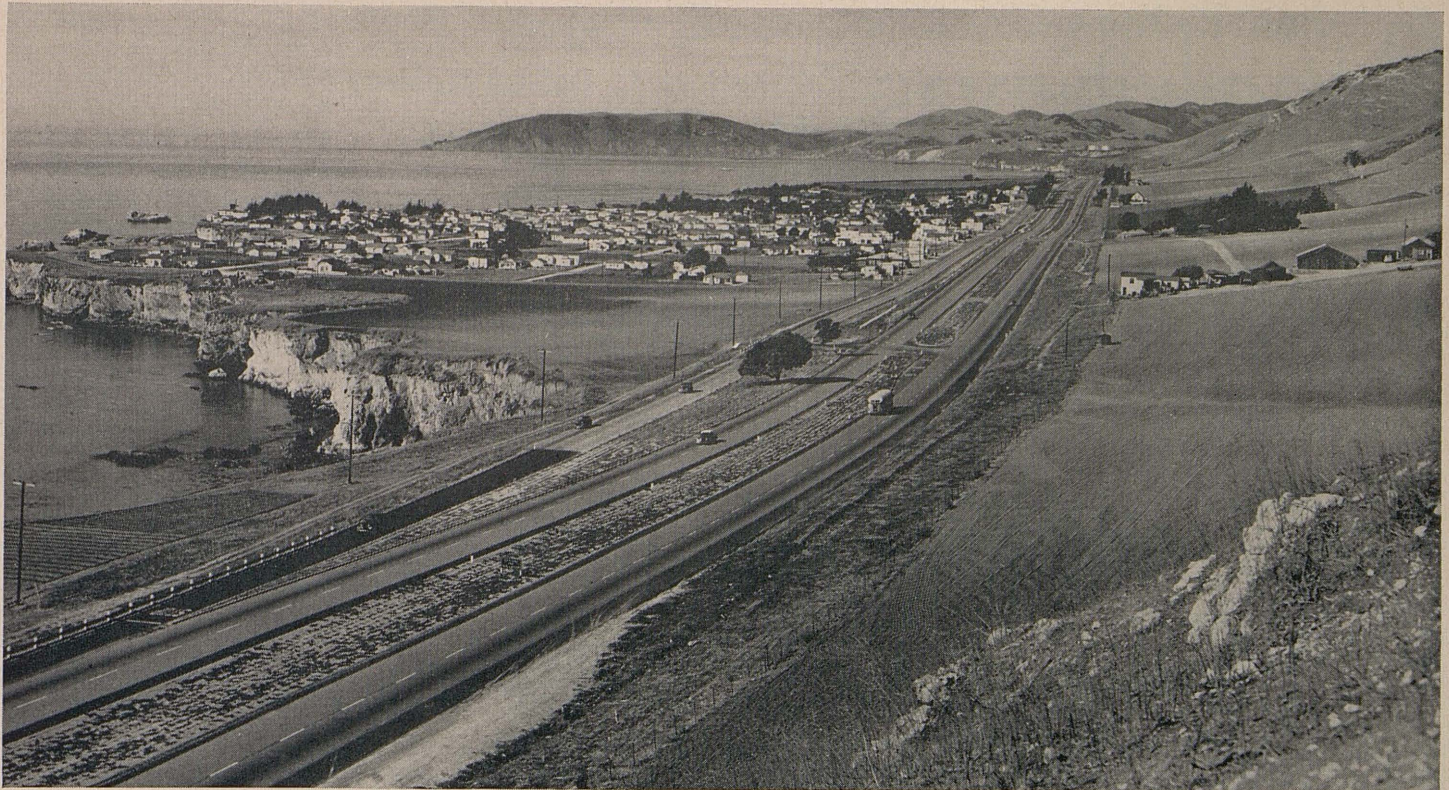
Outer Highway Provided

For the next mile and a half, the existing pavement was left in place to serve as an outer highway for the Shell Beach area, appropriate connections being constructed at the north and south ends and in addition an access ramp located approximately in the center. Paralleling this outer highway on the east are four entirely new lanes constructed on a higher elevation. Except for one short section, the existing 20-foot pavement from Pismo Beach to the north limits of Shell Beach was converted to outer highway and one-way traffic without the necessity for resurfacing.

At the north limits of Shell Beach the freeway connection is so designed that the existing pavement that was

This photograph was taken north of Pismo Beach looking toward Shell Beach and shows new northbound lanes on right which converted this section of U. S. 101 into a four-lane divided highway



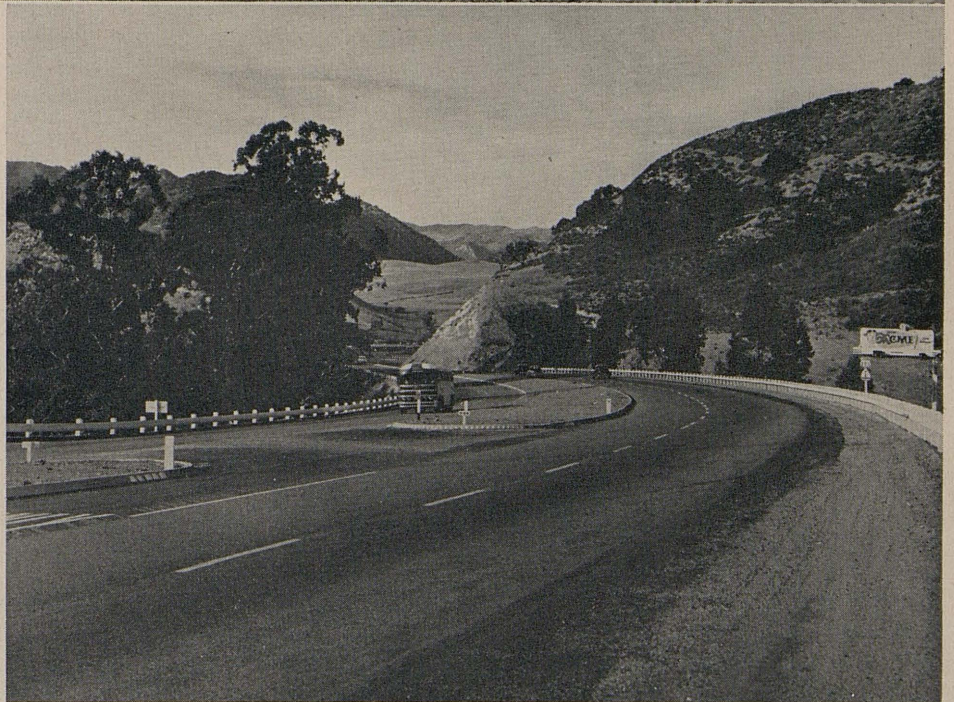


converted to outer highway, at this point comes into use as the two north-bound lanes of the present freeway, and this situation prevails to the end of the project at Miles Station, south-bound traffic being handled by two new lanes constructed on the ocean side of the existing ones. The new construction consists of two 24-foot roadways with the opposing lanes separated by a division strip generally 36 feet in width.

Bridge for Southbound Traffic

At San Luis Obispo Creek, near the end of the project, a 570-foot reinforced concrete bridge for southbound traffic was built alongside the existing structure. With a clear roadway width of 28 feet and two 1-foot 9-inch wide safety curbs, the new bridge consists of 14 spans supported on reinforced concrete piers and abutments with timber pile foundations.

Of particular interest on this project, however, is the outer highway through the Shell Beach resort area. Aside from the usual advantages of increased safety and convenience it provides for local traffic, we once more find refutation of the so-far unprovable claim that "outer highways ruin local business." Again, as in the case



UPPER—View looking northerly through Shell Beach toward San Luis Bay, showing existing pavement as outer highway and new four-lane divided highway. LOWER—Freeway looking northerly on Ontario Grade

of Bulletin (see *California Highways and Public Works*, September-October issue, 1949), a majority of business proprietors indicates its trade is not adversely affected by diversion of main-line traffic but in some instances, due most likely to increased parking safety, is improved.

Business Improves

One operator reports his cafe business continues good and "may even have been improved by the outer highway because customers aren't afraid to park in front now." Evening busi-

. . . Continued on page 52

Resolutions

A. A. S. H. O. Defines Highway Policies at San Antonio, Texas

At its 35th annual meeting in San Antonio last October, the American Association of State Highway Officials adopted a number of resolutions defining its policies on important highway subjects. These resolutions are published in *California Highways and Public Works* for the information of all who are interested in highway development in this and other countries.

RESOLUTION NO. 1

HIGHWAY VEHICLE SIZES AND WEIGHTS

WHEREAS, The Committee on Maintenance and Equipment of the American Association of State Highway Officials has approved and adopted the report of its subcommittee on the destructive effects of overloading highway vehicles; and

WHEREAS, The contents of that report disclose matters of grave concern to highway officials and the general public relative to the rapidly rising cost of highway maintenance, due largely to excessive loads; and

WHEREAS, Notwithstanding the very liberal maximum standards formulated and promulgated by this association relative to highway vehicle sizes and weights, particularly to the recommended maximum single axle load of 18,000 pounds, great damage to our highways has resulted from the failure of some highway users to respect and comply with these well-considered standards; and

WHEREAS, This ruinous practice of overloading our roads is destroying our primary highways faster than we can rebuild or replace them; and

WHEREAS, In an effort to secure greater economy in construction there has been a similar increase in the size and weight of construction machinery beyond a point which can safely be permitted to move over the highways even under a special permit for a single trip; and

WHEREAS, In some cases old roads have been damaged almost to the point of destruction in moving construction equipment over them to the site of new highway construction; now, therefore, be it

Resolved, by the American Association of State Highway Officials in annual convention assembled in San Antonio, Texas, on October 13, 1949, That each member state or regional group of states be advised and urged to initiate a vigorous, fearless, and sustained program of law enforcement, including special springtime restrictions, and that every effort be put forth to secure the legal adoption of the A. A. S. H. O. standards in those states which now legally sanction sizes or weights in excess of these standards; and be it further

Resolved, That this association urges all highway users and shippers, whether public or private, to refrain from contribution, either directly or indirectly, to the abuse of our public highway systems by overloading.

RESOLUTION NO. 2

OBSTRUCTIONIST TAX POLICY OF PETROLEUM INDUSTRIES

WHEREAS, The cost of highway construction and maintenance has virtually doubled during the war and postwar periods; and

WHEREAS, The cost of owning and operating motor vehicles has also increased in similar proportion, while on the other hand there has not been a proportionate increase in gasoline tax rates; and

WHEREAS, There exists an enormous backlog of desperately needed construction to place our streets and highways in adequate condition, as revealed by highway needs studies in a number of states; and

WHEREAS, The petroleum industries, whose members are undoubtedly among the chief beneficiaries of an adequate system of highways, have apparently adopted an obstructionist policy opposing virtually any increase in gasoline taxes, however modest or however urgently needed, despite fre-

quent and even greater increases during the same period in the sales price of gasoline to the highway users; now, therefore, be it

Resolved, by the American Association of State Highway Officials in annual convention assembled in San Antonio, Texas, on October 13, 1949, That the petroleum industries be urged to review this obstructionist policy with a view to the adoption of a new policy of cooperation with public officials in their attempt to provide the highway facilities our people desire and deserve.

RESOLUTION NO. 3

FORMATION OF STATE GOOD ROADS ORGANIZATIONS

WHEREAS, There have developed good roads federations or associations in 18 states in recent years, composed of individuals, or groups of taxpaying citizens, for the purpose of fostering sound and timely highway and legislative programs; and

WHEREAS, In many states today the only organized effort put forth with respect to highway matters is solely in opposition to any and all proposed highway tax increases; now, therefore, be it

Resolved, by the American Association of State Highway Officials, in annual convention assembled in San Antonio, Texas, on October 13, 1949, That the organization in each state of a Good Roads Association to support constructive highway development is to be commended and encouraged.

RESOLUTION NO. 4

INCREASE PORTION OF HIGHWAY TRANSPORTATION DOLLAR ALLOCATED TO ROADS

WHEREAS, A recent authoritative and unbiased national survey has disclosed the amazing fact that less than 10 cents of the highway transportation dollar is allocated to the construction and maintenance of our roads and streets; and

WHEREAS, The remaining 90 cents, or more, of every such dollar goes for

the purchase, operation, maintenance, insurance, storage, etc., of the vehicles using the roads and streets; and

WHEREAS, The same study concluded that over-all economies would result from expending a larger proportion of the total dollar on our highway facilities; now, therefore, be it

Resolved, by the American Association of State Highway Officials in annual convention assembled in San Antonio, Texas, October 13, 1949, That this disclosure and conclusion be brought directly to the attention of the public, the press and radio, our governmental leaders, and our legislators, by the members of this association.

RESOLUTION NO. 5 HIGHWAY SAFETY

WHEREAS, The mounting toll to life and limb on the highways of the Nation prompted the president of the National Safety Council, following the reports of fatalities this last Labor Day week-end, to assert that the "loss of life was a national disgrace"; and

WHEREAS, Highway officials have an individual and collective responsibility to build the maximum safety into all new highways, and eliminate structural hazards on old highways and relocate all roadside obstructions. Now, therefore, be it

Resolved, by the American Association of State Highway Officials in annual convention assembled in San Antonio, Texas, on October 13, 1949, That we do hereby renew our pledge of wholehearted cooperation with all well-conceived programs of highway safety be they local, state or national; and be it further

Resolved, That we further pledge our continuing research in and removal of all hazards to highway safety on the traveled way and the more effective public control of hazards to highway safety along the roadsides.

POWER TO DESTROY

Paraphrasing a familiar saying, the California State Automobile Association observes that "the power to speed is the power to destroy." Traffic accidents each year exact untold destruction of life and property, and most fatal accidents are caused by excessive speed.

and Public Works

State Engineers Are Given Award Of Merit

Nineteen engineers of the California Division of Highways who have completed 25 years of service were given the Award of Merit of the American Association of State Highway Officials

engineers; I. O. Jahlstrom and Stewart Mitchell, Principal Bridge Engineers, and Andrew J. Meehan, Supervising Bridge Engineer; E. J. Saldine, Principal Highway Engineer.



Retiring President Carl W. Brown of American Association of State Highway Officials presents to Fred J. Grumm, Deputy State Highway Engineer, Division of Highways, Awards of Merit for state highway engineers

at the October annual convention of the association in San Antonio, Texas.

The awards were presented to Fred J. Grumm, Deputy State Highway Engineer of the Division of Highways, by Carl W. Brown, retiring President of A. A. S. H. O.

Upon his return from the convention, Grumm delivered the awards to the following:

Central Office, Sacramento—William Bock, Marshall H. Hubbs, Wilburn H. Irish, Joseph M. Cane, Perry R. Lowden, J. H. Obermuller, and George A. Tilton, Jr., Supervising Highway En-

District IV, San Francisco—Raymond P. Duffy and Ralph D. Kinsey, Supervising Highway Engineers.

District VI, Fresno—Don G. Evans and Clement F. Waite, Supervising Highway Engineers.

District VII, Los Angeles—Ralph C. Myers and James M. Hodges, Supervising Highway Engineers.

District VIII, San Bernardino—Lester R. McNeely, Supervising Highway Engineer.

District X, Stockton—Clifford J. Temby, Supervising Highway Engineer.

Civil Service Examinations For Engineers

Examinations have been announced by the U. S. Civil Service Commission for Highway Engineer Trainee, Highway Engineer, and Highway Bridge Engineer. These positions, which pay from \$2,650 to \$3,825 a year, are mainly in the Bureau of Public Roads of the Department of Commerce in Washington, D. C., and throughout the country. A few positions may also be filled outside the United States.

To qualify for highway engineer trainee positions paying \$2,650 to \$3,100 a year, applicants must pass a written test and, in addition, must have had college study in civil engineering. For the \$3,100 positions, appropriate engineering experience may be substituted for the required college study. Applicants for highway engineer or highway bridge engineer positions, which pay \$3,825 a year, must, in addition to passing the written test, have had one year of professional highway or highway bridge engineering experience or have completed the requirements for the master's degree in engineering. Applications will be accepted from students who expect to complete the required courses not later than June 30, 1950.

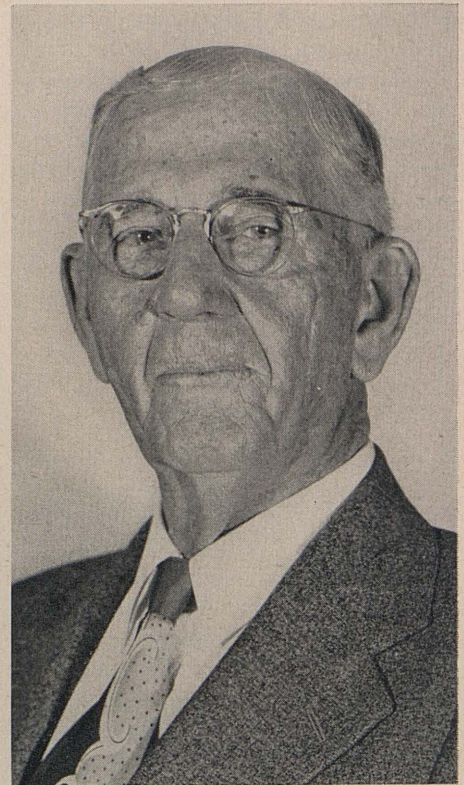
Further information and application forms may be obtained from most first- and second-class post offices, from civil service regional offices, or from the U. S. Civil Service Commission, Washington 25, D. C. Applications must be received in the commission's Washington office not later than February 8, 1950.

W. E. Peck Ends 25 Years State Service With California Division of Highways

AFTER OVER 25 years of service with the Division of Highways, W. E. Peck of the Materials and Research Department, Sacramento, has started a well-earned retirement. Throughout his long years of service he was an energetic worker and his friends expect that he will enjoy an active retirement. His future plans include part-time and short duration positions with local private engineering firms interspersed with periods devoted to travel and to his home work shop to enjoy use of the machine tools included among his retirement gifts.

Mr. Peck's engineering career began in Kansas City in 1903. During the ensuing 20 years prior to his locating in California, his record includes a long and diversified list of assignments in engineering and construction work throughout the states of Kansas and Missouri. After settling in California his experience included short periods of service with the Equipment Department, Bridge Department and Headquarters Office and in 1929 Mr. Peck became associated with the Materials and Research Department, remaining with the laboratory until his retirement.

Mr. Peck is gifted with unusual mechanical and inventive initiative. This has been evidenced by the many improvements in equipment designed and technique developed by him for the handling and testing of soils and aggregates.



W. E. PECK

A farewell luncheon with an attendance of well over 100 guests was given in his honor on October 26th, at the Tuesday Clubhouse in Sacramento. This was followed by an evening stag party at the Odd Fellows Hall, Oak Park. Commemorating his retirement, a scroll depicting highlights in his career and signed by Mr. Peck's many friends and fellow employees was presented to him.

Honor Is Paid S. V. Cortelyou by Supervisors of Los Angeles

A resolution highly commending Spencer V. Cortelyou, who retired on October 1 with the rank of Assistant State Highway Engineer after 37 years of public service, was adopted by the Board of Supervisors of Los Angeles County on October 11. The resolution adopted on motion of Supervisor John Anson Ford follows:

"WHEREAS, Spencer V. Cortelyou is retiring from the service of the California

State Division of Highways after 37 years of public service; and

"WHEREAS, During this period, the physical pattern of California highways has been completely transformed and the transportation habits of the people have practically revolutionized our mode of living; and

"WHEREAS, Mr. Cortelyou's services as District Engineer for this area entailed vast responsibilities and expenditure of millions of dollars; and

"WHEREAS, Mr. Cortelyou was formerly

a county employee; now, therefore, be it

Resolved, That the board of supervisors extend best wishes to Mr. Cortelyou on his retirement from public service, with special appreciation for the engineering skill and the integrity with which he has carried forward his great responsibilities in the tremendous expansion of Southern California's highway system; be it further

Resolved, That a suitably engrossed and sealed resolution be forwarded to Mr. Cortelyou, as well as a copy to the State Highway Commission."

Freshwater Lagoon

Continued from page 14 . . .

Project Items

The project included construction of a fill, 4,500 feet in length, on Freshwater Lagoon sandspit south of Lookout Point. This 183,000-cubic yard fill, varying in height from 8 feet to 14 feet, was constructed generally on the landward side of the spit which varies from 500 to 700 feet in width. Protection against possible damage from surf action or run of the tide was provided by placing 6,130 cubic yards of heavy stone riprap (up to 2-ton stones) at the more vulnerable locations along the fill. The stone, which had the rather high specific gravity of 2.90, was hauled from a quarry 19 miles southerly by a fleet of five 10-yard trucks, dumped on the grade, and handled into place by crane.

The southerly third of the 3.8 mile project, south of the sandspit, lay in unstable mountainous terrain. In this 1.3 mile length it was necessary to construct 11 stabilization trenches.

Ground Water Escape Trenches

The purpose of the trenches was to facilitate escape of ground water. The

consequent reduction of moisture in the foundation material would increase the stability of the foundation and its ability to support the fill.

The trenches were generally constructed 12 feet wide on the bottom, as much as 37 feet deep, and 200 feet long. Material was excavated to firm bottom or to water strata by dragline and bulldozer, and wasted beyond the roadway slope stakes—in some instances, it was placed as struts or buttresses for the roadway fill. A perforated metal pipe and 3-foot layer of filter material (coarse beach sand, with gravel immediately around the pipe), were placed in the bottom of the trench; the filter material was also placed up the sides of the trench if side seepages indicated its need.

The project included several other items of more than passing interest: The stripping of 45,000 cubic yards of unstable fill foundation material from an area 900 feet long, up to 150 feet wide, and as much as 32 feet deep; the placing of gravel embankment material under water, and the construction of a 6 x 6-foot concrete relief culvert on piles through the sandspit.

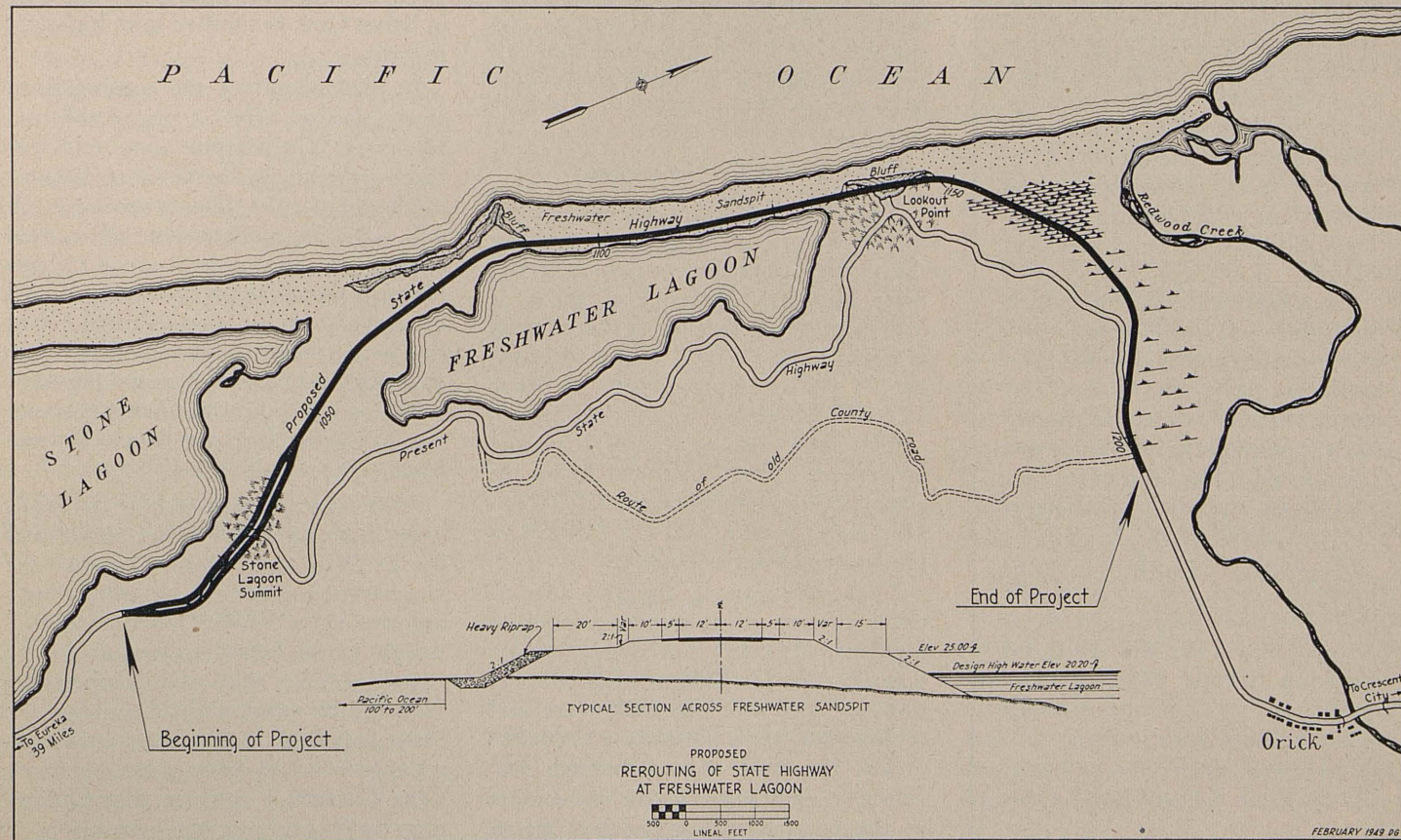
Project 85 Percent Complete

To date, on the 800,000 cubic yard project, only a nominal amount of slides has occurred, although more may be expected during the coming winter, particularly in some of the cuts where the material is a talc schist.

It is expected the project will be approximately 85 percent complete before winter shutdown occurs. The grading should be completed early in next year's construction season.

Surfacing of the project is to be done next year under separate contract.

Progress and quality of work have been very satisfactory. During the peak month of grading, 173,600 cubic yards of excavation were handled, which on one day reached a 9,800-cubic yard output. The contractor is Piombo Construction Company, with Phil Dunn as Resident Superintendent. Inspection is under the supervision of the Eureka office of the Division of Highways, with A. M. Nash as District Engineer. The Resident Engineer on the project is H. M. Hansen.



In Defense of the Highway Engineers

Editor, News-Press:

It is about time someone came to the defense of the Highway Department. In regard to Buellton, the original plan to detour the town was changed at the request of some of the residents.

In claiming damages from a public project, one should not base his claim on values created by that project. The Cachuma contract states this. To avoid the wasteful expense of endless lawsuits on payments for rights of way, legislation could be put through that would set the maximum payment for needed land at a certain number of times the assessed valuation of similar property in that locality. Then if the landowners wished more, they would have to see that their property was assessed higher. This would create an automatic balance.

If the Highway Department paid the full price asked by the landowners, they would be criticized by the general taxpayer for wasting public funds. So their necks are always out. Authority is the vital force in civilization, and if the department obeyed the wish of each citizen along the way, there would be many windings and detours from the best course.

Looking back over 40 years, each new job the Highway Department has undertaken has been criticized as wasteful and unnecessary at the time, but shortly after completion its value was recognized. The engineers are specialists, and their thinking is 10 years ahead of us.

No single efforts of the government has more influence on our daily life than the good roads, or is so popular in use. The advanced thinking of our Highway Department was of tremendous value in both world wars.

F. W. NORDHOFF

From Santa Barbara News-Press

New Santa Cruz Freeway Typical

Continued from page 7 . . .

Collier-Burns Act off these main arteries was this modern highway between Rob Roy Junction and Santa Cruz. As the cost of the improvement was such that it was impractical for the Highway Commission to budget the entire work in one annual budget, the grading and structures were let to contract in October, 1947, and the pavement placed under a separate contract which was awarded in April, 1948.

The project consisted of construction of a four-lane divided freeway with access limited to specific locations. In the 7.7 miles between Rob Roy Junction and Morrissey Avenue in Santa Cruz, the new freeway represents the best in modern arterial development, designed for safe and expeditious movement of traffic in this locality.

The actual construction cost of the project, including construction engineering but not including right of way, totaled \$3,041,800, for the three contracts: grading and structures; paving; and lighting. The major structures included the North and South Aptos underpasses separating the highway and railroad; the Aptos Creek bridge and the Soquel Creek bridge; and highway grade separations at Capitola Avenue, Bay Avenue, Soquel Road, and Fonda Avenue.

Other Santa Cruz Projects

The State feels that this new freeway is a mark of progress in meeting the problem of traffic congestion on the State Highway System and today it is presented for service to the citizens of Santa Cruz County. It is a forerunner of similar improvements at other locations where the need is pressing.

The State plans to complete the improvement opened to traffic today by constructing a connecting link between Morrissey Avenue and the Los Gatos Highway as soon as possible.

Your attention is directed also to other recent major improvements to highways in Santa Cruz County undertaken by the Division of Highways in the past two and one-half years and which total approximately \$1,200,000.

The largest of these provided construction on new alignment of 1.4 miles of the coastal road at the San Mateo

County line, including a new bridge across Waddell Creek. The total cost of this improvement, which was accomplished in cooperation with Joint Highway District No. 9, amounted to \$721,000. The recently completed bridge across the Pajaro River on Chittenden Road at the San Benito County line was constructed at a cost of \$220,000. A new crossing of the San Lorenzo River on State Route 116 about six miles north of Boulder Creek was another project.

Soquel Creek Bridge

The State also let contracts for two improvements to county roads as federal aid secondary projects in cooperation with the County Road Commissioner of Santa Cruz County. One of these projects provided for the construction of a bridge across Soquel Creek in the town of Soquel and the other construction of a bridge and grading and surfacing of a half mile on the Green Valley Road between Freedom and the Holohan Road.

The new highway maintenance station buildings now being erected here in Santa Cruz is another state highway project.

In the budget for the coming fiscal year, this is 1950-51, the California Highway Commission has included three projects in Santa Cruz County totaling \$101,500. This proposed work will provide construction of a new bridge on the coastal road across Responi Creek about two miles south of Davenport; erosion control along the new freeway between Rob Roy Junction and Santa Cruz; and the construction of bridge abutments at crossings of the San Lorenzo River between Santa Cruz and Boulder Creek.

Thus, major construction on highways in Santa Cruz County performed by the Division of Highways since the war has totaled over \$4,200,000, including this three million dollar freeway which is dedicated today. It is the State's sincere wish that such progress may be continued throughout the State and with cooperation and support, such as has been given by Santa Cruz County, I am sure that California's traffic problem will be solved.

Smith River Bridge

Continued from page 11 . . .

The construction of the new South Fork Bridge was necessitated by the obsolescence of the existing bridge at the site. This bridge was of the suspension type, with single suspended span of 168 feet, and short simple span approach at each end. It was strictly a one-way bridge, with roadway width of but 10 feet between timber wheel guards. Cable towers, main cables, hangers, light stiffening trusses and floor beams were of steel, with timber deck stringers and planking of hewn redwood.

Span Built in 1914

This bridge had been erected by the county in about 1914 and had more than served its purpose, having rendered faithful and adequate service for some three and one-half decades, even under the unanticipated and ever increasing loads to which it was subjected. But in the natural course of events, portions of the structure had yielded to the ravages of the elements and for some years it had necessarily been posted for a maximum load of four tons.

The new bridge was constructed on the same alignment and at the same site as the old structure. The deep and narrow canyon at this location, with its precipitous walls of native rock was naturally and geologically adapted to the construction of a bridge of the arch type. The use of the conventional open-spandrel reinforced concrete arch type of structure was economically precluded by the disproportionate cost of the high falsework required for the arch centering, and the difficulty of its erection and maintenance in the ever present depth of water, with the possibility of its destruction by storm waters during the rainy season.

Savings in Cost

The structure selected as the most feasible for the site is of the fixed-end, structural steel arch type. With the adoption of this design, the necessity of costly arch centering was obviated. No doubt the designer envisioned the use of the existing cable towers in the

MATHEMATICIAN'S PASSION

The profundity of two plus two,
The magnitude of x plus y ;
The startling awe of Euclid nude,
The academic joy of Pi!

To know a formula in Greek
Is such ecstatic pleasure found,
To dance with rhomboids cheek
to cheek
And lay a curve upon the
ground!

What deep emotion thus surrounds
The mystic rites of minus one!
O Engineer! O Metes and
bounds!

Sweet Math is truly regal fun!

—John Warwick Daniel, III,
Delineator, Division VII,
Los Angeles

erection of the structural steel of the new bridge by the "high line" method. Without doubt the anticipated savings in cost of construction afforded by the use of this convenience so readily to hand was reflected in the proposal of the successful bidder on the contract.

The arch spans the more precipitous portion of the gorge and has a length of 140 feet between supports and a rise of 18 feet at the crown. Two simple spans of 18 feet each, with steel stringers on reinforced concrete abutment and two-column bents, approach the arch at the north end, with one similar span at the south end. The concrete deck slab has a roadway width of 20 feet between curbs and is properly super-elevated to accommodate the short radius curves of approach roadways. Rails of the three-bar railing are of five-inch pipe, panels of which may be readily removed and replaced in the event of damage by traffic.

Design of Bridge

The steel arch ribs are of "I" section. In lieu of using the rolled "I" section, bent to the arch radius, the contractor elected to furnish the equivalent welded section built up from rolled plate. Webs were flame cut to the arch curve from $\frac{3}{8}$ -inch plate, to

which the $1\frac{1}{8}$ -inch x 12-inch flange plates were welded.

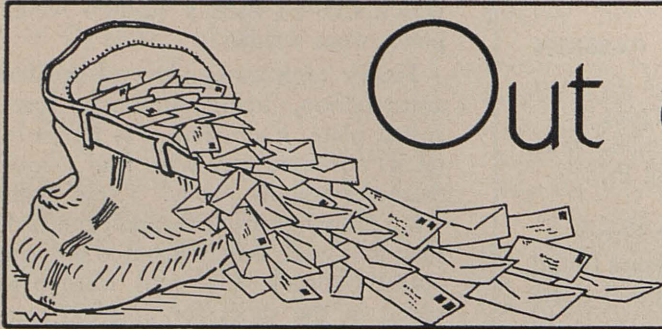
Heavy arch shoes were of welded construction, being built up from rolled plate. Each shoe was mounted on its concrete pier with four 2-inch diameter anchor bolts. These bolts were passed entirely through the arch pier, and were deeply grouted into the native bedrock. End pins were provided in the shoes for erection purposes, and to permit the arch to assume its normal position under full dead load. After all dead load had been placed on the arch span, end fixation was obtained by heavily welding the ends of arch ribs to the shoes, web fins and flange splice-plates having been incorporated in the shoes for this purpose.

Approaches Improved

Graded approach roads having a total length of 1,000 feet were constructed on improved alignment to meet the requirements of contemplated future extension of the improvements. Although the curves tangent to the ends of the bridge have maximum radii of 125 feet, the approaches to the bridge are gentle, there being a maximum down grade of 7.5 percent on the north approach, and this some distance back from the structure.

The project was financed jointly with Federal, State and county funds. General contract for construction was with the Underground Construction Company of Oakland, California. The fabrication and erection of the structural steel was subcontracted to the Judson-Pacific Murphy Corporation of Emeryville. The structure was designed by Clarence Seage. Construction engineering and inspection were provided by the Bridge Department, California Division of Highways, with the author representing the State as Resident Engineer.

Upon the completion and acceptance of the project, suitable plaques were placed on the bridge by the county designating it the George L. Tryon Bridge, in honor of Mr. Tryon, Chairman of the County Board of Supervisors, who was so instrumental in seeing the project through from its very inception.



Out of the Mail Bag

MAGAZINE HELPFUL

THE LOWE BROTHERS COMPANY

Route 1, Box 146

VANCOUVER, WASHINGTON

California Highways and Public Works
Sacramento, California

GENTLEMEN: I wish to thank you for the July and August edition of the magazine entitled "*California Highways and Public Works*." This feature is as interesting to read as the splendid highways in California are enjoyable to drive upon. The writer has supervision of my company's operations throughout Oregon, Washington and Idaho. These states could benefit a great deal by following the pattern of construction set by the State of California—referring, of course, to your excellent highway system.

Very truly yours,

ELMER C. HILBERG
Division Manager

MAGAZINE IN SCHOOL

THEODORE ROOSEVELT HIGH SCHOOL

LOS ANGELES 33, CALIFORNIA

KENNETH C. ADAMS, *Editor*

California Highways and Public Works

Sacramento, California

DEAR MR. ADAMS: For over ten years I have been on the mailing list of the *California Highways and Public Works* magazine. My physics and science students always find it one of the most interesting sources of information as to what is going on in this field of public works and highway construction.

Sincerely yours,

GEORGE W. DAVIS

Instructor, Mathematics-Science,
Roosevelt High School,
Los Angeles, California

LIKES OUR HIGHWAYS

ALHAMBRA CHAMBER OF COMMERCE

Alhambra, California

Mr. Kenneth C. Adams, *Editor*

California Highways and Public Works
Sacramento, California

MY DEAR MR. ADAMS: For the last few months you were kind to me in sending me your journal and I enjoyed every page of it.

Am sure that the good work your highway commission has done in making our streets and highways safer will save many lives.

I have been active in safety work (in Chicago) since 1904, that is over 40 years and I believe a lot can be done yet. Over 30,000 were killed in this country last year and I suppose this year will have the same record.

Keep up the good work in order that our highways in California will be safer than any other state.

Cordially yours,

(Signed) FRANK J. TOMCZAK

THANK YOU

GENERAL BEARINGS COMPANY

1360 Van Ness Avenue, Fresno, California

California Highways and Public Works
Post Office Box 1499
Sacramento, California

GENTLEMEN: Recently I had the pleasure of reading an issue of your California Highways Public Works magazine and I wish to compliment your staff on the fine work they are doing.

Yours very truly,

GENERAL BEARINGS COMPANY
JOHN A. ROHRS

AID TO POST OFFICE

RAILWAY MAIL SERVICE

Office of District Superintendent

SAN FRANCISCO 1, CALIFORNIA

California Highways and Public Works
Post Office Box 1499
Sacramento, California

GENTLEMEN: You now are forwarding copies of your very fine publication to this office and to the office of District Superintendent, District No. 3, San Francisco. We find the contents of the magazine very useful, inasmuch as we are responsible for the transportation of the United States mails in Northern California.

On a recent visit to Los Angeles we mentioned to district superintendents located at that point that we received your magazine and they both expressed a desire to be placed on your mailing list, if same is possible. Therefore, may I request that District Superintendent, District No. 2, and District Superintendent, District No. 5, of the Railway Mail Service at Los Angeles be placed on your mailing list for your publication.

Yours very truly,

WALTER R. REES
District Superintendent

NEW READER

RICHARD M. STARNES, JR.

Consulting Engineer

BERKELEY, CALIFORNIA

California Highways and Public Works
Post Office Box 1499
Sacramento, California

GENTLEMEN: May I be put on the list to receive your publication, "*California Highways and Public Works*." I am much impressed with the publication and consider the information as put out by it very valuable.

Yours very truly,

RICHARD M. STARNES, JR.

APPRECIATION

DEPARTMENT OF GEOLOGY
University of Sydney

The Editor

California Highways and Public Works
Sacramento, California

DEAR SIR: By the July-August issue of your valued journal just to hand, I notice that you will be forwarding a postcard with the September-October issue to be returned to you by recipients who desire to continue receiving "California Highways and Public Works." As some issues of your publication have failed to reach me, I write at once in case the postcard should go astray.

I earnestly request you to be so good as to retain my name on your mailing list. You have very generously sent me your issues for some years, and I warmly thank you for so doing. Your excellent journal has proved of very much interest, and of real value to me in my extensive contacts with Civil Engineering students and with professional engineers in various government bodies. The splendid illustrations add much to the value of the many fine articles published.

Very warmly thanking you for your past goodness, and sincerely wishing you long continued success in your good work,

Yours sincerely,

L. LAWRY WATERHOUSE
Reader in Economic Geology,
The University of Sydney,
N. S. Wales, Australia

FROM DOWN UNDER

MELBOURNE AND METROPOLITAN
BOARD OF WORKS

110 SPENCER STREET,
MELBOURNE, C.1.

RESEARCH LABORATORIES

The Editor

California Highways and Public Works
Sacramento, California

DEAR SIR: I have to acknowledge with thanks receipt of your very interesting and well presented journal *California Highways and Public Works*. As you are no doubt aware, there are very many resemblances between climate, topography, and general conditions in Melbourne area and parts of California. Your record of solutions to

and Public Works

INVITATION FROM INDIA

BERHAMPUR (GANJAM)
ORISSA PROVINCE
October 17, 1949

MR. F. W. PANHORST
Bridge Engineer
Division of Highways
Sacramento, Calif.

DEAR MR. PANHORST: I am glad to be back home. I have now settled down to work. I look back with great pleasure to my visit to the United States. I am particularly happy of the personal contacts and friends I have gained in your great country. I am proud of it and shall look forward to the opportunities of writing to you now and then to get your valuable advice when necessary. I have always felt that engineers all over the world should come closer together and exchange ideas for mutual benefit. You Americans are machine-minded; we in India have vast man power. We have to devise ways and means to get the best out of them. You have quickness of execution at a cost which seems too much for our country. We, on the other hand, go slow with our manual labour and wonder what is all the hurry about in your country. I cannot say to what extent we will be mechanised. This is a problem which will resolve itself.

I think the engineers of your country should travel all over the world, particularly India, and other yet undeveloped countries. We will then have opportunities of discussing with you our problems at spot and have the benefit of your valuable advice. I hope this wish of mine will be realised some day.

I like to express once again my grateful thanks to you for the kindness you showed me and the valuable information you gave me during my stay in the States.

I take this opportunity of extending my humble invitation to you to visit my country.

Very sincerely yours,

(Signed)

E. V. S. IYER

your problems are thus of far more than normal interest to us.

So I have again to thank you for your courtesy in forwarding this record to us.

Yours sincerely,

D. L. GLYNN

INTEREST IN LONDON

1675 38th Avenue
San Francisco 22

California Highways and Public Works
Post Office Box 1499
Sacramento, California

GENTLEMEN: I have been receiving your publication for many years and eagerly await every issue. I get an inside knowledge of what is being done for the California motorist with his taxes and am able to pass this information along every opportunity that presents itself.

I have even gone so far as to mail copies to the Iford County Council, London. The interest shown there is more than passing.

Once again thanks for your interesting and valuable information so ably presented in your publication.

I remain yours sincerely,

JAMES J. HARMAN

APPRECIATIVE READER

WARREN H. BRANDT

4730 West Shakespeare
CHICAGO 39, ILLINOIS

MR. KENNETH C. ADAMS, *Editor*
California Highways and Public Works
Post Office Box 1499
Sacramento, California

DEAR MR. ADAMS: During the past year I have been receiving *California Highways and Public Works* and have always looked forward to each issue.

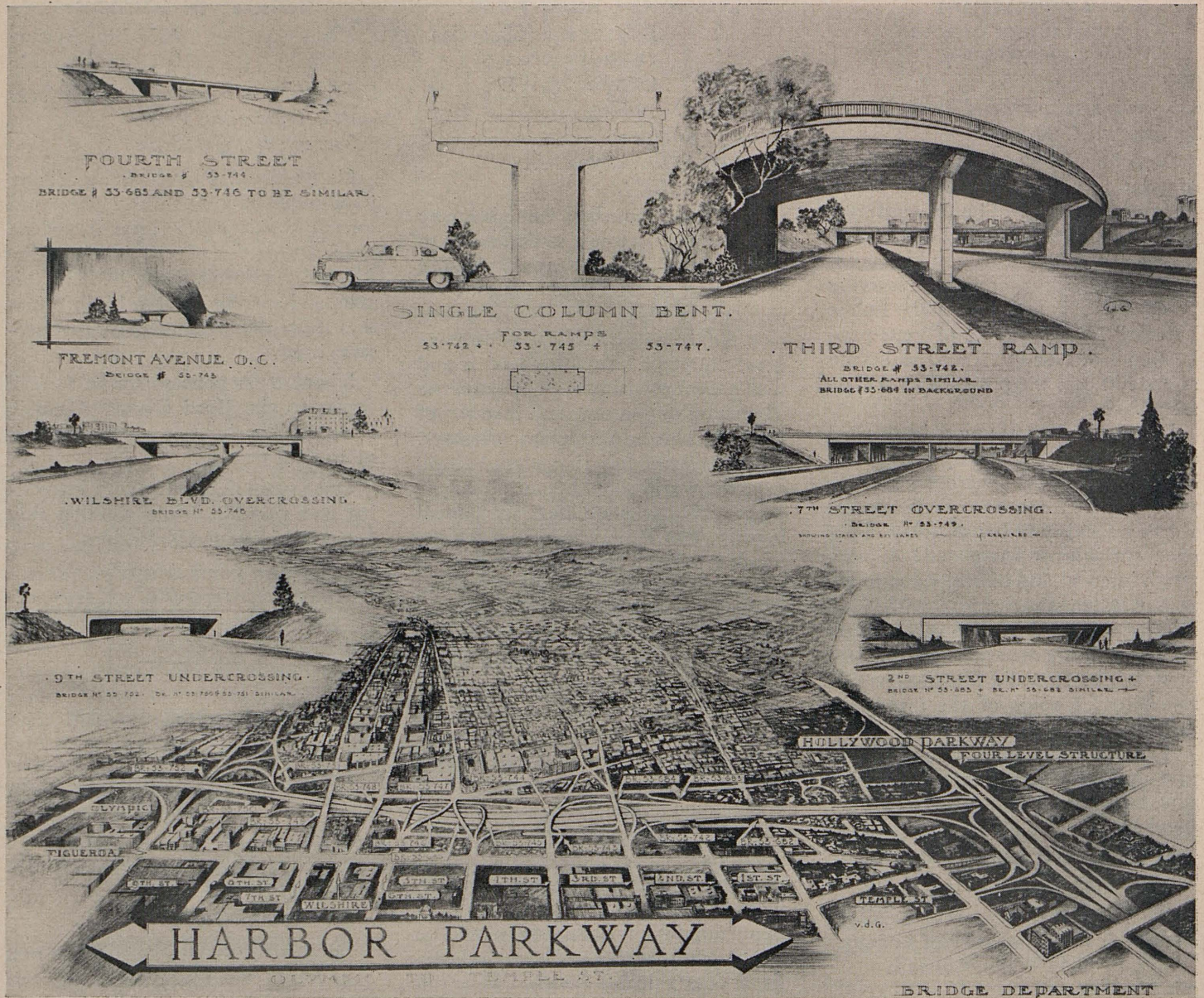
As one who is intimately concerned with the development and design of freeways and superhighways, I can safely say that your magazine has become a standard for the design of these projects.

The kindness of the California Division of Highways in furnishing this valuable journal to me is greatly appreciated.

I shall consider it a personal favor if you will retain my name on your mailing list.

Respectfully,

WARREN H. BRANDT



FREEWAYS are becoming more and more important units of California's far-flung State Highway System. They traverse hill-sides, a maze of city streets and entail costly right of way expenditures. They comprise bridges, ramps curved in both directions and clearances for all main crossings.

Simplification of design, structurally and aesthetically, is the goal of the engineers of the Division of Highways. Simplification is in itself an economy. Simple, effective methods of construction have never increased the cost.

This is an over-all perspective study of the Harbor Freeway and some of its structures by Van der Goes, Bridge Department, Division of Highways.

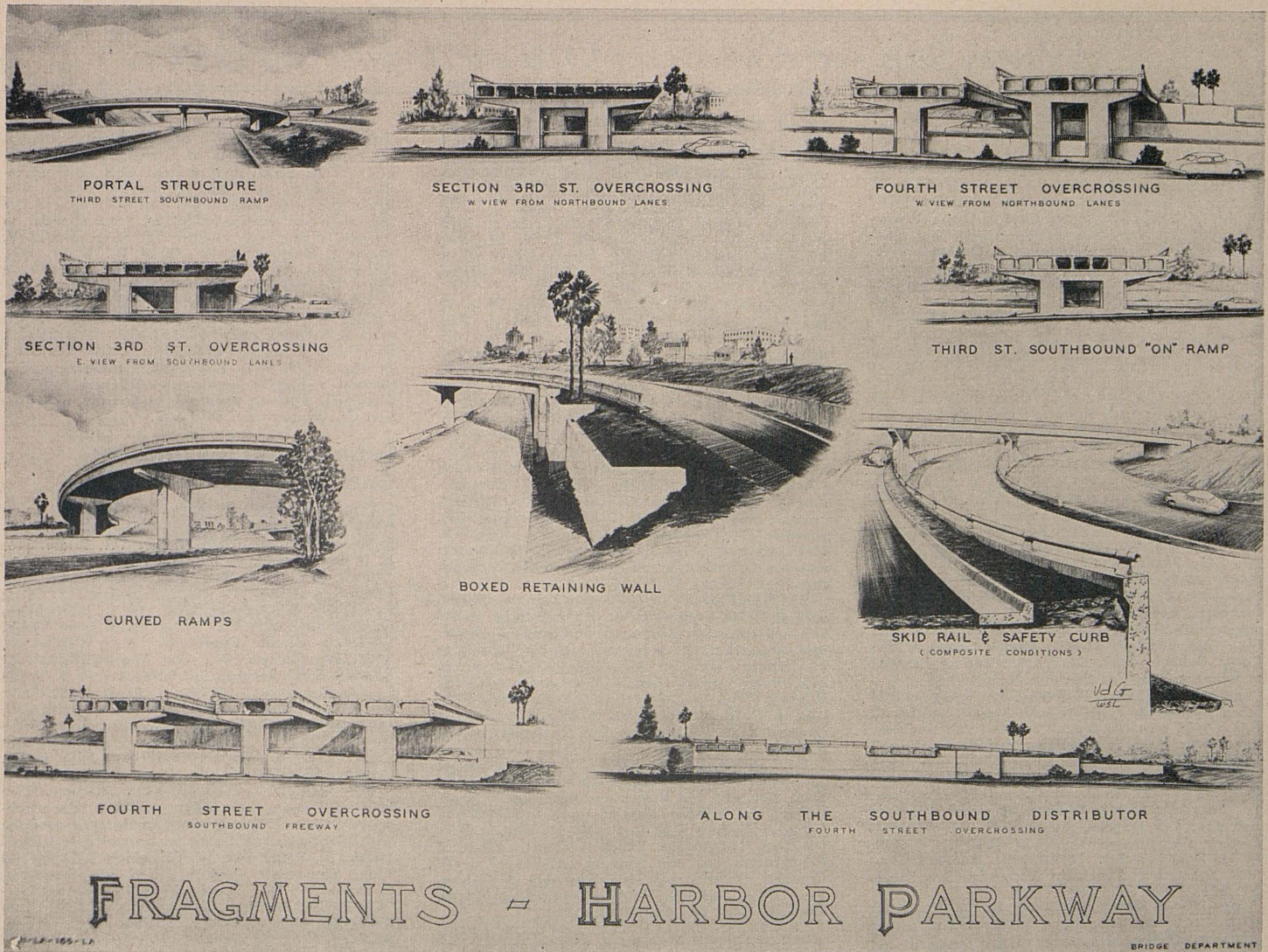
Pismo Beach

Continued from page 43 . . .

ness of a night club proprietor continues good and possibly improved, due also to correction of the once dangerous and unattractive parking situation.

Operators of two first-class motels indicate the same, and express satisfaction with the recent traffic diversion. The reasons given by these two different operators were not the same, it is interesting to note. One found an advantage in that heavy traffic no longer thundered by the door throughout the

night, jarring buildings and making sleep difficult, but was now appreciably farther away and at a different level. The other motel operator advanced the claim that more and more motorists today are "shopping around" before taking accommodations and that this is an advantage to the motel



BRIDGES over and under parkways, freeways and highways give the motorist every possible opportunity to arrive at a given destination safely and in comfort. The magic of comfort and safety when expressed in a structure gives the motorist confidence and pleasure.

The graceful horizontal curves of a structure that are required for ease of travel should remain undistorted and in full view as shown in these perspective studies of "fragments" of structures on the Harbor Parkway by Van der Goes.

In the building of these and similar units of a freeway the engineers strive for streamlining, space enough for light and air and the elimination of crowded conditions by the use of fewer columns. These make for unrestricted travel and freedom from unsightly and hazardous supports. Landscaping completes the picture.

located on the more leisurely and convenient route of outer highway traffic.

Motorists Approve Freeway

All merchants, of course, do not find their trade undiminished, but in more than one instance, especially where competing establishments are unaffected or actually improved, the

current trade volume of certain enterprises today as compared with a year ago can as easily be traced to variance in management practices as it can to traffic diversion.

Reactions of the through-traffic motorists naturally are overwhelmingly in favor of the new four-lane freeway between Pismo and Miles and especially above the Shell Beach area, for

gone now are the dangerous slow-down and bottle necking influences of the old narrow pavement and the through motorist now may enjoy this scenic portion of highway with markedly advanced safety and convenience. The firm of Fredericksen & Kasler was contractor on this project, with A. L. Lamb of the Division of Highways as Resident Engineer.

Highway Bids and Awards for October, November, 1949

October, 1949

ALAMEDA COUNTY—On Foothill Boulevard at 150th Avenue, traffic signal system and highway lighting to be furnished and installed. District IV, Route 5, Section D. Abbett Electric Corp., Emeryville, \$13,386; Scott Buttner Electric Co. Inc., Oakland, \$13,746; Spott Electrical Co., Oakland, \$15,589; R. O. Ferguson Co., Visalia, \$17,049. Contract awarded to L. H. Leonardi Electric Construction Co., San Rafael, \$13,011.

ALAMEDA COUNTY—At Rosewars Undercrossing 1.5 miles east of Niles, about 0.2 mile to be graded and surfaced with plant-mixed surfacing on crusher run base. District IV, Route 107, Section A. J. R. Armstrong, El Cerrito, \$57,012; Edward Keeble, San Jose, \$58,734; Warren & Drayer, Oakland, \$71,036; O. C. Jones & Sons, Berkeley, \$72,774; J. Henry Harris, Berkeley, \$77,186. Contract awarded to Elmer J. Warner, Stockton, \$55,943.

ALPINE COUNTY—Between westerly boundary and Carson Pass, about 5.4 miles to be graded, surfaced with imported surfacing material on imported base material, bituminous surface treatment and seal coat applied. District X, Route 34, Sections A, B. Elmer J. Warner, Stockton, \$296,580; Harms Bros., Sacramento, \$313,639; Clyde W. Wood, Inc., North Hollywood, \$326,736; Fredrickson Bros., Emeryville, \$399,227; Piombo Construction Co., San Francisco, \$409,962; Fredrickson & Watson Construction Co., Oakland, \$420,235; A. Teichert & Son, Inc., Sacramento, \$421,494; United Concrete Pipe Corp., Baldwin Park, \$477,904. Contract awarded to Johnston Rock Co., Stockton, \$266,139.75.

KERN COUNTY—Between 21st Street and H Street in the City of Bakersfield. Furnish and install full traffic actuated signal system with highway lighting at three intersections, furnish and install highway lighting at three intersections, and revise full traffic actuated signal system at one intersection. District VI, Route 4. Clinton Electric Corp., Los Angeles, \$42,432; Westates Electrical Construction Co., Los Angeles, \$43,868; L. H. Leonardi Electric Construction Co., San Rafael, \$45,239; C. D. Draucker, Inc., Los Angeles, \$45,403. Contract awarded to Ets-Hokin & Galvan, San Diego, \$41,871.

KERN COUNTY—Between Chimney Creek and Walker Pass, about 5.7 miles, portions to be graded and surfaced with bituminous surface treatment and portions to be surfaced with road-mixed surfacing. District IX, Route 57, Section K. Rand Construction Co., Bakersfield, \$44,309; Oilfields Trucking Co. & Phoenix Construction Co., Inc., Bakersfield, \$49,049; Rexroth & Rexroth, Bakersfield, \$51,940; Kleinsmid Construction Co., Bakersfield, \$52,148; Tyson & Watters Co., Sacramento, \$57,144; R. A. Erwin, Colton, \$58,888; Roland T. Reynolds, Anaheim, \$59,045; George E. France, Inc., Visalia, \$60,192; Clyde W. Wood, Inc., North Hollywood, \$60,349; T. M. Page, Monrovia, \$61,313; Arthur A. Johnson, Laguna Beach, \$62,300; Bonadiman-McCain, Inc., Los Angeles, \$68,880; Anderson Company, Visalia, \$78,100. Contract awarded to Miles & Bailey, Madera, \$44,264.

LOS ANGELES COUNTY—On Hollywood Parkway between Hollycrest Drive and Vineland Avenue, furnish and install illuminated sign system. District VII, Route 2. Westates Electrical Construction Co., Los Angeles, \$5,434. Contract awarded to Electric & Machinery Service, Inc., South Gate, \$3,680.

LOS ANGELES COUNTY—On Firestone Boulevard at La Reina Avenue, on Anaheim-Telegraph Road at Paramount Boulevard, on Whittier Boulevard at Passons Boulevard, and in the City of Alhambra on Valley Boulevard at Vega Street, furnish and install semitraffic actuated signal systems at two intersections, fixed time traffic signal system at one intersection, full traffic actuated signal system with intersection lighting at one intersection and interconnection facilities at two intersections. District VII, Routes 2, 77, 166, 174, Sections D, Ah, A, B. C. D. Draucker, Inc., Los Angeles, \$22,314; Clinton Electric Corp., Los Angeles, \$23,242; Paul R. Gardner, Ontario, \$24,276. Contract awarded to Westates Electrical Construction Co., Los Angeles, \$20,408.

LOS ANGELES COUNTY—On Pioneer Boulevard at Orangethorpe Avenue, and on Norwalk Boulevard at Anaheim-Telegraph Road, furnish and install traffic actuated signal systems and highway lighting at two intersections. District VII, Route 170, Section A. Ed. Seymour, Long Beach, \$18,250; Paul R. Gardner, Ontario, \$18,693; Clinton Electric Corp., Los Angeles, \$19,434; C. D. Draucker, Inc., Los Angeles, \$19,564. Contract awarded to Westates Electrical Construction Co., Los Angeles, \$18,176.

LOS ANGELES COUNTY—Firestone Boulevard between Lakewood Boulevard and Rosecrans Avenue, about 4.3 miles to be graded and surfaced with plant-mixed surfacing on untreated rock base and on existing pavement and the existing reinforced concrete girder bridge over San Gabriel River to be widened. District VII, Route 174, Section B. Griffith Co., Los Angeles, \$453,421; United Concrete Pipe Corp. and Jesse S. Smith & A. A. Edmondson, Baldwin Park, \$460,591; Cox Bros. Construction Co., Stanton, \$467,874; Vido Kovacevich Co., South Gate, \$472,487; Silva & Hill Construction Co., Los Angeles, \$485,748; Arthur A. Johnson, Laguna Beach, \$490,853; Peter Kiewit Sons Co., Arcadia, \$496,784; C. O. Sparks Inc. & Mundo Engineering Co., Los Angeles, \$498,236. Contract awarded to Basich Bros. Construction Co. & Basich Bros., San Gabriel, \$410,818.

SACRAMENTO COUNTY—On Fair Oaks Boulevard at Howe Avenue, about 0.4 mile to be graded and surfaced with plant-mixed surfacing on crusher run base and traffic signal and highway lighting to be installed. District III, Route 98, Section A. McGillivray Construction Co., Sacramento, \$40,569; Brighton Sand and Gravel Co., Sacramento, \$41,872; J. R. Reeves, Sacramento, \$43,989. Contract awarded to A. Teichert & Son, Inc., Sacramento, \$39,848.

SAN BERNARDINO COUNTY—In the City of San Bernardino, on Mt. Vernon Avenue at Fifth, Sixth, Seventh, and Base Line Streets, traffic signal systems and highway lighting to be furnished and installed. District VIII, Routes 9, 31. Clinton Electric Corp., Los Angeles, \$18,263; Westates Electrical Construction Co., Los Angeles, \$18,291; Paul R. Gardner, Ontario, \$19,316; Ets-Hokin & Galvan, San Diego, \$19,969. Contract awarded to C. D. Draucker, Inc., Los Angeles, \$17,509.

SAN LUIS OBISPO COUNTY—Painting District V Office Building at 50 Higuera Street in San Luis Obispo. R. W. Reade & Co., Berkeley, \$2,546. Contract awarded to G. F. Rhodes, San Luis Obispo, \$2,205.

SANTA CLARA COUNTY—Between Cape Horn and Merced County line about 3.3 miles to be graded and surfaced with plant-mixed surfacing on cement treated base. District IV, Route 32, Section C. Fredrickson & Watson Construction Co., Oakland, \$928,049; Piombo Construction Co. & Clements & Co., San Francisco, \$940,266; Fredrickson Bros., Emeryville, \$941,005; N. M. Ball Sons, Berkeley, \$952,815; Westbrook & Pope & United Concrete Pipe Corp., Sacramento, \$986,473; McNutt Bros., Eugene, Oregon, \$1,007,335; Harms Bros., Sacramento, \$1,050,734; H. Earl Parker, Inc., Marysville, \$1,081,458; Peter Kiewit Sons Co., Arcadia, \$1,103,950; Parish Bros., Benicia, \$1,110,862; Guy F. Atkinson Co., South San Francisco, \$1,116,198; Vinnell Co., Inc., Alhambra, \$1,116,829; A. Teichert & Son, Inc., Sacramento, \$1,129,435; Fredricksen & Kasler, Sacramento, \$1,236,485; Clyde W. Wood, Inc., North Hollywood, \$1,243,881; Macco Corp., Paramount, \$1,277,514. Contract awarded to Eaton & Smith, San Francisco, \$888,192.

SHASTA COUNTY—Across Burney Creek, about 9 miles north of Burney, in McArthur-Burney Falls State Park, a timber foot bridge to be constructed. District II. C. C. Gildersleeve, Nevada City, \$5,498; J. P. Brennan, Redding, \$5,575; Evans Construction Co., Berkeley, \$6,240; Metzger Co., San Pablo, \$11,750. Contract awarded to O'Connor Bros., Red Bluff, \$5,300.

SONOMA COUNTY—Stockpiling aggregates about 0.5 mile east of the junction of Route 56 and the county road to Annapolis, District IV, Route 56, Section E. Jones & Caldwell, Napa, \$14,950. Contract awarded to Arthur B. Siri, Inc., Santa Rosa, \$13,787.

VENTURA AND SANTA BARBARA COUNTIES—Between 0.2 mile east of Ventura County line and 0.2 mile east of Carpinteria, about 2.5 miles to be graded and surfaced with Portland cement concrete pavement on cement treated subgrade and with plant-mixed surfacing on existing pavement and cement stabilized base material to provide a four-lane divided highway. District V, Route 2, Sections G, H. Clyde W. Wood, Inc., North Hollywood, \$674,906; United Concrete Pipe Corp., Baldwin Park, \$679,417; Basich Bros., Construction Co. & Basich Bros., San Gabriel, \$680,192; Griffith Co., Los Angeles, \$697,314; Peter Kiewit Sons Co., Arcadia, \$711,080; Guy F. Atkinson Co., South San Francisco, \$718,568; N. M. Ball Sons, Berkeley, \$745,647; Cox Bros. Construction Co., Stanton, \$755,513; Fredrickson & Watson, Oakland, \$761,784. Contract awarded to Granite Construction Co., Watsonville, \$661,807.

Federal Aid Secondary County Roads

LOS ANGELES COUNTY—Across San Gabriel River on Rosecrans Avenue, a reinforced concrete bridge to be constructed. District VII, Route 840. R. R. Bishop & H. C. Johnson, Long Beach, \$229,296; Robert E. McKee, Los Angeles, \$240,468; Charles MacClosky Co., San Francisco, \$251,683; Lars Oberg, Los Angeles, \$255,245; K. B. Nicholas, Ontario, \$263,207; Guy F. Atkinson, Long Beach, \$264,820; Granite Construction Co., Watsonville, \$265,212; Metzger Co., Los Angeles, \$271,482; Byerts & Sons, Los Angeles, \$286,210; C. B. Tuttle Co., Long Beach, \$290,162; J. E. Haddock, Ltd., Pasadena, \$290,869; Oberg Bros. Construction Co., Inglewood, \$297,836; Carlo Bongiovanni, Hollywood, \$391,059; W. E. Robertson Co., Los Angeles, \$479,736. Contract awarded to John Strona, Pomona, \$214,276.

SAN JOAQUIN COUNTY—On Thornton Road between Benson Ferry Bridge and 0.8 mile southeasterly, about 0.8 mile to be graded and surfaced with plant-mixed surfacing on untreated rock base. District X, Route 540. W. C. Lefever & D. Gerald Bing, Sacramento, \$68,919; Karl C. Harmeling, Stockton, \$69,161; Harms Bros., Sacramento, \$71,789; Fredrickson Bros., Emeryville, \$72,138; Munn & Perkins, Modesto, \$74,251; Louis Biasotti & Son, Stockton, \$76,938; Claude C. Wood, Lodi, \$79,270; McGillivray Construction Co., Sacramento, \$79,370; Brighton Sand & Gravel Co., Sacramento, \$79,998; C. M. Syar, Vallejo, \$82,203; W. C. Railing, Woodland, \$84,336; Nevada Constructors, Inc., Reno, \$85,724; Elmer J. Warner, Stockton, \$88,134; A. Teichert & Son, Inc., Sacramento, \$89,323; J. R. Armstrong, El Cerrito, \$91,420. Contract awarded to M. J. B. Construction Co., Stockton, \$68,501.

November, 1949

BUTTE COUNTY—At Hamilton Slough and Biggs Extension Canal, respectively, about 3.8 and 5.0 miles north of Gridley, one reinforced concrete bridge to be constructed and another to be widened, and approaches thereto to be graded and imported base material and plant-mixed surfacing to be placed. District III, Route 3, Section B. H. Earl Parker, Inc., Marysville, \$37,016; O'Connor Bros., Red Bluff, \$38,111; Chittenden & Chittenden, Auburn, \$39,411; J. W. Hoopes, Sacramento, \$42,177; Rice Brothers, Inc., Marysville, \$42,387; A. L. Miller, Sacramento, \$46,543; Robert Taylor, Oroville, \$50,865. Contract awarded to Huettig & Schromm and A. T. Bennett Construction Co., Palo Alto, \$35,270.50.

BUTTE COUNTY—In the City of Chico, on Main Street at First, Third, and Fifth Streets, on Broadway at Third and Fifth Streets, and on First Street at Shasta Way; furnish and install fixed time interconnected traffic signal systems and intersection lighting at five intersections and street improvement at one intersection. District III, Routes 3 and 47. Reliable Elevator Works, Sacramento, \$21,250; Wismer & Becker, Sacramento, \$22,900; Luppen & Hawley, Sacramento, \$23,003; R. Gool & Son, Stockton, \$23,439; L. H. Leonardi Electric Construction Co., San Rafael, \$23,670. Contract awarded to Clinton Electric Corp., Los Angeles, \$19,863.

FRESNO COUNTY—Between Orange Cove Road and White Deer Road, about 5.4 miles to be graded and bituminous surface treatment applied. District VI, Route 41, Section T. John Delphia, Patterson, \$519,489; H. Earl Parker, Inc., Marysville, \$526,068; A. Teichert & Son, Inc., Sacramento, \$531,912; N. M. Ball Sons, Berkeley, \$575,195; Guy F. Atkinson Co., South San Francisco, \$588,530; Harms Bros., Sacramento, \$604,542; Clyde W. Wood, Inc., North Hollywood, \$615,847; Fredrickson & Watson Construction Co., Oakland, \$640,032; Rand Construction Co., Inc., Bakersfield, \$641,040; Parish Bros., Benicia, \$663,611; Cox Bros. Construction Co., Stanton, \$696,521; Fredrickson Bros., Emeryville, \$697,735; Vinnell Company, Inc., Alhambra, \$699,504; C. G. Willis & Sons, Inc., Los Angeles, \$707,020; Piombo Construction Co., San Francisco, \$723,476; Sharp & Fellows Contracting Co., Los Angeles, \$774,954; United Concrete Pipe Corp. & Ralph A. Bell, Baldwin Park, \$831,458. Contract awarded to R. A. Heintz Construction Co., Portland, Oregon, \$442,628.

IMPERIAL COUNTY—Between Main Street in Niland and two miles northwest of Niland, about 2.2 miles to be graded and surfaced with road-mixed surfacing on untreated rock base and construction of four bridges. District XI, Route 187, Sections E, F. Frank T. Hickey, Inc., Los Angeles, \$224,517; Clyde W. Wood, Inc., North Hollywood, \$224,699; Basich Bros. Construction Co. & Basich Bros., San Gabriel, \$226,822; Heuser & Garnett, Glendale, \$226,835; Anderson Co., Visalia, \$228,995; W. C. Lefever & D. Gerald Bing, Sacramento, \$230,098; Claude Fisher Co., Ltd., Los Angeles, \$232,240; Hensler Construction Corp., Glendale, \$235,272; Cox Bros. Construction Co., Stanton, \$247,402; Dimmitt & Taylor, Monrovia, \$445,898. Contract awarded to Roland T. Reynolds and Thomas Construction Co., Burbank, \$219,413.30.

IMPERIAL COUNTY—At Sandia and Alamo Turn, a distance of about 1.3 miles in length to be graded and surfaced with road-mixed surfacing on imported base material. District XI, Route 187, Sections B, C. R. E. Hazard Contracting Co., San Diego, \$55,880; Anderson Co., Visalia, \$59,866; Frank T. Hickey, Inc., Los Angeles, \$63,411; Roland T. Reynolds & Thomas Construction Co., Burbank, \$70,224; Warren Southwest, Inc., Torrance, \$71,132; W. C. Lefever & D. Gerald Bing, Sacramento, \$71,721; Heuser & Garnett, Glendale, \$78,627; Clyde W. Wood, Inc., North Hollywood, \$79,992; Clifford C. Bong & Co., Arcadia, \$97,677. Contract awarded to E. C. Young & Co., Bakersfield, \$53,981.70.

INYU COUNTY—Between Southern Pacific Railroad crossing west of Keeler and Soda Plant, a net distance of 5.4 miles in length to be graded, imported base material to be placed and surfaced with road-mixed surfacing. District IX, Route 127, Sections C, D. Carden & Cox, Sacramento, \$98,097; Louis Biasotti & Son, Stockton, \$102,949; George E. France, Inc., Visalia, \$104,638; M. J. Ruddy & Son, Modesto, \$106,219; Brown & Krull, Hayward, \$107,368; Basich Bros. Construction Co. & Basich Bros., San Gabriel, \$107,780; Nevada Constructors, Inc., Reno, Nevada, \$107,898; Clyde W. Wood, Inc., North Hollywood, \$108,218; Fredericksen & Kasler, Sacramento, \$111,529; Westbrook & Pope, Sacramento, \$112,372; R. A. Erwin, Colton, \$120,741; Oilfields Trucking Co. & Phoenix Construction Co., Bakersfield, \$124,520; Tyson & Watters Co., Sacramento, \$125,125; Hensler Construction Corp., Glendale, \$125,691; Claude Fisher Co. Ltd., Los Angeles, \$127,145; Dico, Inc. & Dix-Syl Construction Co. Inc., Bakersfield, \$128,411; Peter Kiewit Sons Co., Arcadia, \$129,545; Tomb Foundation Co., Compton, \$134,269; Rand Construction Co., Bakersfield, \$143,637; Close Building Supply, Hayward, \$156,004. Contract awarded to Rice Bros. Inc., Marysville, \$91,771.

LOS ANGELES COUNTY—On Harbor Freeway at First Street and Second Street in the City of Los Angeles, two reinforced concrete bridges for undercrossings to be constructed. District VII, Route 165. Spencer Webb Co., Los Angeles, \$429,967; R. R. Bishop & Lars Oberg, Long Beach, \$435,448; Erickson, Phillips & Weisberg, Oakland, \$437,414; Chas. MacClosky Co., San Francisco, \$438,880; W. J. Disteli & R. J. Daum Construction Co., Los Angeles, \$441,984; J. E. Haddock, Ltd., Pasadena, \$452,618; C. B. Tuttle Co., Long Beach, \$453,410; MacDonald & Kruse, Sun Valley, \$456,388; Guy F. Atkinson Co., Long Beach, \$459,081; Carlo Bongiovanni, Los Angeles, \$483,215. Contract awarded to Oberg Bros. Construction Co., Inglewood, \$422,503.40.

ORANGE COUNTY—On Grand Avenue at Commonwealth Ave. and on East First Street at Tustin Avenue, traffic signal systems and intersection lighting to be furnished and installed at two intersections. District VII, Routes 2, 43, 171, Sections C, A, B. C. D. Draucker, Inc., Los Angeles, \$18,860; Paul R. Gardner, Ontario, \$19,212; Westates Electrical Construction Co., Los Angeles, \$19,880; Fadco Electric, Long Beach, \$24,576. Contract awarded to Clinton Electric Corp., Los Angeles, \$18,426.

PLACER COUNTY—Between 3.5 miles north of Roseville and 0.9 mile south of Sheridan across Pleasant Grove Creek, Rock Creek, Yankee Slough, and Big Yankee Slough; reinforced concrete bridges to be constructed and approaches thereto to be graded and surfaced with crusher run base and plant-mixed surfacing. District III, Route 3, Sections A, B. Rice Bros., Inc., Marysville, \$119,773; A. L. Miller, Sacramento, \$123,169; Charles MacClosky Co. & H. Earl Parker, Inc., San Francisco, \$123,483; H. W. Ruby, Sacramento, \$127,377; Chittenden & Chittenden, Auburn, \$130,940; O'Connor Bros., Red Bluff, \$132,143; Fred J. Maurer & Son, Eureka, \$140,766; Brighton Sand & Gravel Co. & Lew Jones Construction Co., Sacramento, \$151,241. Contract awarded to Fredrickson Bros., Emeryville, \$116,386.75.

SAN BERNARDINO AND RIVERSIDE COUNTIES—Between 2.3 miles east of Redlands and Beaumont, about 9.6 miles to be graded and surfaced with plant-mixed surfacing on cement treated base and existing surfacing. District VIII, Route 26, Sections B, A, Bau. Basich Bros. Construction Co. & Basich Bros., San Gabriel, \$1,161,803; Westbrook & Pope & Clements Co., Sacramento, \$1,172,706; Gibbons & Reed Co., Salt Lake City, \$1,177,616; Peter Kiewit Sons Co., Arcadia, \$1,188,000; United Concrete Pipe Corp., Baldwin Park, \$1,190,429; Griffith Co., Los Angeles, \$1,204,020; Cox Bros. Construction Co. & J. E. Haddock, Ltd., Pasadena, \$1,234,566; Vinnell Co. Inc., Alhambra, \$1,248,937; Winston Bros. Co. & Yount Constructors, Inc., Azusa, \$1,254,248; Claude Fisher Co., Ltd., Los Angeles, \$1,265,035; N. M. Ball Sons, Berkeley, \$1,277,236; Match Bros. & E. L. Yeager Co., Riverside, \$1,285,641; Clyde W. Wood, Inc., North Hollywood, \$1,289,036; Johnson Inc. & G. L. Moody, South Gate, \$1,295,529; Fredrickson & Watson Construction Co., Oakland, \$1,303,749; Silva & Hill Construction Co., Peter L. Ferry & Son & John M. Ferry, Los Angeles, \$1,363,333; Guy F. Atkinson Company, Long Beach, \$1,416,431; A. Teichert & Son, Inc., Sacramento, \$1,420,541. Contract awarded to Fredericksen & Kasler, Sacramento, \$1,143,443.25.

SAN MATEO COUNTY—Near Half Moon Bay, producing and stockpiling plant-mixed surfacing at two locations. District IV, Route 56, Sections C, D. Rogers Materials Co., Madera, \$14,757. Contract awarded to A. Teichert & Son, Inc., Sacramento, \$9,590.

SAN MATEO COUNTY—Between Grand Avenue in South San Francisco and Broadway in Burlingame, about 5.5 miles to be planted. District IV, Route 68. Huettig and Schromm & A. T. Bennett Construction Co., Palo Alto, \$42,242; Jack W. Brem, San Diego, \$42,340; Justice-Dunn Co., Oakland, \$42,380; Tyson & Watters Co., Sacramento, \$43,192; Henry C. Soto Corp., Los Angeles, \$61,482. Contract awarded to Leonard Coates Nurseries, Inc., San Jose, \$33,796.50.

SAN DIEGO COUNTY—Between north city limits of San Diego and Miramar, about 6.5 miles to be surfaced with plant-mixed surfacing on cement treated base. District XI, Route 77, Section A. Basich Bros. Construction Co. & Basich Bros., San Gabriel, \$400,199; Peter Kiewit Sons Co., Arcadia, \$416,106; Griffith Co., Los Angeles, \$424,623; R. E. Hazard Contracting Co., San Diego, \$448,792; Hensler Construction Corp., Glendale, \$454,682; Fredericksen & Kasler, Sacramento, \$457,124; Silva & Hill Construction Co., Peter L. Ferry & Son, & John M. Ferry, Los Angeles, \$467,689; Daly Corp., San Diego, \$539,771; V. R. Dennis Construction Co., San Diego, \$555,411; R. P. Shea Construction Co., Indio, \$566,968. Contract awarded to Cox Bros. Construction Co., Stanton, \$397,807.

SANTA BARBARA COUNTY—Grading, placing imported base material and plant-mixed surfacing and applying seal coat thereto on outer highway on the right between Station 320+03 and Station 330+07 in the town of Buellton. District V, Route 2, Section D. Madonna Construction Co., San Luis Obispo, \$8,916; Nichols & Berry, Santa Barbara, \$8,998; Rand Construction Co., Bakersfield, \$10,018. Contract awarded to Valley Paving and Construction Co. Inc., Pismo Beach, \$8,432.

SAN DIEGO COUNTY—Between H Street in Chula Vista and 14th Street in National City, eight bridges to be constructed and about 2.6 miles of approaches to be graded and surfaced with plant-mixed surfacing. District XI, Route 2. Winston Bros. Co., Azusa, \$1,314,935; Griffith Co., Los Angeles, \$1,380,973; Guy F. Atkinson Co., Long Beach, \$1,391,000; J. E. Haddock Ltd., Cox Bros. Construction Co., Pasadena, \$1,474,187. Contract awarded to Charles MacClosky & R. E. Hazard Contracting Co. & C. G. Willis & Sons, Inc., San Francisco, \$1,289,272.

SAN DIEGO COUNTY—At the intersection of 70th Street with El Cajon Boulevard and Market Street with First, Eighth, and 25th Streets in the City of San Diego, furnish and install traffic signal systems and intersection lighting. District XI, Routes 12,200. C. D. Draucker Inc., Los Angeles, \$25,441. Contract awarded to Ets-Hokin & Galvan, San Diego, \$25,227.

SACRAMENTO AND SOLANO COUNTIES—At Steamboat Slough and Cache Slough, respectively, about 3.1 miles west of Ryde and about 2.4 miles north of junction with Route 53, three existing ferry boats to be repaired, cleaned and painted. District X, Routes 100, 99, Sections A, Minton & Kubon, San Francisco, \$24,994; Moore Drydock Co., Oakland, \$25,242; H. F. Lauritzen, Pittsburg, \$32,078; Bethlehem Pacific Coast Steel Corp., San Francisco, \$59,982. Contract awarded to Colberg Boat Works, Stockton, \$17,105.

SHASTA COUNTY—Furnish and erect two prefabricated steel buildings. District II, Route 29, Section A. Liston Ehorn, Red Bluff, \$10,760. Contract awarded to Edwin E. Myers, Chico, \$5,990.

SUTTER AND BUTTE COUNTIES—Between 2.5 miles south of Live Oak and Gridley, portions, existing drainage facilities to be extended. District III, Route 3, Sections A, LiO, A., Rice Bros. Inc., Marysville, \$44,882; O'Connor Bros., Red Bluff, \$46,695; Robert Taylor, Oroville, \$47,321; C. O. Bodenhamer, Redwood City, \$47,969. Contract awarded to Louis Bormolini & Son, Novato, \$42,391.10.

YUBA AND SIERRA COUNTIES—Between .25 mile west of Yuba-Sierra County line and 2.6 miles east of Yuba-Sierra County line, about 2.1 miles to be graded and bituminous surface treatment and seal coat applied. District III, Route 25, Sections A, A. H. Earl Parker, Inc., Marysville, \$263,774; Harms Bros., Sacramento, \$288,070; Fred J. Maurer & Son, Eureka, \$290,157; J. P. Brennan & M. W. Brown, Redding, \$292,937; Chittenden & Chittenden, Auburn, \$296,517; J. R. Reeves, Sacramento, \$298,945; Fredrickson Bros., Emeryville, \$312,054; Westbrook and Pope, Sacramento, \$577,105. Contract awarded to Louis Biasotti & Son, Stockton, \$256,600.

SAN LUIS OBISPO COUNTY—Furnishing and installing highway lighting system at the Santa Fe Bridge intersection between Pismo Beach and San Luis Obispo. District V, Route 2, Section E. Cline's Electric Shop, San Luis Obispo, \$2,757; Electric & Machinery Service Inc., South Gate, \$3,303; L. H. Leonardi Electric Construction Co., San Rafael, \$3,399. Contract awarded to Gallagher and Ochs, San Luis Obispo, \$2,340.

F. A. S. County Roads

MONTEREY COUNTY—At White Creek about 16 miles north of San Simeon, a drainage system to be constructed. District V, Route 564. Wm. Radtke & Son, Gilroy, \$27,398; Mathews Construction Co., Alhambra, \$36,985; Stolte, Inc., Monterey, \$41,353; Granite Construction Co., Watsonville, \$44,657; F. T. Haas Co., Belmont, \$45,805; Pisano Bros., San Jose, \$61,775; Ferguson Bros., Oakland, \$78,714; Green-Mears Construction Co., Inc., Glendale, \$89,500. Contract awarded to W. M. Lyles Co., Avenal, \$24,706.50.

SAN DIEGO COUNTY—On Mission Valley Road near the intersection of Alvarado Canyon Road and Fairmount Extension, a quadruple 72-inch concrete pipe culvert to be constructed. District XI, Route 732. Pace Construction Co., San Diego, \$39,511; Johnson Western Gunitite Co., Coronado, \$41,546; Daley Corp., San Diego, \$45,121; Thomas Construction Co., Burbank, \$45,537; N. M. Saliba Co., Los Angeles, \$46,334; R. E. Hazard Contracting Co., San Diego, \$48,485; E. C. Young Co., Bakersfield, \$48,736; V. R. Dennis Construction Co., San Diego, \$51,946; Walter H. Barber, La Mesa, \$52,557. Contract awarded to Griffith Co., Los Angeles, \$37,713.

SAN LUIS OBISPO COUNTY—On Avila Road, between Ontario Hot Springs and Avila, about 2.5 miles to be graded and surfaced with plant-mixed surfacing on cement stabilized imported base material. District V, Route 679. Valley Paving and Construction Co., Inc., Pismo Beach, \$112,666; Rand Construction Co., Bakersfield, \$128,129; Madonna Construction Co., San Luis Obispo, \$134,758; Clements & Co., Hayward, \$143,202. Contract awarded to Granite Construction Co., Watsonville, \$109,896.

RIVERSIDE COUNTY—On Lovekin Boulevard between Blythe and Palo Verde Mesa about 5.8 miles to be graded and surfaced with imported base material and bituminous surface treatment applied thereto and a reinforced concrete slab bridge to be con-

structed. District XI, Route 735. Foster & McHarg, Riverside, \$132,229; George E. France, Inc., Visalia, \$141,674; Nevada Constructors, Inc., Reno, \$152,504; Clyde W. Wood, Inc., North Hollywood, \$152,739; R. A. Erwin, Colton, \$154,714; Arthur A. Johnson, Laguna Beach, \$154,883; Basich Bros. Construction Co. and Basich Bros., San Gabriel, \$155,526; Dicco, Inc. & Dix-Syl Construction Co., Inc., Bakersfield, \$156,097; Heuser & Garnett, Glendale, \$166,472; Cox Bros. Construction Co., Stanton, \$168,039; Fredericksen & Kasler, Sacramento, \$169,982; Tomb Foundation Co., Compton, \$172,111; Hensler Construction Corp., Glendale, \$172,342; Claude Fisher Co. Ltd., Los Angeles, \$172,930; T. M. Page, Monrovia, \$174,930; Silva & Hill Construction

Co., Los Angeles, \$176,011; Dimmitt & Taylor, Monrovia, \$204,719; Clifford C. Bong & Co., Arcadia, \$217,534. Contract awarded to Nathan A. Moore, El Monte, \$126,595.50.

MERCED COUNTY—Across Dry Creek, on Snelling-La Grange Road, about 7 miles south of La Grange; a timber trestle bridge about 108 feet long to be constructed. District X, Route 919. Minton & Kubon, San Francisco, \$18,775; Bos Construction Co., Oakland, \$18,902; Gordon L. Capps, Stockton, \$19,742; C. O. Bodenhamer, Redwood City, \$21,871; B. S. McElderry, Berkeley, \$22,282; Repsher Brothers General Contractors, Bakersfield, \$22,490; Parker Engineering Co., Claremont, \$25,725; Contract awarded to C. C. Gildersleeve, Nevada City, \$15,686.

CURRENT STATE HIGHWAY PROGRAMS

Addressing the annual meeting of the Associated General Contractors of America in San Francisco on December 2d, Director of Public Works C. H. Purcell informed the delegates that:

Before December 31st, the Division of Highways will have put under way for the calendar year of 1949 a total of 357 contracts aggregating almost \$64,500,000 in construction value.

The state highway construction budget for the current fiscal year totals \$66,126,700, including major construction, construction engineering, minor improvements, and day labor.

Cooperation of Contractors

The major state highway construction budget for the Fiscal Year 1950-51 as adopted by the California State Highway Commission totals \$63,202,000.

"I assure you," Purcell said, "that we realize that our accomplishments in developing and improving the State Highway System have been possible only because of the cooperation of the contracting industry."

Purcell said that the State again will follow its practice of beginning the advertising of projects for the next fiscal year in February as made possible by provision of the Collier-Burns Act, which permit the award of contracts financed from the 1950-51 Fiscal Year budget on or after April 1, 1950.

Current Budget \$66,126,700

"As you know," Purcell said, "state highway budgets function on a fiscal year basis from July 1st of one year to June 30th of the next. The state highway construction budget for the

current fiscal year totals \$66,126,700, including major construction, construction engineering, minor improvements and day labor. Of this amount, work has been put under way and advertised for bids to the value of \$47,304,600, leaving an amount of \$18,822,100 to be put under way before July 1, 1950. Most of the proposed contracts included in this balance will be advertised before March in order to clear the decks for the early advertising of projects in the budget for the next fiscal year (1950-1951).

Bidders Increase

"In this matter of cooperation of the contracting industry in advancing state highway construction, it is of considerable satisfaction to the State to note the increase in the number of bidders competing for highway jobs.

"Records of the Division of Highways show that during the fiscal year from July 1, 1947, to June 30, 1948, the average number of bidders on 362 projects, whose total value was \$67,925,500, was 5.6, while for the Fiscal Year 1948-49, the average number of bidders on 369 projects valued at \$57,898,000, was 6.0. Study of these statistics on competitive bidding shows a steady rise of the average number of bidders from the smaller jobs to the larger; that is, projects under \$50,000 averaged 5.0 bidders; \$50,000 to \$100,000—5.9 bidders; \$100,000 to \$250,000—7.0; \$250,000 to \$500,000—7.6; \$500,000 to \$1,000,000—8.5; and projects over \$1,000,000—7.3. Structure jobs consistently attract more bidders for all sizes of projects. Comparative statistics for the last five months show the

average number of bidders on 149 state highway contracts, with a value of \$18,900,000 to be 7.4, indicating that the increase in bidders is continuing.

Construction Costs

"In considering the highway construction program, the factor which controls the rate at which the objective of correcting the present deficiencies in the State Highway System can be attained is the factor of construction cost. As in most other fields, the peak of prices being paid for highway construction has been passed. This peak occurred in mid-1948 and prices began to decline in the last quarter of that year.

"The California highway construction cost index reached a peak of 216.8 (1940 = 100) and has declined at an almost uniform rate to 187.9 for the third quarter of 1949. This is a decrease of 13.3 percent below the postwar peak.

"We believe that most of the price reductions in the last one and one-half years have been due to increased competition among contractors; increased labor productivity; elimination of uncertainty in securing of materials; and some reduction in material prices.

"It is estimated that projects included in the 1950-51 program will require the following quantities of major construction items:

Roadway excavation	12,866,000 cubic yards
Crusher run base	361,000 tons
Plant-mixed surfacing	1,801,000 tons
Portland cement concrete pavement	214,000 cubic yards
Portland cement concrete structures	125,000 cubic yards
Bar reinforcing steel	20,858,000 pounds
Structural steel	18,577,000 pounds"

U.S. 99 Improved

*Divided Construction on
Bakersfield Section*

By FRANK M. ROUSH, District Construction Engineer

A VERY DIFFICULT traffic situation on U. S. 99 extending south from the south city limits of Bakersfield was relieved by the construction of about 5.1 miles of divided highway, which was completed on August 1, 1949. The traffic in this section is of three types, the first being the normal through traffic, the second originating in the several farming communities south of Bakersfield, and, third the traffic into the motels lining the route for the northerly 2½ miles, and which created turning and cross traffic at peak hours. The completed project provides sufficient lanes for the traffic volume and limits the turning and cross movements to designated crossovers.

This portion of State Highway Route 4 was not constructed as a free-way but as a city street because of the almost solid business development and the fact that the existing 115.5-foot right of way was sufficient for devel-

oping a city street section similar to that previously built immediately north of this project.

Typical Section

The two outer lanes were constructed of Portland cement concrete 12 feet wide and 8 inches thick over 4 inches of cement treated subgrade and 18 inches of imported borrow. The two inner lanes were of plant mixed surfacing 12 feet wide and 4 inches thick. The plant mix lane on the east side was placed on 12 inches of crusher run base and 16 inches of imported borrow. Plant mix on the west lane was placed on crusher run base about 4 inches thick, which was laid directly over the existing pavement. Borders three feet wide of 6-inch thick plant mix surfacing and penetration treatment of a 3-inch thickness of crusher run base 5 feet wide completes the traveled way. No curbs or gutters were constructed.

Concrete Curbed Median

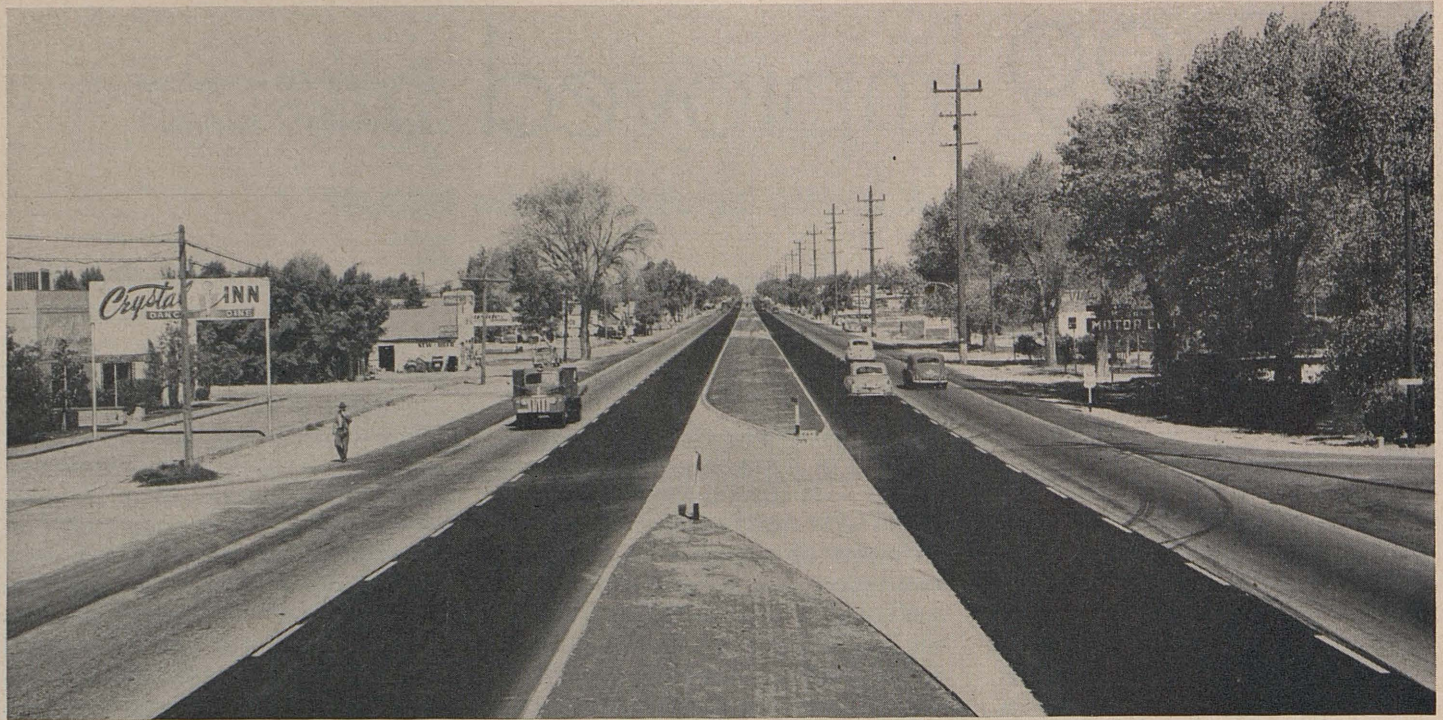
A median or dividing strip 16 feet in width was curbed for the entire length of the project. Crossovers were established at all through streets, and in the northerly 2½ miles, at 660-foot intervals between the intersecting streets. For the remainder of the project the crossovers were at 1,320-foot intervals. Because the inner lanes were of plant mix surfacing, the crossovers were paved with Portland cement concrete to provide a color differential which would tend to prevent main line traffic from encroaching on the crossover area. This encroachment might take place in those sections where the dividing curb is not adjacent to the pavement for a considerable distance due to the use of storage lanes in connection with the crossovers.

Cigarettes Start Fires

The area within the median was filled with roadway excavation over

View southerly from about three miles south of Bakersfield. South Chester Avenue, channelized and signalized intersection in the center background





Typical crossover about two miles south of Bakersfield, viewed northerly

the existing pavement, leveled, and given a penetration treatment. At about 50-foot centers, Parkinsonia were planted in the divider after first breaking through the old pavement.

In connection with the planting of these trees, a rather unusual event took place. According to specifications, manure was to be placed on the top of the soil around the tree and well

watered. After several days it was noted that several of the basins had no manure in them and investigation showed that it had burned. At first it was considered that this burning was deliberate but more careful investigation showed that nearly every basin had from two to a dozen cigarette butts in it. Experimentation showed that a lighted cigarette would start the

dried-out manure burning like punk. Arrangements were made to turn the manure under a light cover of soil.

The work was performed by Griffith Company at a cost of about \$750,000. Frank Maupin was the contractor's superintendent and W. E. Bertken was Resident Engineer for the State.

CALIFORNIA FREEWAY LAW SUMMARIZED

AT THE 51st Annual Conference of the League of California Cities, held in San Francisco October 24th-26th, one of the highlights of the program provided for the Public Works Officers' Department was the outline of the Bay Region Freeway Development given by B. W. Booker, District Engineer, State Division of Highways.

Following Mr. Booker's talk a large number of public works officials were taken in busses to visit the site of present and future freeway developments on both sides of San Francisco Bay.

Mr. Booker explained provisions of the Freeway Act. California law defines a freeway as a highway with respect to which the owners of ad-

acent property have no right or easement of access, or with respect to which they have only limited right or easement of access. In other words, under the definition, whenever access to adjacent property is restricted, there is an application of the freeway principle. A so-called "full freeway" has no direct access excepting at predetermined points, and there are no intersections at grade. A "partial freeway" limits the access to the extent that adjacent property is partially served by the freeway to a degree which does not interfere with its main purpose; that is, providing adequate traffic service for all of the users of the facility.

In general, the design of any freeway

must be so conceived that the character of the facility is consistent with the character of the traffic which will use it directly after construction, and in the predictable future. A distinction must be drawn between rural and urban types of freeways in this respect.

An important difference in the character of urban and rural traffic is that the peak-hour volume in urban areas represents a much higher percentage of the total 24-hour traffic than for rural highways.

One of the principal distinctions between freeways in urban and rural areas is that freeways alone can never be expected to provide adequate transportation service in the larger cities.

Public Contracts

Continued from page 10 . . .

reason of limitation of funds or for engineering reasons, to split projects. It is not uncommon for the State to have grading done by one contractor and to do the paving at a later date under another contract. Such a practice, of course, does not involve any possible charge of attempting to evade the competitive bidding statute, but it does indicate that there are many good and substantial reasons for splitting projects.

Opinion of Attorney General

The law on this subject is summarized by an opinion of the Attorney General (NS 5279, 3 Opinions Attorney General, page 5) furnished to the District Attorney of Ventura County under date of January 10, 1944. In this opinion the Attorney General says that the test is whether there is a present intention to do the entire work, and if the work was broken up into more than one job for the purpose of avoiding the competitive bidding statutes, then the expenditures would be improper. On the other hand, if another project is later agreed upon it constitutes a separate job and if under the limit, competitive bidding is not required. I personally believe that the opinion does not go far enough. I think that in any case where a public official can show that there was a substantial reason for splitting a job, the courts will approve the exercise of the officer's discretion. It will only be a case where there is no real reason for splitting that the courts are apt to question the validity of the contract. I have known of many cases where the placing of a seal coat or screenings has been deleted from a state highway job due to a job having gotten behind and run into winter weather. The following spring the work is performed either by state forces or by another contract. The recommendation of the County Road Commissioner, based on sound engineering reasons, would, I think, protect the supervisors in cases of splitting work into separate contracts.

One of the subjects worth discussing, is the Contractors Licensing Law (Ch. 9, Div. 3, B. & P. C.).

Briefly stated, this law creates the Contractors' State License Board for

licensing of contractors. It defines "contractor" as synonymous with "builder" (Sec. 7026, B. & P. C.).

Section 7028 provides:

"It is unlawful for any person to engage in the business or act in the capacity of a contractor within this State without having a license therefor, unless such person is particularly exempted from the provisions of this chapter."

Section 7028.5 makes it unlawful for a member of a licensed partnership or officer of a licensed corporation to act individually as a contractor without an individual license.

Section 7029 prohibits two or more licensed contractors from bidding, or otherwise acting as a contractor in a joint venture, without being licensed as a joint venture.

Section 7030 makes acting as a contractor without a license a misdemeanor.

Section 7031 provides no court action may be maintained on any contract for which a license is required without proof that the contractor was duly licensed at all times during performance.

It has been repeatedly held, in actions brought by contractors, that the unlicensed contractor cannot recover even the value of materials furnished.

Phillips v. McIntosh (1942),
51 Cal. App. (2d) 340;
Holm v. Bramwell (1937),
20 Cal. App. (2d) 332.

The law has been weakened, as to the requirement that joint venturers take out a license, by the decision in

Gatti v. Highland Park Builders, Inc.
(1946), 27 Cal. (2d) 687.

In that case the Supreme Court held that where both partners were individually licensed, and during the course of the job took out a partnership license, there had been substantial compliance with the act. The contractors were permitted to recover.

Now, how does all this affect us? It affects us in this way: First, the law declares acting as a contractor, including the act of bidding, without a license to be unlawful. A contract made in violation of an express provision of law is ordinarily void. If contracts with unlicensed contractors are void, the strict rule of accountability heretofore discussed might be invoked by the courts. The point has not been passed upon yet, but in view of the

possibility that public officers might be held personally liable for payments to an unlicensed person, the Division of Highways has established the procedure of clearing every low bidder with the Registrar of Contractors. This seems the only safe procedure. To the person who is following it, or should hereafter adopt it, I will give one word of warning. In 1945, legislation was again enacted for classification of contractors (Ch. 1159, Statutes of 1945). They are divided into

- (a) general engineering contracting
- (b) general building contracting
- (c) specialty contracting.

As a result of this classification, a general building contractor can build a building, but unless he also has a general engineering license, he cannot build a bridge or a road! So the wheels turn within the wheels, and life grows more complicated day by day.

Function of Engineers

It might be well to talk a little about the function of engineers in construction contracts.

We will skip over such matters as design of projects, acquisition of right of way, and preparation of plans and specifications, with one exception. That is, we cannot fail to note that the engineer is not accountable for his errors in computing estimated quantities of work. The courts hold that the contractor, having equal means of determining the quantities from the plans, relies on the engineer's estimate at his peril.

Hackett v. State of California (1894),
103 Cal. 144;
Ariss-Knapp Co. v. County of Sonoma
(1925), 73 Cal. App. 262.

Specifications which grant discretion to the engineer, such as provisions that "soft material shall be removed to the satisfaction of the engineer" or that "oil shall be applied as directed by the engineer" are necessary to meet unforeseen contingencies, and are valid.

City Street Improvement Co. v. Kroh
(1910), 158 Cal. 308;
Town of Mill Valley v. Bonding Co.
(1924), 68 Cal. App. 372, 380.

Inspections by Engineers

Specifications which provide for a final estimate of work done by the engineer, and for payment based thereon, are valid, notwithstanding the fact that the engineer is an employee of one of the parties. In order to excuse the failure to produce the engineer's estimate, the contractor must plead and prove fraud, or gross mistake amounting to constructive fraud, on the engineer's part.

Loup v. California Southern Ry. Co.
(1883), 63 Cal. 97;
Gray v. Cotton (1913), 166 Cal. 130.

The question in such cases is not whether the engineer "correctly" decided the question;

Connel v. Higgins (1915), 170 Cal. 541.

In

City Street Improvement Co. v. Marysville (1909), 155 Cal. 419,

the Supreme Court had to consider the legal effect of inspection by the engineer. A sewer job, laid below the water table, was installed with continual inspection. It was tested at the end of the job, and found to be flowing 1,100 gallons of water a minute or three-fourths capacity, from water entering at the joints. Investigation then revealed that most of the joints had no cement, or mortar in the lower halves. Held: The city was estopped by the inspector's approval of the work as it went along.

Marysville Case Decision

This was a four-three decision. The rule announced by the majority is good law as applied to minor defects and small variations from the contract. It seems an unwise rule when applied to a substantial and major violation of the specifications, as in the *Marysville* case. However, the decision still stands.

The moral from the case is to say "no" in the first place. There is no problem when an engineer changes his "no" to "yes," but just try the reverse. Try changing, against the contractor, your interpretation of the contract, or your findings on quantities, on the final estimate, when all the progress estimates were in his favor! You can look forward to an embarrassing cross-examination in such cases.

Provision in a contract giving the engineer the right to increase or decrease quantities are valid;

City Street Improvement Co. v. Kroh,
supra.

The California courts have not yet had occasion to spell out the limitations inherent in this rule, except to say that the provisions come within the rule permitting provision for unforeseen contingencies. Other courts have considered the question. The general rule laid down is that this is not an unlimited discretion; it should be exercised as developments during construction indicate is desirable for the proper completion of the job as a whole and it is not authority to plan a new and different job;

Kiebertz v. Seattle (1915),
84 Wash. 196; 146 Pac. 400.

Moot Question

There is another point which the California courts have not yet, to my knowledge, covered. That is the matter of control of the work. The engineer's function is inspection, that is, to see that the finished product complies with the plans and specifications. In the absence of unusual specifications, the choice of means or methods of obtaining the desired end is with the contractor. Where the engineer steps out of his role and dictates methods, bosses the contractor's men and in other ways takes control of the work, trouble can be anticipated, on the job and in the courts.

In connection with the duties of the County Road Commissioners in preparing plans and specifications, those interested in reading a little law on the subject are referred to the case of

City Street Improvement Co. v. Kroh,
supra,

which contains a lengthy discussion of various specifications and is probably the leading California case on the subject.

I have already referred to the necessity of certainty in specifications. Further reference to cases should include

Dillingham v. Welch (1919),
179 Cal. 656.

This case holds that specifications must be reasonably certain in order to afford

competition, but that an exception will be made of such details and unforeseen contingencies as arise during construction which can be left to the discretion of the engineer.

A case where the notice to bidders, plans and specifications were held bad for uncertainty is

Healey v. Anglo-Californian Bank, Ltd. (1907), 5 Cal. App. 278.

Among other defects in the specifications pointed out by the court were the following:

1. There was no time fixed for completion, thereby opening the door to favoritism.
2. There were contradictory specifications regarding the right of the engineer to change the plans.
3. It was provided that "bidders may submit their own plans and specifications for the whole or any portion of the contract."
4. There were various references in the specifications to work shown on the plans, whereas, in fact, the plans did not show any such items.

There are three important laws relating to public works now codified in the Labor Code. These are:

1. The so-called Public Works Wage Rate Law, Sections 1770 to 1781, inclusive, Labor Code.
2. The eight-hour law for public works, Labor Code, Sections 1810 to 1817, inclusive.
3. Law prohibiting employment of aliens on public works, Sections 1850 to 1854, inclusive, Labor Code.

Each of these acts requires a provision to be inserted in the contract specifying a penalty of \$10 per day for each violation. The Public Works Wage Rate Law requires the prevailing wages for each character or type of workman to be employed on the contract to be specified in the call for bids and in the contract itself. It has been held that a contract failing to set forth the prevailing wages is invalid;

Southern California Roads Co. v. McGuire (1934), 2 Cal. (2d) 115.

Certain other laws of lesser importance relating to public works are cited in Section 7 of the Standard Specifications of the Division of Highways dated January, 1949, at pages 38 and 39.



This recent aerial photograph by the U. S. Navy vividly shows Shasta Dam and Reservoir with Mount Shasta in background

Mobile Offices

Trailers Used by Field Crews
Of Division of Highways

WITH INCREASING construction costs and the great number of projects being built under the expanded State highway program, the cost of building individual field engineering offices for each job became prohibitive. To reduce this high expenditure, the Division of Highways purchased a number of bare house trailers and fitted them out as field offices. Originated as a cost-cutting measure, the trailers proved to be so convenient that they are now used almost exclusively for the smaller jobs.

Trailers Fitted for Field Use

The bare trailers were fitted with a drafting table across one end and one or more desks. An oil heater was also provided for cold weather, and where available, some office trailers were connected to running water. Filing cases, plan racks, and racks for surveying gear were also built in. As the field men

became accustomed to their use, many special little conveniences were added.

Some have special stationary chests and cupboards for the orderly storage of equipment. Most of the men take a special pride in their trailers and in the fitting out process try to make them as convenient as possible. Most of the outfitting was done on the job by contractors' carpenters. The major part of the furniture was obtained from the Stores Department.

Where electricity is available, the lighting system is arranged so that it may be either plugged into a convenient outlet, or a meter box may be installed so that power may be received directly from a pole.

Housing Provided

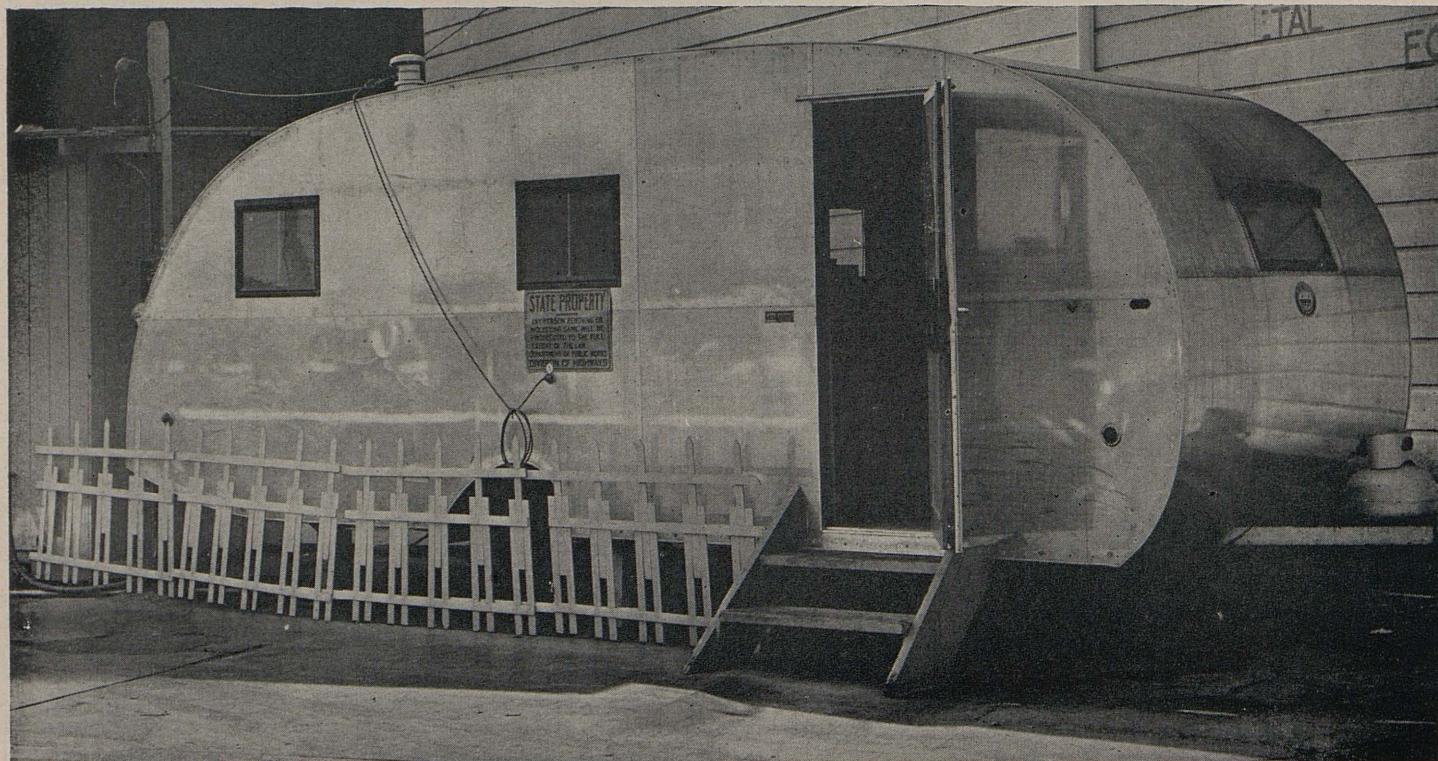
It has not been found generally expedient to use the trailers in the more densely populated metropolitan areas, owing to the fact that the cost of pro-

viding and housing the necessary sanitary facilities frequently is nearly as expensive as building an entire office would be. For many of the metropolitan installations a demountable semi-permanent type office has been developed.

Closely allied with the difficulty of obtaining offices was the scarcity of housing which the field men encountered on most of their assignments. To ease the difficulty of finding living quarters, the Division of Highways also purchased a number of house trailers which were delivered to the jobs and rented to the field men. About 120 house trailers are now in service in the field.

In smaller towns where housing is usually more difficult to secure, the trailers have been especially appreciated. Finding a house for a short assignment is frequently an impossibility whereas the trailers may be brought in

Exterior view of typical trailer office used in field by Division of Highways engineers





View of interior of trailer showing portion of office equipment and facilities

with little or no delay. No attempt is made here to claim life in a trailer to be equal to or as desirable as living in a private house but in an emergency such as that occasioned by a short assignment in a remote location, a house trailer fills an urgent need.

Trailers Easily Moved

In practice, the pick-up and delivery of the trailers is handled with very little delay. As a trailer is ordered for a particular job, the Equipment Department sends a tractor unit, picks up the trailer and delivers it to the new location ready for use, usually in less than one day's time. The wheels are removed and the trailer is mounted on blocks for the duration of its stay.

Thirty-one of these office trailers are in use by the Bridge Department

on bridge jobs, as well as a considerable number which are being used on highway jobs in the various districts.

The accompanying photographs illustrate the type of the trailer used for the office installations and also show how the interior is fitted out to accommodate a field office.

COMPLIMENT

528 ALAMEDA ST.,
VALLEJO, CALIF.

C. H. PURCELL, DIRECTOR
Department of Public Works

DEAR MR. PURCELL: It is always a pleasure to write you regarding your department's modern highway accomplishments. Four-lane divided roadways in California are certainly ap-

preciated by all out of State tourists and by Californians. Safer driving, better transportation, are rewards of these noted improvements. With such appropriate roadways, it is quite possible that various areas of Northern California will now grow and expand in proportion.

As we near the one hundred year anniversary of California's admission to the Union, it is quite pleasing to realize that this State has kept up with other larger states in the matter of roadway developments.

I take this opportunity to thank you for your department's magazine, which you have been so kind to send me for the past several months.

Respectfully,

(Signed) WILMER W. VOORHEES

Federal Aid

Continued from page 28 . . .

gram on a board scale designed to meet the needs developed in prewar studies. The Federal Aid Highway Act of 1944 authorized \$500,000,000 for each of the first three postwar years to be expended according to the long established federal aid plan. Since funds were to be matched by the states, a three-year program of \$3,000,000,000 was made possible.

The annual appropriation was assigned as follows:

\$225,000,000 for the federal aid highway system; \$150,000,000 for secondary or feeder roads, and \$125,000,000 for the federal aid system in urban areas.

New Highway Systems

The legislation required the designation of two new highway systems. One, the national system of interstate highways, was limited by law to 40,000 miles, a portion of which has now been designated. This system connects the principal metropolitan areas, cities, and industrial areas and has an important relationship to the national defense. It reaches 42 state capital cities and will serve 182 of the 199 cities in the country having a population of 50,000 or more persons.

The other new system consists of the principal secondary or feeder roads, including farm-to-market roads, rural free delivery mail roads, and public school bus routes.

Under the Federal Aid Highway Act of 1944, California was apportioned \$66,613,045 for each of the first three postwar fiscal years.

California's apportionments under the 1944 and 1948 acts are as follows:

Fiscal year ending	Federal aid primary system	Federal aid secondary system	Federal aid system in urban areas
June 30, 1946	\$9,018,749	\$5,162,254	\$8,122,233
June 30, 1947	9,017,519	5,161,445	8,122,233
June 30, 1948	8,897,891	5,092,619	8,018,102
June 30, 1950	8,025,813	4,595,138	7,216,292
June 30, 1951	8,037,278	4,602,788	7,216,292
Totals	\$42,997,250	\$24,614,244	\$38,695,152
Total All Types Federal Funds . . . \$106,306,646			

Extension of 1944 Act

The Federal Aid Highway Act of 1948, approved June 29, 1948, was essentially an extension of the 1944 act except that the total appropriation for each year was reduced from \$500,000,000 to \$450,000,000 and no appropriation was made for the fiscal year ending June 30, 1949.

The above funds were apportioned to the states in accordance with the following formulae:

Federal Aid Primary Funds

(a) One-third in the ratio that the population of California bears to the population of the United States (Census of 1940).

(b) One-third in the ratio that the area of California bears to the area of the United States.

(c) One-third in the ratio that the mileage of post roads in California bears to the total post-road mileage in the United States (mileage figures supplied by Postmaster General).

Federal Aid Secondary Funds

(a) One-third in the ratio that the rural population of California bears to the rural population of the United States (Census of 1940).

(b) One-third in the ratio that the area of California bears to the area of the United States.

(c) One-third in the ratio that the mileage of post roads in California bears to the total post-road mileage in the United States (mileage figures supplied by Postmaster General).

Federal Aid Urban Funds

In the ratio which the urban population of California bears to the urban population in the United States (Census of 1940).

In connection with apportionment of federal funds under the 1944 and the 1948 acts, the term "urban area" means an area including and adjacent to a municipality or other urban place of 5,000 or more, the population for which, including the municipality or other urban place, to be determined by the latest available federal census. The latest available census is that of 1940.

Urban Area Boundaries

The boundaries of urban areas in California have been fixed by the Division of Highways with the approval of the Bureau of Public Roads.

The term "rural area" means all areas of the State not included in "urban area."

The federal aid apportionment to California for the fiscal year ending

June 30, 1951, which was made on September 8, 1949, was the last apportionment of federal funds authorized under existing federal legislation.

In order that the federal aid program may continue, without a break, it will be necessary for the next Congress, which convenes in January, to pass additional legislation.

At the annual meeting of the American Association of State Highway Officials in San Antonio in October, the executive and administrative committees were directed to meet in Chicago on November 20th to 22d to formulate recommendations to Congress regarding the type of legislation and the amount of federal funds necessary to help the states solve the critical highway problems with which we are still faced.

INDIA INTERESTED

SAN FRANCISCO, CALIFORNIA

CALIFORNIA HIGHWAYS AND
PUBLIC WORKS
Sacramento, California

GENTLEMEN: As a leader of a delegation of road engineers from India who are going around this country with the object of getting themselves acquainted with the methods of road construction in this country, I had an occasion to call in at the office of the State Highway Department at Sacramento, and was very much interested to receive a copy of your publication, *California Highways and Public Works* for the months of May and June, 1949. I wonder if it could be possible for you to send me a few of the back numbers, say, for a period of one year, which I am sure would be of great interest.

I should be grateful if I could be put on the mailing list for the future, as I feel that some of the articles in a magazine of this type are found to be very helpful to us in India where we have to encounter problems quite similar to those you get in a large portion of this State.

My mailing address would be 20 Patel Park, Amballa Cantonment, India.

Yours gratefully,

D. P. NAYAR

EARL WARREN
Governor of California

CHARLES H. PURCELL
Director of Public Works

FRANK B. DURKEE
Deputy Director

HIGHWAY COMMISSION

C. H. PURCELL Chairman
HARRISON R. BAKER Pasadena
HOMER P. BROWN Placerville
JAMES A. GUTHRIE San Bernardino
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CHESTER H. WARLOW Fresno
CHARLES T. LEIGH San Diego

DIVISION OF HIGHWAYS

GEO. T. MCCOY State Highway Engineer
FRED J. GRUMM Deputy State Highway Engineer
J. G. STANDLEY Assistant State Highway Engineer
R. M. GILLIS Assistant State Highway Engineer
F. W. PANHORST Assistant State Highway Engineer
J. W. VICKREY Assistant State Highway Engineer
R. H. WILSON Assistant State Highway Engineer
T. E. STANTON Materials and Research Engineer
GEORGE F. HELLESOE Maintenance Engineer
C. E. WAITE Engineer of Design
EARL WITHYCOMBE Construction Engineer
H. B. LA FORGE Engineer of Federal Secondary Roads
L. V. CAMPBELL Engineer of City and Cooperative Projects
EARL E. SORENSON Equipment Engineer
H. C. McCARTY Office Engineer
J. C. YOUNG Traffic Engineer
J. C. WOMACK Planning Engineer
I. O. JAHLSTROM Principal Bridge Engineer
STEWART MITCHELL Principal Bridge Engineer
E. R. HIGGINS Comptroller

Right of Way Department

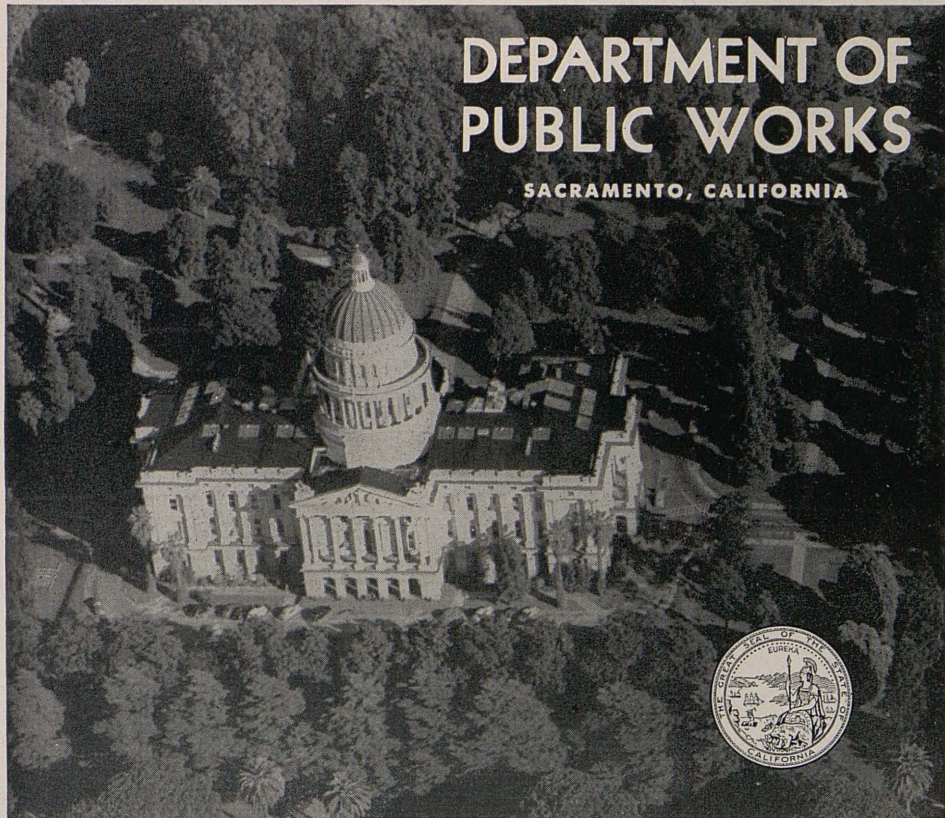
FRANK C. BALFOUR Chief Right of Way Agent
E. F. WAGNER Deputy Chief Right of Way Agent
GEORGE S. PINGRY Assistant Chief
R. S. J. PIANEZZI Assistant Chief
E. M. MacDONALD Assistant Chief

District IV

JNO. H. SKEGGS Assistant State Highway Engineer

District VII

P. O. HARDING Assistant State Highway Engineer



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A. M. NASH District I, Eureka
F. W. HASELWOOD District II, Redding
CHARLES H. WHITMORE District III, Marysville
B. W. BOOKER District IV, San Francisco
L. A. WEYMOUTH District IV, San Francisco
E. J. L. PETERSON District V, San Luis Obispo
E. T. SCOTT District VI, Fresno
W. L. FAHEY District VII, Los Angeles
M. E. CESSNA District VII, Los Angeles
E. O. SULLIVAN District VIII, San Bernardino
S. W. LOWDEN District IX, Bishop
JOHN G. MEYER District X, Stockton
E. E. WALLACE District XI, San Diego
HOWARD C. WOOD Bridge Engineer, San Francisco-Oakland Bay Bridge and Carquinez Bridge

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Legal

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ROBERT E. REED Attorney
GEORGE C. HADLEY Attorney
HOLLOWAY JONES Attorney

DIVISION OF SAN FRANCISCO BAY TOLL CROSSINGS

RALPH A. TUDOR Chief Engineer

DIVISION OF WATER RESOURCES

EDWARD HYATT State Engineer, Chief of Division
A. D. EDMONSTON Assistant State Engineer
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G. H. JONES Principal Hydraulic Engineer, Sacramento River Flood Control Project
P. H. VAN ETEN Principal Hydraulic Engineer, State-wide Water Plan
T. B. WADDELL Principal Hydraulic Engineer, Central Valley Project
GORDON ZANDER Principal Hydraulic Engineer, Water Rights
GEORGE B. GLEASON Supervising Hydraulic Engineer, Los Angeles Office
HENRY HOLSINGER Principal Attorney
T. R. MERRYWEATHER Administrative Assistant

DIVISION OF ARCHITECTURE

ANSON BOYD State Architect
W. K. DANIELS Assistant State Architect (Administrative)
P. T. POAGE Assistant State Architect (Design and Planning)
D. C. WILLETT Chief Construction Engineer

Headquarters

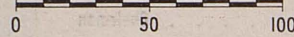
A. F. DUDMAN Principal Architectural Designer
H. W. DeHAVEN Supervising Architectural Draftsman
CARLETON PIERSON Supervising Specification Writer
FRANK A. JOHNSON Principal Structural Engineer
C. A. HENDERLONG Principal Mechanical and Electrical Engineer
WADE HALSTEAD Supervising Estimator

SCHOOLS

W. H. PETERSEN Principal Structural Engineer, Sacramento
H. W. BOLIN Principal Structural Engineer, Los Angeles

CALIFORNIA STATE HIGHWAY SYSTEM

SCALE IN MILES



centimeters
 10 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 10
 inches
 4 3 2 1 0 1 2 3 4

Golden Thread
 Colors by Munsell Color Services Lab

1	2	3	4	5	6	7	8	9	10	11(A)	12	13	14	15
39.12	65.43	49.87	44.26	55.56	70.82	63.51	39.92	87.06	92.02	82.14	72.06	62.15	52.16	42.17
13.24	18.11	16.11	-13.80	9.82	-33.43	34.26	11.81	-48.55	-0.40	-0.60	-0.75	-1.06	-1.19	-1.07
15.07	16.72	16.72	-22.29	-22.85	-44.49	-3.35	59.60	-46.07	18.51	1.13	0.23	0.43	0.28	0.19

Density
 0.04 0.09 0.15 0.22 0.36 0.51

D50 Illuminant, 2 degree observer