

# CALIFORNIA

## HIGHWAYS AND PUBLIC WORKS



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# Twin Span

## Toll Bridge Authority Orders Parallel Crossing of S. F. Bay

BY UNANIMOUS vote the California Toll Bridge Authority on March 23d went on record as favoring the immediate building of a second San Francisco Bay crossing paralleling the existing San Francisco-Oakland Bay Bridge and the construction of a southern crossing as soon as its financing is possible.

Action was taken by the authority after Governor Earl Warren, its chairman, cited seven reasons why he favors a parallel crossing and Director of Public Works C. H. Purcell strongly recommended a twin-span. Both Governor Warren and Purcell emphasized that they believe both crossings are needed but expressed the opinion that a parallel bridge will best serve present urgent traffic needs and that a southern crossing cannot be financed at this time.

### Governor's Reasons

Governor Warren listed his reasons for deciding in favor of a parallel span as follows:

1. The parallel bridge will better serve 82 percent of the traffic that will use it. The southern crossing only 18 percent.
2. With conditions as they are today it will be possible to maintain a 25-cent toll on the existing bridge and a new parallel crossing. It would be necessary to increase the toll to 35 cents on the existing as well as the southern crossing.
3. The parallel bridge will relieve the congestion immediately upon its completion. The southern crossing will not relieve the congestion at any time.
4. The parallel bridge, including approaches, can be completed two and one-half years sooner than a southern crossing.
5. The parallel crossing can be constructed more cheaply.
6. Safety to traffic will be greatly favored by a parallel bridge.
7. The cost of maintenance and operation of two parallel bridges will be cheaper by more than \$400,000 per year than the cost of maintenance

and operation of a combination of the present bridge and a southern crossing.

### Approve Tudor Report

By its action, the authority approved the report and recommendations of the Division of San Francisco Bay Toll Crossings, of which Ralph A. Tudor is Chief Engineer.

The authority adopted two resolutions. One states that the authority finds that public interest and necessity require the construction of the parallel bridge at the earliest possible moment and prior to the construction of a southern crossing, authorizes the Department of Public Works to proceed immediately with the necessary work and directs the department to suspend work on a southern toll highway crossing until a possible method of financing such a crossing can be recommended by the department to the authority.

The second resolution petitions Congress to authorize the proper officers of the United States to convey to the State of California a perpetual easement for an additional toll bridge over and across Yerba Buena Island and over and across such other federal lands in and about the Bay of San Francisco as may be required as a right of way for the bridge.

Members of the Toll Bridge Authority are: Governor Warren, Chairman; Purcell, Secretary and Member; Lieutenant-Governor Goodwin J. Knight; Director of Finance James S. Dean, and Ernest L. Adams, Chico.

### Governor's Statement

Governor Warren read the following prepared statement:

"The time has arrived for the California Toll Bridge Authority to make its final decision on the location of a second San Francisco-East Bay Crossing of San Francisco Bay and to proceed with its construction as soon as possible. The need for such a crossing is apparent to everyone who uses the present bridge or who has studied the problem. The phenomenal growth of

the five counties surrounding the bay during war years, must convince any thoughtful person that the area is destined to be one of the most densely populated areas of America. This area already has a population of 2,000,000 people. It has grown 39 percent since the 1940 census. Its possibilities for growth are almost unlimited provided, among other things, its traffic problems are solved. Like the New York City area, its parts are separated by water, which must be crossed at various places if the traffic is to be facilitated.

### New Crossings Needed

"A start has been made with the San Francisco-Oakland and the Golden Gate Bridges, but as experience has already demonstrated, additional crossings will be needed in the comparatively near future, one of which should be constructed immediately to relieve present congestion.

"The Toll Bridge Authority through the State Department of Public Works has studied the problem for a period of three years in accordance with legislative authorization. It has spent \$657,000 in this work. It has employed the most eminent tube, bridge and traffic engineers in the country as consultants. It has cooperated with the Army-Navy Board which in the early stages of the matter, made a study based upon then available data. It has given serious consideration to the findings of that board and this may be measured by the fact that approximately 64 percent of the state funds spent during the past year were on the Army-Navy Board proposed southern crossing.

### Twin Span Needed Now

"Although the Army-Navy Board recommended a southern crossing and the Department of Public Works a parallel bridge, the two reports were not at such variance as that fact might imply. Each of them found that both such crossings are feasible and will be required for the future. The Army-Navy Board concluded that the parallel



On the findings and recommendation of these internationally known engineers, the California Toll Bridge Authority instructed the Department of Public Works to proceed with the construction of a second crossing of San Francisco Bay paralleling the existing San Francisco-Oakland Bay Bridge. Left to right—Ralph A. Tudor, Chief Engineer; George L. Freeman, New York; C. H. Purcell, Director of Public Works; Ralph Smillie, New York; and O. J. Porter, Sacramento and New York City

crossing would have more tangible advantages at the present time but that the southern crossing would have greater advantages in the future development of the bay area and should be built first. Our department, recognizing the growth possibilities of the southern part of the bay, concluded that a southern crossing was desirable for that section and should be constructed in the orderly course of events, but that present traffic conditions, present population densities, and present needs call for another northern crossing immediately.

"This is not a question of conflict between the two agencies. It is a question of the emphasis to be placed on the complicated needs of one of the fastest growing areas in America.

#### Southern Crossing Later

"I personally believe that both crossings are needed and should be constructed as early as possible. I believe our plans should be projected on that premise. If it were financially possible to do so I would vote for their construction simultaneously. But it cannot be done. Any new crossing must be financed by revenue bonds and the experts who pass upon such matters advise that we could not sell the bonds of two crossings at one time. We must, therefore, select that site which in our opinion will best serve the present needs of the district; in other words,

### Will Require 4 Years Work

At the meeting of the California Toll Bridge Authority in Sacramento on March 23d, Governor Earl Warren asked Director of Public Works C. H. Purcell how soon he could start construction on a new parallel bridge across San Francisco Bay provided there are no unforeseen delays.

"We can be ready to start construction in June, 1950," Purcell said.

"How long will it take to build the bridge," the Governor asked.

"If we are not unnecessarily hampered or delayed, we could have the new bridge in operation in June, 1954," Purcell replied.

that which will do the greatest good for the greatest number—now.

"I have concluded after long study that the parallel bridge will accomplish that purpose. I know there are those who will honestly disagree. But there is no conclusion upon which all would agree. All we can do is to try to balance the equities.

#### National Defense

"Because it is a matter of such importance, I have been particularly concerned with the effect of another crossing to national defense and the possibility of serious bomb damage. This has been discussed at length with military experts and I am convinced

that in this instance the problems of national defense are by no means controlling—the Army-Navy Board did not find them so.

"I have also been concerned with the problem of street congestion at the bridgehead areas on both sides of the bay. Our traffic studies and plans for ramps and freeway connections have explored this in great detail and I find it makes no difference where the next crossing is located. The ramps will effectively distribute bridge traffic and even improve present conditions.

#### Federal Help

"The Army has issued a permit for the construction of either or both crossings. All that is needed from the Federal Government is to acquire the necessary rights of way across certain government-owned land—in the case of the parallel bridge across Yerba Buena Island, and on both sides of the bay—and to repeal the provision of the 1931 federal act that tolls on the San Francisco-Oakland Bay Bridge must be discontinued, or at least restricted, when that bridge has paid for itself.

"These rights of way should be requested immediately in order not to delay the project.

"I therefore am prepared to vote for the new parallel crossing of San Francisco Bay which has been recommended by Mr. Charles H. Purcell, our Director of Public Works, and his staff, in whom I have implicit confidence."



# Purcell Report

Public Works Director  
Recommends Twin Bridge

IN A REPORT to the California Toll Bridge Authority on March 23d, Director of Public Works C. H. Purcell recommended that a parallel bridge across San Francisco Bay be first financed and constructed before the construction of a southern crossing is undertaken.

"The desirability of both crossings is recognized," Purcell told the authority, "but it is, in my opinion, not possible to finance both crossings at this time by revenue bonds. No method of financing both crossings has been suggested."

Purcell said that he had carefully considered the report of the Division of San Francisco Bay Toll Crossings, which recommended that priority be given to the building of the Parallel Bridge, which it is proposed to construct on a line between Rincon Hill in San Francisco and the City of Oakland via Yerba Buena Island, approximately parallel to, and northerly of, the existing San Francisco-Oakland Bay Bridge, together with approaches at the termini thereof, and a tube under the Oakland Estuary with connections with the East Bayshore Freeway and the City of Alameda.

#### Purcell Requests Action

Purcell requested that the Department of Public Works be authorized to proceed immediately with the necessary work for the completion of final plans, specifications and estimates of cost, the necessary financial investigations and negotiations, including the preparation of a bond indenture for presentation to the authority, federal legislation necessary for the acquisition of rights of way over federal property or for financing, and to do all other things required for the construction of a parallel bridge and approaches at the earliest possible moment. He requested that the department be authorized to suspend work on the Southern Crossing until a possible method of financing such a crossing can be recommended by the department to the authority.

Purcell said that his recommendation for a parallel bridge is based in par-

ticular on known value of traffic now requiring service at the location of the existing bridge, which is resulting in congestion on the Bay Bridge and danger to life and property; the anticipated traffic for such location as conservatively estimated by the Division of San Francisco Bay Toll Crossings and by recognized traffic engineers employed by the division as consulting experts, and on the other reasons set forth in the report of the Bay Toll Crossings Division.

"It is in the public interest that construction of the Parallel Bridge should be commenced as soon as possible," Purcell said.

#### Purcell Report

The Purcell report to the authority follows:

*To the California Toll Bridge Authority, Sacramento, California*

GENTLEMEN: By resolution dated November 10, 1947, the California Toll Bridge Authority authorized and directed the Department of Public Works to make necessary surveys and prepare detailed plans, specifications and estimates for an additional toll bridge and for an additional toll highway crossing, their appurtenances and approaches, across the Bay of San Francisco as an aid to, and as a part of, the public highways of the State, and as state highways, at the locations therein described.

Thereafter, by order dated December 29, 1947, duly approved by the Governor, I, as Director of Public Works, created in the Department of Public Works the Division of San Francisco Bay Toll Crossings. Continuously since its creation this division has been engaged in and has made further investigations, studies, estimates of cost and plans in respect to said additional toll bridge, commonly known as the "Parallel Bridge," and said additional toll highway crossing, commonly known as the "Southern Crossing."

#### Tudor Report

A report has been submitted to the Director of Public Works by said

division. Said report is entitled "A Report to Department of Public Works on Additional Toll Crossings of San Francisco Bay," dated November, 1948, and is attached hereto and is hereby respectfully presented to the authority.

In said report it is recommended that the Parallel Bridge, namely, an additional toll bridge built on a line between Rincon Hill, in the City and County of San Francisco, and the City of Oakland, County of Alameda, via Yerba Buena Island, approximately parallel to, and northerly of, the existing San Francisco-Oakland Bay Bridge, together with approaches at the termini thereof, and a tube under the Oakland Estuary with connections to the East Bayshore Freeway and the City of Alameda, be constructed before the construction of the Southern Crossing is undertaken.

#### Hearings Held

Printed copies of said report were given wide distribution and publicity. More than three thousand copies of this report were distributed, the report being furnished to all who expressed any interest in the matter. The report was before the authority at a public meeting, at which time the Chief Engineer explained it in detail and answered questions concerning it. Thereafter, on December 14, 1948, your honorable body held a public hearing in Sacramento, at which time all persons and organizations so desiring were afforded a full and free opportunity to present their views on the report.

I have carefully considered this report and the presentations of interested parties concerning it. The desirability of both crossings is recognized, but it is, in my opinion, not possible to finance both crossings at this time by revenue bonds. No method of financing both crossings has been suggested. It is therefore necessary, at this time,

... Continued on page 57

# Convict Labor

Story of Prison Road Camps  
In State of California

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

*This is the first of a series of articles to be published in "California Highways and Public Works," covering the history, legislation and operation of state highway prison road camps in California. Administration of prison road camps is vested in the Department of Public Works by law. The articles are intended to record experience with the various phases of administrative control, cooperation with prison authorities,<sup>1</sup> and procedure under statute provisions, including: History and legislation, organization, camp layouts, feeding and nutritional accounting, care and welfare, and accounting of prisoner's earnings under statute provisions.*

*This first article covers history and legislation.*

THIRTY-FOUR YEARS ago, employment of prison labor for the construction of state highways in California was first advocated in a bill introduced in the 1915 Legislature by Assemblyman B. B.

<sup>1</sup> Prior to May, 1944, State Board of Prison Directors. Subsequent to May, 1944, Department of Corrections.

Meek of Butte County, who later held the office of Director of Public Works from July 29, 1927, to January 6, 1931.

The bill was enacted into law and became effective August 8, 1915.<sup>2</sup> It authorized the employment of prison labor on state highways; provided for

<sup>2</sup> Chapter 124, 1915 Statutes.

handling of such labor; authorized good-time allowance for prisoners, and provided penalties for interference with the prisoners.

Records indicate that state penal institutions were overcrowded then as they are today. Penologists were pointing out and pressing the need for some

*Early day prison road camp in Lassen County in 1916*







Prison road camp "E" on Merced River, State Sign Route 140, in Meriposa County in 1924

means of rehabilitating prisoners outside prison walls before they were returned to society.

At the same time, the prevailing method of building roads in mountain areas was with pick-and-shovel station-gang labor, often augmented with teams and fresno scrapers, and occasionally with a steam power shovel.

Indications are that these conditions, coupled with the difficulty experienced in inducing free labor to work in remote areas of California during the period prior to World War I, influenced legislators to enact California's first comprehensive prison labor law.

#### First Prison Road Camp

Shortly thereafter, in September, 1915, the first state highway prison road camp was established at Leggett Valley in Mendocino County to begin work on Route 1—later to be known as the "Redwood Highway."

Other camps were soon established in Calaveras County, between Valley Springs and San Andreas (Route 24), and in the Yuba River Canyon (Route 25) in Sierra County near Downieville. By the end of 1916, 385 prisoners from

San Quentin and Folsom prisons were working in the road camps.

Some idea of the remoteness of the first prison road camp locations can be conveyed by quoting from a report by District Engineer F. G. Somner at Eureka.<sup>3</sup>

"The first section of road selected by the Highway Commission to be constructed by convict labor embraces a portion of the coast trunk line, extending from San Francisco to the City of Eureka, in Humboldt County, distant 297 miles. The section under discussion is 33.10 miles in length, extending from what is known as Rattlesnake Summit, a point on the old overland road to Eureka, to the Mendocino-Humboldt County line. This stretch may be considered as being the most important link on the coast route in Northern California, inasmuch as it eliminates the Bell Springs grade, which, attaining an altitude of 4,100 feet above sea level datum, has always been a formidable barrier to tourist travel at all seasons of the year.

"The route lies along the east bank of the South Eel River, traversing a country as rugged and picturesque in character and as remote from civilization as any portion of California; in a virgin state, sparsely

<sup>3</sup> Pages 104-106. First Biennial Report, California Highway Commission, December 31, 1918.

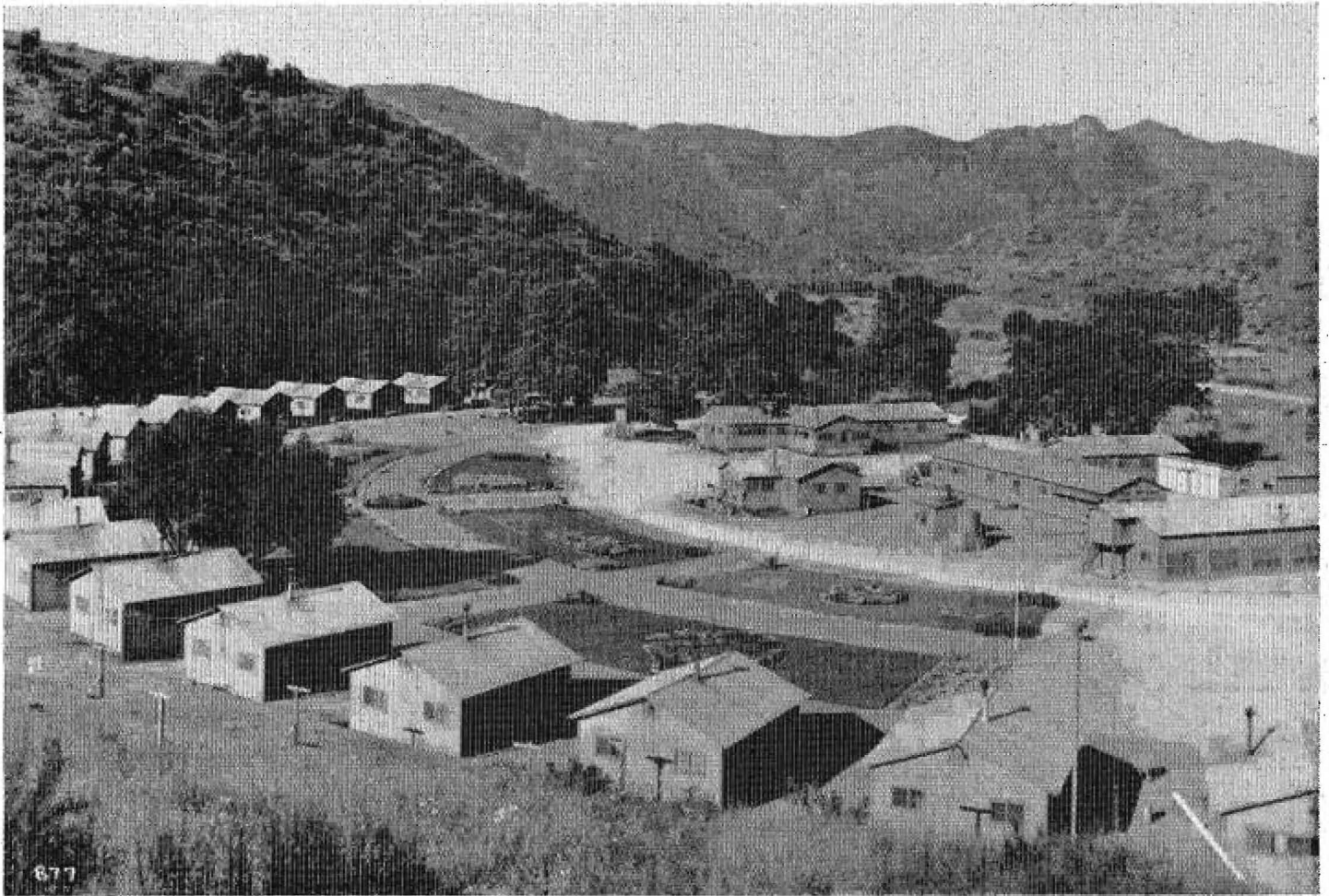
settled by homesteaders and accessible by trails only, built by engineers during the survey of the proposed road.

"The camps were first located centrally, being situated 23 miles from the nearest coast port, Union Landing, the base of supplies during the major part of the construction of the road. The men were shipped from the prison to Fort Bragg, the nearest railroad station, 45 miles distant, and transported by motor trucks to the camps. \* \* \*

"On August 15, 1917, the road was completed to a width of 12 feet, thus affording a connection with the state highway at the Mendocino-Humboldt county line, and on this date Governor Stephens and party, including the Highway Commission, made an official inspection of the road, camping overnight in the redwoods near Bridges Creek. On July 1, 1918, the road was completed to a proper width and opened to travel."

#### Legislative Act of 1915

The 1915 statutes provided that the California Highway Commission designate and supervise all road work, and provide, supervise and maintain necessary camps and commissariat, but did not provide specific authority for administration of prisoner activities.



*This is a modern prison road camp in Moosa Canyon on U. S. 395 in San Diego County—July, 1941, to December, 1948*

The act provided also that the State Board of Prison Directors have full jurisdiction at all times over the discipline and control of convicts employed in the road camp.

The State Board of Prison Directors was the dominant authority under the 1915 act. Their authority was transmitted through the prison wardens to the guards appointed to supervise the prisoners in the camps.

The guards were authorized under the rules set up by prison wardens, to discipline prisoners, to issue clothing, govern the cookhouse, select cooks, waiters and other camp upkeep help, and to decide when and where prisoners should lay off or work on highway construction.

#### **Highway Funds Used**

Under 1915 statute provisions, all expense of operating the road camps

were paid out of highway funds, including clothing, feeding and medical care of the prisoners, construction and maintenance of camp buildings, and guarding expense.

A prisoner received no pay for his work. The principal benefit was good-time allowance for tenure in camp authorized by the law, not to exceed one day for each two calendar days spent in camp. Other benefits lay in his enjoyment of freedom from prison walls and freedom from constant surveillance of armed guards; an outdoor life; and a chance to prepare himself physically and psychologically under an honor-camp system for return to society.

By 1922, after seven years of operating the road camps under the broadly written dual authority prescribed by the original convict labor law of 1915, it was becoming increasingly evident

to all concerned that continuance of the system whereby a prisoner was required to serve two masters could not succeed.

With a view to working out a solution to the unsatisfactory aspects of the dual control provisions of the 1915 statutes, joint conferences between highway officials and prison officials in the early part of 1923 led to recommendations for revision of laws controlling prison road camp administration.

Through the efforts of Julian Alco, a member of the State Board of Prison Directors, a bill was introduced in the 1923 Legislature by Assemblyman Walter Schmidt of San Francisco, which was designed to correct deficiencies of the 1915 act. The bill was enacted into law June 9, 1923.<sup>4</sup>

<sup>4</sup> Chapter 316, 1923 Statutes.

... Continued on page 55



# Firm Foundation

Ingenuity Displayed on  
Santa Ana Freeway

By W. V. BRADY, Assistant Highway Engineer

WITH CONSTRUCTION finished on that section of the Santa Ana Freeway between Soto Street and Eastman Avenue, another two-mile link in the main line from Los Angeles to Orange County has been provided in the Los Angeles Metropolitan Area.

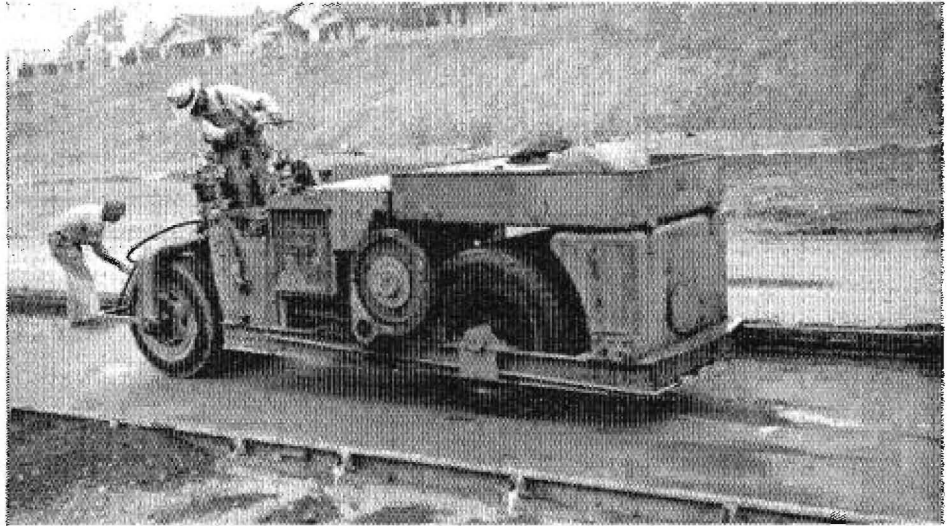
The roadway surface, over which busy travelers will speed, will be a Portland cement concrete pavement, eight inches thick, supported by a hard, firm, and well built cement treated subgrade 4 inches in depth, the details of the construction of which may be of interest to motorists at home and elsewhere.

The secret of success in building this type of subgrade is the element of elapsed time between mixing and final rolling; the less the elapsed time, the better the final result.

## Preparation of Area

In the preparation of the area to be cement treated, the material being in place on the roadbed, and the contractor having decided to use the road-mix method, the area was shaped to approximate grade and cross-section, and thoroughly compacted by rolling with a 12-ton three-wheel roller. Steel side forms eight inches high were set to the lines and grades established by the engineer for the surface of the finished pavement. The depth of the side forms was equal to the proposed thickness of the pavement. The area between them was then trimmed to such elevation that, upon completion of cement treatment, the area would be brought to final elevation for pavement subgrade without excessive waste of cement treated material in the final trimming.

The area to be treated was then scarified and broken up by roter teeth attached to a blade grader so operated as to leave an undisturbed plane at a uniform depth of four inches below the surface. The loosened material was then brought to as finely divided a condition as possible by lightly watering



Rolling subgrade, after cutting to finish grade, with converted rubber-tired tandem roller

it and by crushing lumps and clods with repeated trips of a tandem roller. The material was then shaped into a windrow on the subgrade by using a motor grader. This windrow was of such size that all the material therein would pass through the mixing machine during the mixing operation.

## Special Cement Tank Truck

Portland cement, in the amount of 3½ percent by weight, was then spread on top of the windrow by means of a specially constructed cement tank truck (see photo); with worm gears arranged so as to deposit the proper amount of cement per linear foot to give the required results. This truck, designed and built by the contractor, was equipped with an ingenious system of large and small gear wheels at the discharge end, so devised that the amount of cement deposited on the windrow could be increased or decreased a definite amount by changing the size of one gear. This piece of equipment proved satisfactory.

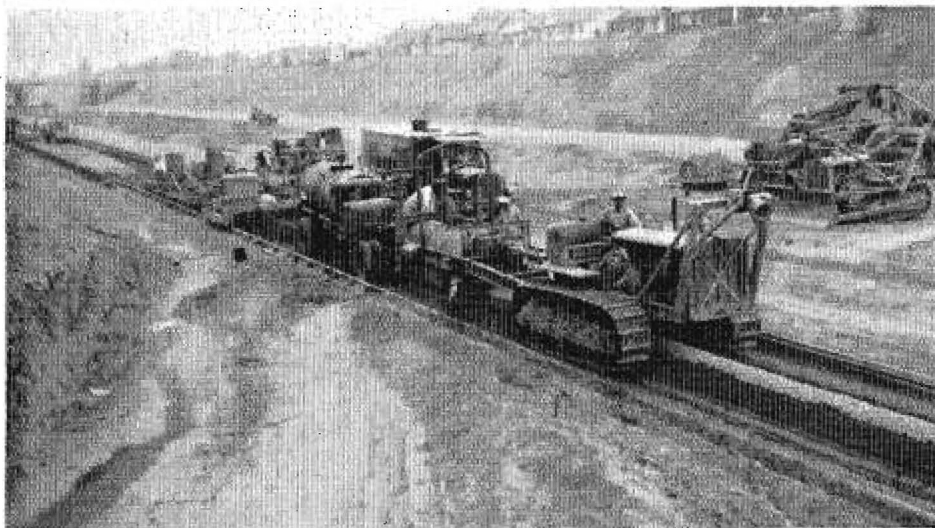
The materials were then mixed by means of a "Woods" mixer (see photo) towed by a D8 Caterpillar tractor, traveling at about 0.2 mile per hour.

This mixer was of the pug mill type, which picked up the loose material in the windrow completely, without leaving any appreciable amount on the ground. Water was introduced into the forward end of the mixer through a metering device (supplied by a tank truck and auxiliary traveling along with the mixer) and at a rate designed to give a satisfactory mix about 8 percent of water by weight which produced a uniform mixture of more or less unchanging appearance. Variations in material from sandy to rock content required slight variations in amounts of water added from time to time. It was found that one mixing was sufficient to give satisfactory results.

## Process of Mixing

In the process of mixing, a compensation was made for tendency of mixing equipment to shift windrowed material in a longitudinal direction, especially when leaving or approaching pavement notches of the several bridges on the project.

After passing through the mixer, the now thoroughly mixed material was immediately spread to uniform depth between the steel side forms by means



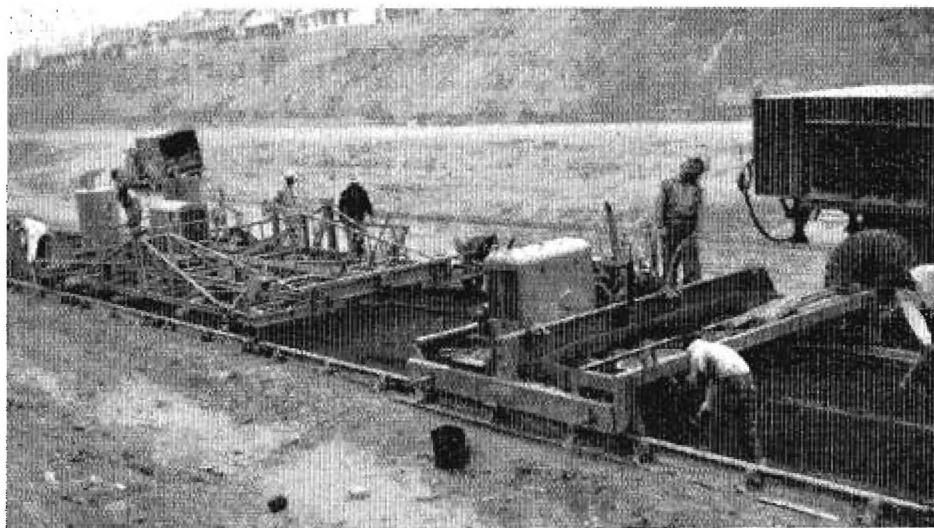
Upper—Mixing and spreading cement treated base



Center—Cement spreader truck in operation

of a Jaeger spreader, a self-propelled machine with flanged wheels which traveled along on top of the side forms (see photo). The spreading device consisted of a large auger revolving on a horizontal axis at right angles to the headers, arranged so it could be raised or lowered as conditions required, also so that the direction of rotation could be reversed when so desired.

Directly behind the spreader a self-propelled Johnson float followed closely, also riding the side forms. This float was equipped with steel grader blades instead of the conventional wooden blades and gave more satisfactory results thereby. Also, this float was adjusted so as to strike off the



Lower—Spreading machine and modified Johnson float laying down cement treated base material

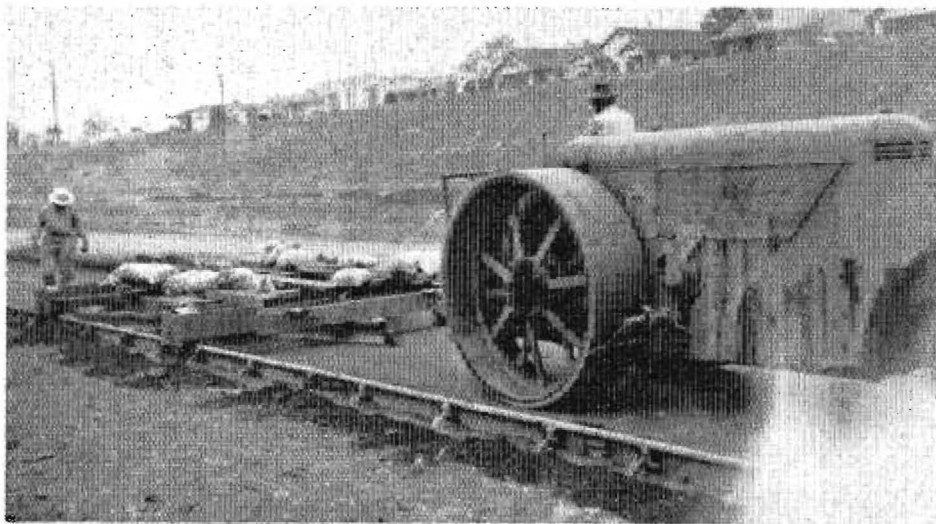
mixed material to a uniform depth below side form grade, allowing about 1 1/2 inches for compaction.

#### Compaction

Immediately after the completion of spreading and floating operations, the cement treated material was thoroughly compacted by means of a Buffalo Springfield, 12-ton, three-wheel roller having a compression on rear wheels of over 390 pounds per linear inch of tire width, which, produced the required 95 percent or more relative compaction throughout the full depth of the treated material. Rolling proceeded without interruption upon the area to be compacted until the required degree of compaction was attained, successive trips being so spaced that not more than 75 percent of the width of any rear wheel, after the initial trip, was on uncompact material. Rolling was performed in such a manner as to avoid the formation of bumps or irregularities, and every effort was made to secure a thoroughly compacted surface true to grade and cross-section.

The surface of uncompact, partially compacted, and completely compacted material was kept moist at all times, and an adequate water supply was maintained at points of spreading and compacting, and equipment was available so that water was applied without driving equipment over uncompact material.





Cutting subgrade to finish grade

#### Grade-cutter Operation

As soon as the roller had completed the compaction of the material, a weighted V-type grader-cutter (designed and built by the contractor), riding on the side forms, was towed by the roller (see photo). The steel blades on this grader-cutter were set to the grade of bottom of Portland cement concrete pavement. Finished subgrade was checked every 25 feet and found to average about one hundredth of a foot low, which was quite an achievement considering varying conditions encountered. Filling in of low subgrade with sand or with treated material cut from subgrade was not permitted. All excess material was removed at once after cutting, and disposed of on the adjacent shoulders, and no loose material was left on the finished treated subgrade.

All subgrade, spreading and finishing equipment which was supported on adjoining new pavement, including inlets, outlets, acceleration and deceleration lanes, was equipped with rubber-tired wheels, which were offset so as to run at least one foot from the edge of the new pavement.

#### Surface Compaction

Immediately after cutting and trimming, a Buffalo-Springfield pneumatic-tired tandem roller was used to complete the surface compaction (see photo). The contractor made up this roller by removing the customary steel roller wheels and substituting therefor

three heavy truck wheels and tires in front, and four behind, which made the roller heavy enough to do a very satisfactory job of finishing the surface. This roller was of such construction as to permit operation forward or backward without turning around on the roadbed. It was provided with water tanks and spray nozzles, fore and aft, so as to apply a fine spray of water to the surface of subgrade during rolling operations.

At the end of each day's work a construction joint was made by trimming the end of the compacted material to a straight line normal to the center line of the roadway, and with a vertical face in thoroughly compacted material.

#### Seal Application

After the treated subgrade was finished and the surface thereof still moist, it was covered with a curing seal of liquid asphalt SC-6 emulsion, sprayed on by hand at a pressure of 90 pounds per square inch. This seal was applied at the rate of approximately one-tenth of a gallon per square yard, and provided a continuous membrane of asphalt over the surface of the surface of the treated subgrade. This seal was applied as soon as possible after the completion of finishing operations. No traffic was permitted on the finished subgrade, which otherwise might have damaged the curing seal.

In general, not more than thirty minutes elapsed between the time water

was added to the cement and subgrade material, and the time the mixture was spread on the subgrade; and not more than one hour elapsed between the time of starting compaction and the time of completion of finish rolling.

#### Mechanical Ingenuity

The adaptation of equipment used in this process to accomplish the required results indicated considerable ingenuity and skill on the part of the contractor and his men. As mentioned above, several of the various pieces of equipment used had been modified and improved, both in their construction and method of operation. One combination which made for better work and results was to "button up" (as the Resident Engineer called it) the string of machinery by attaching the Jaeger spreader to the rear of the Woods mixer, using two 10-foot long cables, and, similarly, hooking up the Johnson float to the spreader so that the D8 tractor, mixer, spreader and float moved along as a unit at the same pace (see photo). A Northwest crane on a truck chassis proved most useful in moving equipment on and off side forms at bridge crossings. The foreman and crew were most cooperative and took a keen interest in this process, which was new to most of them.

The work was begun on September 21, 1948, and was completed on November 12, 1948, and was done under the general direction of S. V. Cortel-you, Assistant State Highway Engineer. B. N. Frykland was Resident Engineer, assisted by J. D. Needham, Field Office Engineer, and the writer in immediate charge on the grade. Griffith Company was the contractor, with J. F. Porcher, Superintendent.

#### DOUBLE MEANING

Pedestrians who are prone to jay-walking should keep in mind that the word *prone* has two meanings, both of which apply to pedestrian carelessness, says the California State Automobile Association. In one sense, prone means "mentally disposed or inclined"; in the other, "lying flat."

# Access Rights

Colusa Jury Upholds State  
In Interesting Lawsuit

By GILBERT MULCAHY, District Right of Way Agent

A JURY TRIAL for the acquisition of access rights in Colusa County has resulted in another verification of the State's contention that the taking of access rights through agricultural areas does not necessarily create a compensable damage.

The property involved lies between Arbuckle and Williams on State Highway Route 7 or U. S. Highway 99W. This section of road was reconstructed to modern standards in 1946, and after this new construction, it was decided to acquire access rights on the com-

pleted section. With this in mind, negotiations were initiated for the acquisition of 18,000 feet of access rights from two properties, both properties being devoted to dry grain farming; one having an area of 2,240 acres with 12,100 feet of highway frontage, and the other comprising 458 acres with a highway frontage of 5,900 feet.

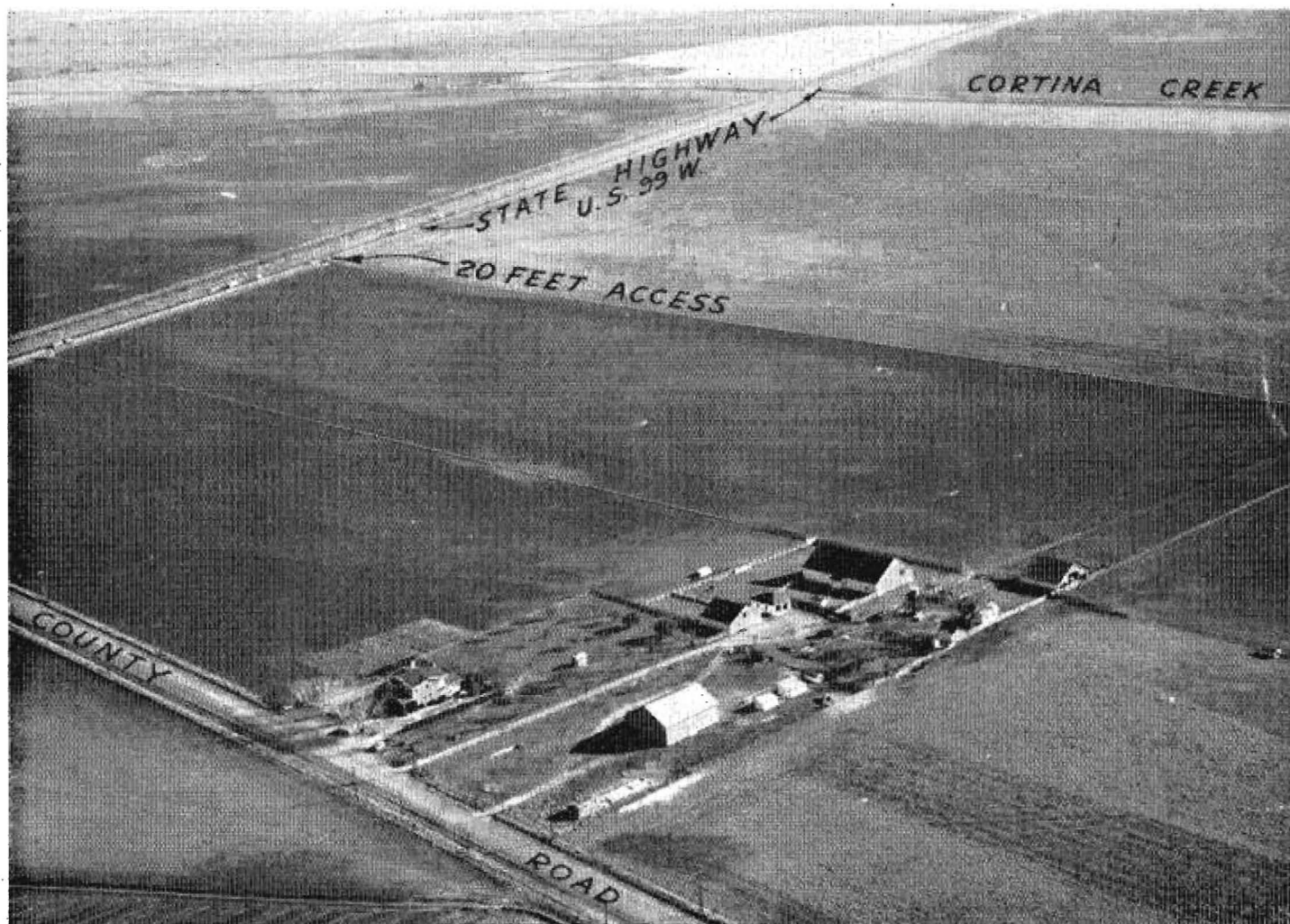
#### Only Nominal Damage

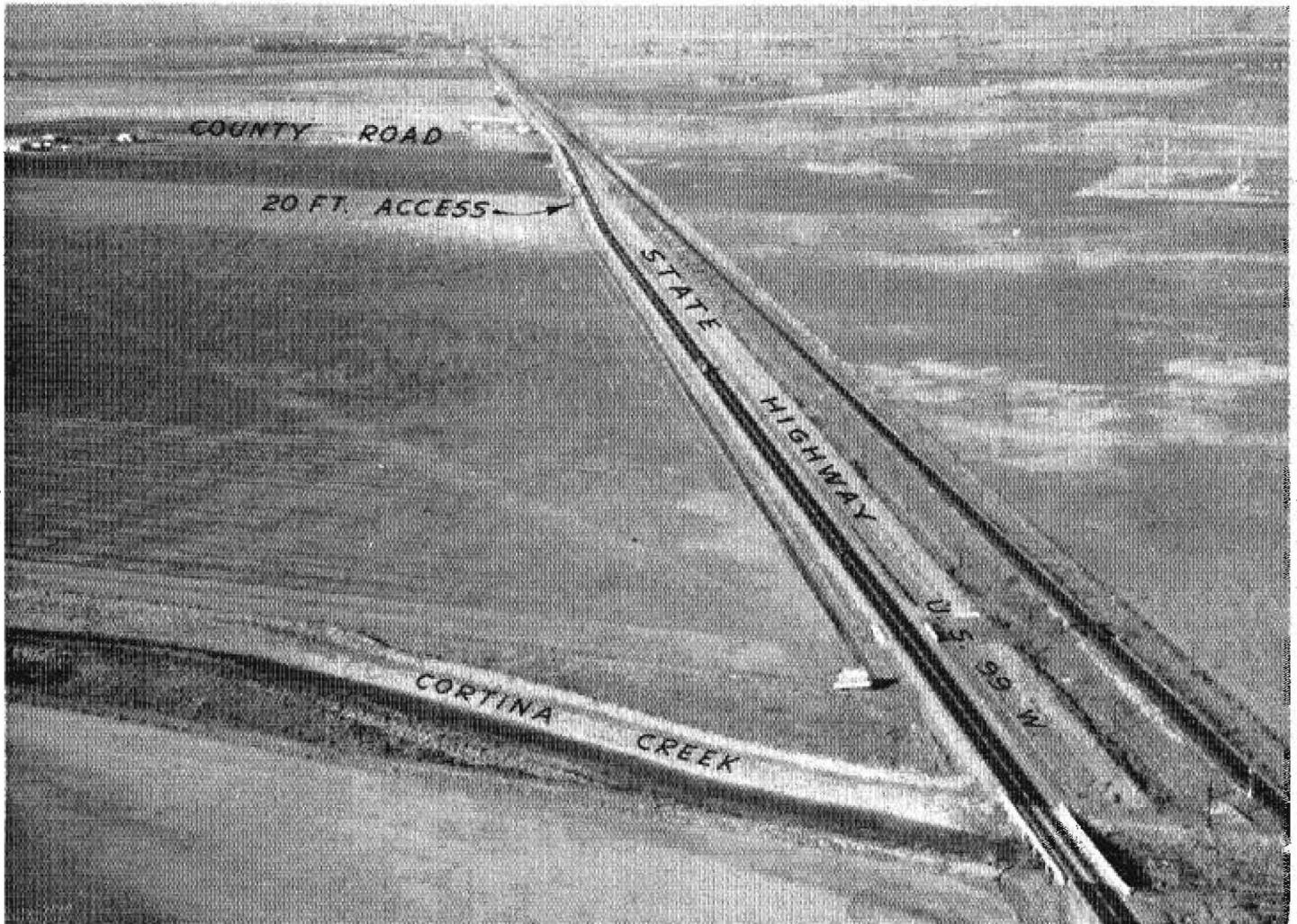
Under the prenegotiation appraisal procedure used by the Right of Way Department, a careful analysis was

made of the two properties to determine possible damages which would result from the taking of access rights as proposed. The present and potential uses of the properties were considered and it was decided that only nominal damages would result if four 20-foot openings were allowed to serve the road approaches necessary to efficiently operate the properties.

Negotiations were carried to a successful conclusion with the first property owner, who was paid a nominal sum for the 12,100 feet of access rights

*Aerial view of 458-acre parcel of land between Arbuckle and Williams on U. S. Highway 99W involved in access rights litigation in Colusa County*





This is another aerial view of property in Colusa County to which the State won access rights for improvement of U. S. 99W

taken along the state highway frontage, the State having permitted three 20-foot openings from the through lanes of traffic to permit agricultural operations to be carried on. Unfortunately, negotiations with the second property owner could not be brought to a successful conclusion.

Mr. William G. Myers, the owner of the second property, did not agree with our opinion that the access damage to his agricultural holding was nominal, with the result that it was necessary to take the condemnation case into the Superior Court for trial.

#### Adequate Access Provided

The accompanying pictures show two views of this 458-acre parcel. The location of the 20-foot opening is indicated on each of these photographs.

This property is actually headquarters for operations involving over two thousand acres, and therefore, the

building improvements are more numerous and far superior to those normally found on a 450-acre ranch. The improvements are situated along the county road which forms the northerly boundary line of the property, approximately 1,200 feet west of the state highway, and for that reason had little bearing in this case. This county road is connected to the highway and leaves the property with adequate access after the highway taking. In addition to the access rights, the State also wished to acquire the underlying fee to the existing highway easement in front of the property.

A jury trial was commenced November 30, 1948, in Colusa County. This county is predominantly agricultural, and the majority of the jurors selected were actively engaged in farming, or entirely familiar with farming operations. From the start of the trial,

the jury evidenced a keen interest in the entire proceedings.

#### State's Contentions

The defendant presented four witnesses who testified to damages ranging from \$5,600 to \$41,850 based on the reduction in acreage value by reason of the taking of all the access rights to the state highway except the one 20-foot opening. These four witnesses testified that the portion of the land facing the highway was adapted to subdivision into tracts of forty acres more or less, which would not be possible after the taking of the access rights.

The jury apparently did not agree with this, as it was obvious that any subdivision of this property could be accomplished from the county road as well as from the highway. Two appraisers testified as witnesses for the

... Continued on page 41



# F.A.S. Bridge

New Span Across Santa Clara River Completed

By J. E. McMAHON, Senior Bridge Engineer

TRAFFIC between Palmdale and Los Angeles began flowing on March 2d over the new \$250,000 Santa Clara River Bridge and Overhead, which was constructed as a part of the Los Angeles County Federal Aid Secondary Program. The structure is a part of the general improvement of a section of county road through Soledad Canyon.

The deck of the structure is carried 60 feet above the stream bed in order to provide the required vertical clearance above the main line track of the Southern Pacific Railroad which passes beneath the east end of the bridge. The structure provides a 26-foot roadway, and consists of two 145-foot and two 106-foot structural steel girders, 330 feet long, which are continuous over the three center piers. The bridge crosses the canyon on a sharp skew and to simplify girder fabrication single leg cylindrical piers are used to eliminate the necessity of skewing the girders.

#### Unusual Method

The channel piers were founded on bedrock which, in the case of the

deepest pier, is 35 feet below the bottom of the channel. Structure excavation was through sand, gravel and large boulders. Because of the boulders the contractor did not attempt to construct sheet pile cofferdams, but planned to glory hole the excavations and pour the footings in the dry. Ground water was very near the surface and it soon became evident that it would be very expensive, if not impossible, to dewater the excavations by pumping only. This difficulty was solved by the adoption of an unusual but very effective method.

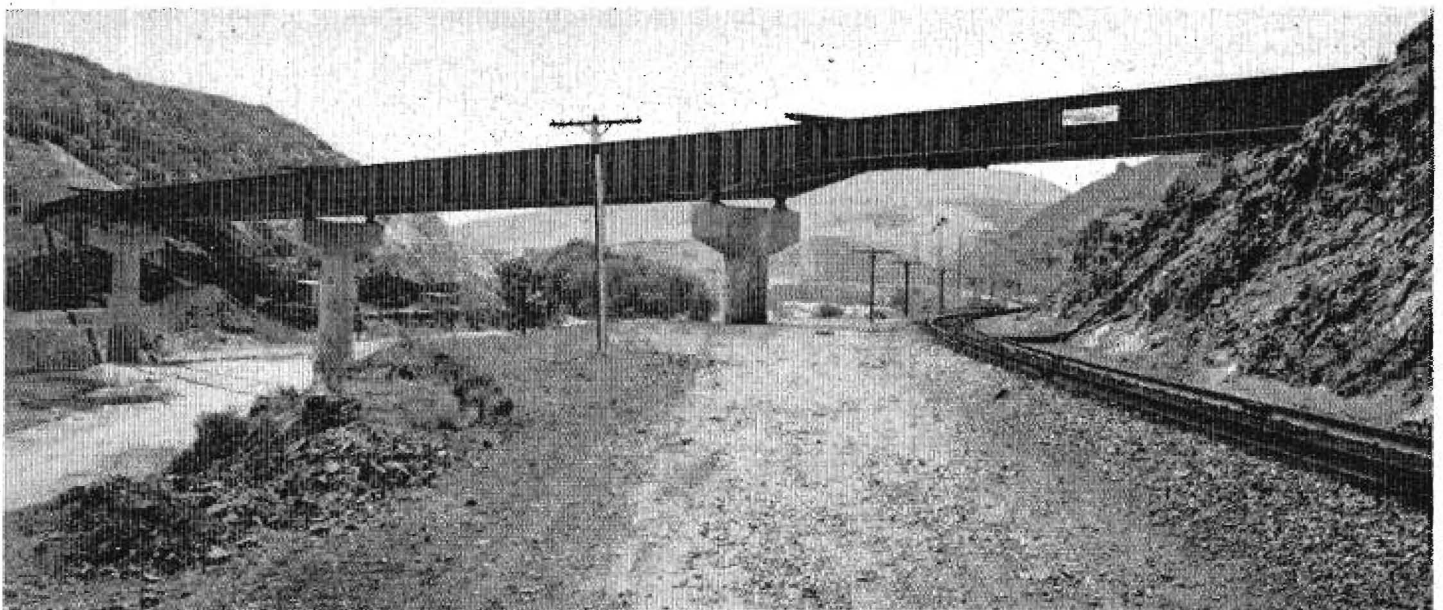
The grade of the channel in the vicinity of the structure is about 1¼ percent. The contractor began about fifteen hundred feet downstream from the bridge site to excavate a drainage ditch 10 feet wide at the bottom and with one to one side slopes. The ditch was constructed on a grade of one-fourth percent, reaching a depth of about fifteen feet at the bridge site. The channel was extended to a large sump which was constructed 50 feet upstream from the centerline of the bridge. By means of this drainage ditch the water table at the bridge site was lowered ap-

proximately twelve feet, permitting the contractor to dewater the remainder of the excavation by normal pumping operations.

#### Caisson Required

When the glory hole at Pier 3 had been excavated to an elevation about ten feet above the designed elevation of the bottom of the footing the material was sloughing so badly that it was decided that a caisson would be required for the remainder of the excavation. It was decided to construct, in place, a circular caisson of reinforced concrete. The caisson was 26 feet in diameter, 12 inches thick, and 8 feet high. It was reinforced by a single mat of five-eighths-inch round bars at 12-inch centers both ways, located at the center of the 12-inch wall. Forms for the structure were constructed in the contractor's yard. By means of a crane the forms were lowered into position in the completed excavation. Concrete used in pouring the caisson was made from local riverbed material, combined with eight sacks of cement per cubic yard. Calcium chloride was added to

Photo of recently completed Santa Clara River bridge and overhead in Los Angeles County



accelerate the setting of the concrete. Eighteen cubic yards of concrete were used.

#### Caisson Is Placed

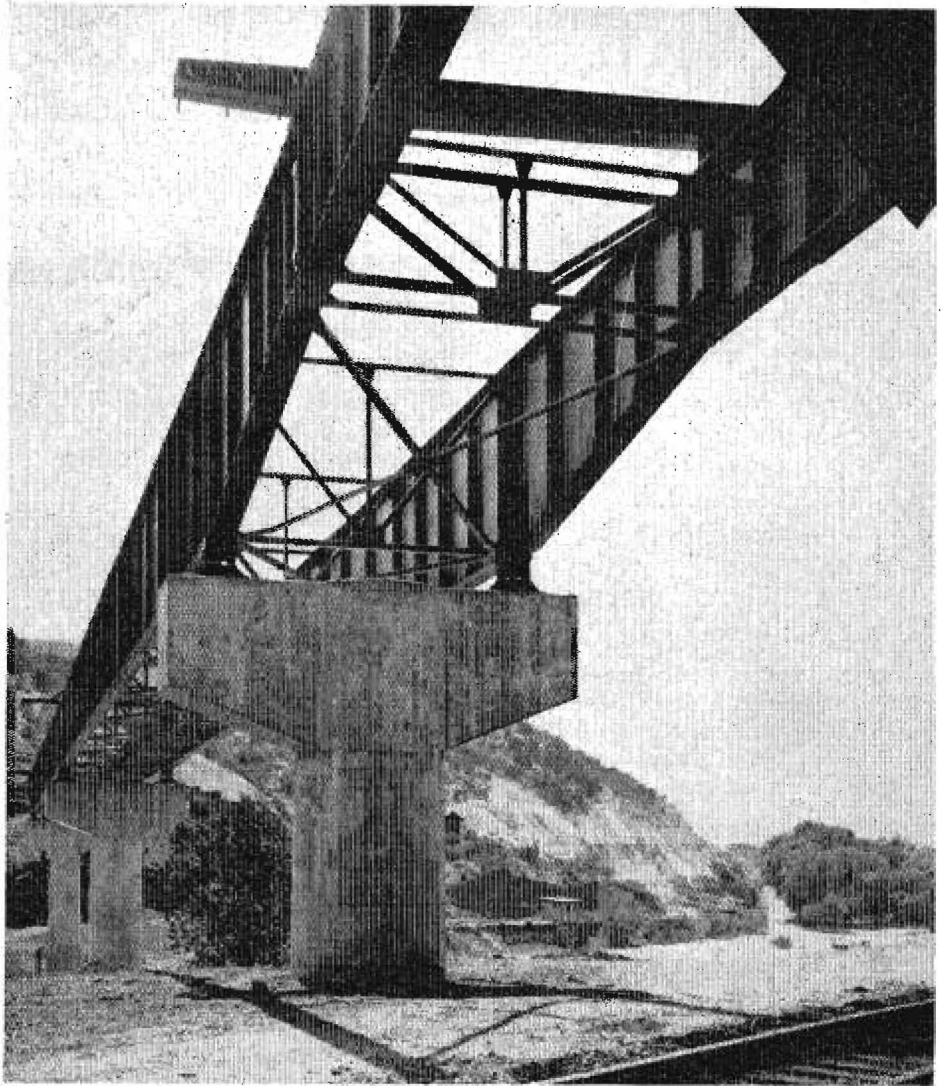
Forms were stripped from the concrete ring on the second day after pouring, and excavation within the caisson was begun on the third day. After two days of excavating, one end of the caisson came to rest on the sloping surface of bedrock. As excavation continued, sandbags were placed to fill the space between the sloping bedrock and the bottom of the concrete caisson. Jackhammers were used to bench the bedrock, and forms for the concrete footing block were constructed within the caisson.

A concrete aggregate plant was erected on the west bank of the channel. Aggregates were delivered by truck to a point on the existing road near the east end of the bridge. They were dumped into timber bunkers which had been constructed on the slopes of the channel, and were fed by gravity into the batching plant which was erected at a lower level, near the bottom of the channel. A transit mix truck, which was used as a concrete mixing plant, shuttled back and forth between the batching plant and the concrete pour.

#### Structural Steel Work

One month was required to erect the structural steel. There were four field splices in each of the 330-foot continuous plate girders. The girder sections were hauled to the job by truck, and were erected by two 20-ton cranes. Two structural steel falsework bents were used as temporary supports for the girder sections until the field splices were completed.

Construction engineering was handled by the county's engineering staff under the direction of Mr. O. F. Cooley, County Road Commissioner. The work was performed under the general supervision of Mr. F. W. Panhorst, Assistant State Highway Engineer-Bridges. The contractor on the work was Bent Construction Company. Mr. S. I. Hart was Resident Engineer for Los Angeles County.



*This photo shows close up of single leg cylindrical piers used in construction of Santa Clara River bridge*

## State Auto Registration Leads World

Californians registered 4,216,532 motor vehicles in 1948, a total larger than that of any other state or any foreign country, the Department of Motor Vehicles has announced.

San Francisco, with the third largest county registration, accounted for 251,394 vehicles, an increase of 20,000 over 1947.

Department Director A. H. Henderson said the state total was an increase of 282,437 vehicles over 1947, or approximately 7.5 percent. Fees were

paid on 4,158,843 vehicles and 57,689 were exempt.

Los Angeles led all counties in the State with 1,720,353 registrations, almost as many as the latest available combined figures for Washington, Oregon, Nevada, Utah, and Arizona. The Los Angeles increase over 1947 is 128,151.

Alameda County was second with 263,733 registrations.

California's smallest county, Alpine, registered 455 vehicles in 1948; only 127 in 1947.

# County Road

Marin Completes Its First  
Federal Aid Secondary Highway

By CARL P. CLOW, Road Commissioner, Marin County

SHORTLY AFTER the end of the war, the County of Marin embarked on a program of improvement of the more important county roads with highest priority to the modernization of the highway from Point Reyes Station to Novato, a distance of 19 miles. This route, now designated FAS-879, is used mainly as a farm-to-market road with constant hauling of feed and supplies to the coastal area and return of milk and other products to metropolitan areas via connection with U. S. 101 at Novato.

Through the cooperation of the State of California and the Public Roads Administration of the Federal Government, Marin County has completed its first project under the Federal Aid Program, covering modernization of the *westerly 10 miles* of the Point Reyes Station-Novato Road. Construction was started May 6, 1948 and completed November 4, 1948. Preliminary surveys, preparation of plans



Looking westward at rock cut, where radius was increased from 85 feet to 250 feet

Looking eastward at rock cut, where double reverse curve was eliminated



and estimates and construction engineering were handled by Albert E. Borgwardt, Consulting Engineer of Mill Valley, under the direction of the author.

The road originally consisted of an oiled or road-mixed surface of width varying from sixteen to eighteen feet with narrow shoulders for a distance of  $12\frac{1}{2}$  miles eastward from Point Reyes Station, from which point on into Novato the paving is of concrete. It is planned to continue improvement eastward at an early date. The alignment was not changed materially except for two heavy rock cuts in one of which the radius of curvature was increased from 85 to 250 feet and in the other a double reverse curve was eliminated. Minimum radius of curves was held to 250 feet except at intersections. Grades were altered where necessary for adequate sight distance and in one location, about one and one-half miles

... Continued on page 40



# Interesting Job

Highway to Be Built on Sandspit in Humboldt

By L. R. REDDEN, District Office Engineer

A UNIT of the Redwood Highway is to be constructed across a uniform, nearly level sandspit 4,500 feet long during the 1949 construction season. The site of the proposed construction is Freshwater Lagoon Sandspit, along the Northern California Coast, about forty miles north of Eureka.

On April 1st, Director of Public Works C. H. Purcell awarded a \$668,708 contract for this project to Piombo Construction Co., San Francisco.

The present road in the area serves at least two important purposes: it is the only direct coastal route into the Crescent City area from Central California, and it passes through a large tributary area in which logging and

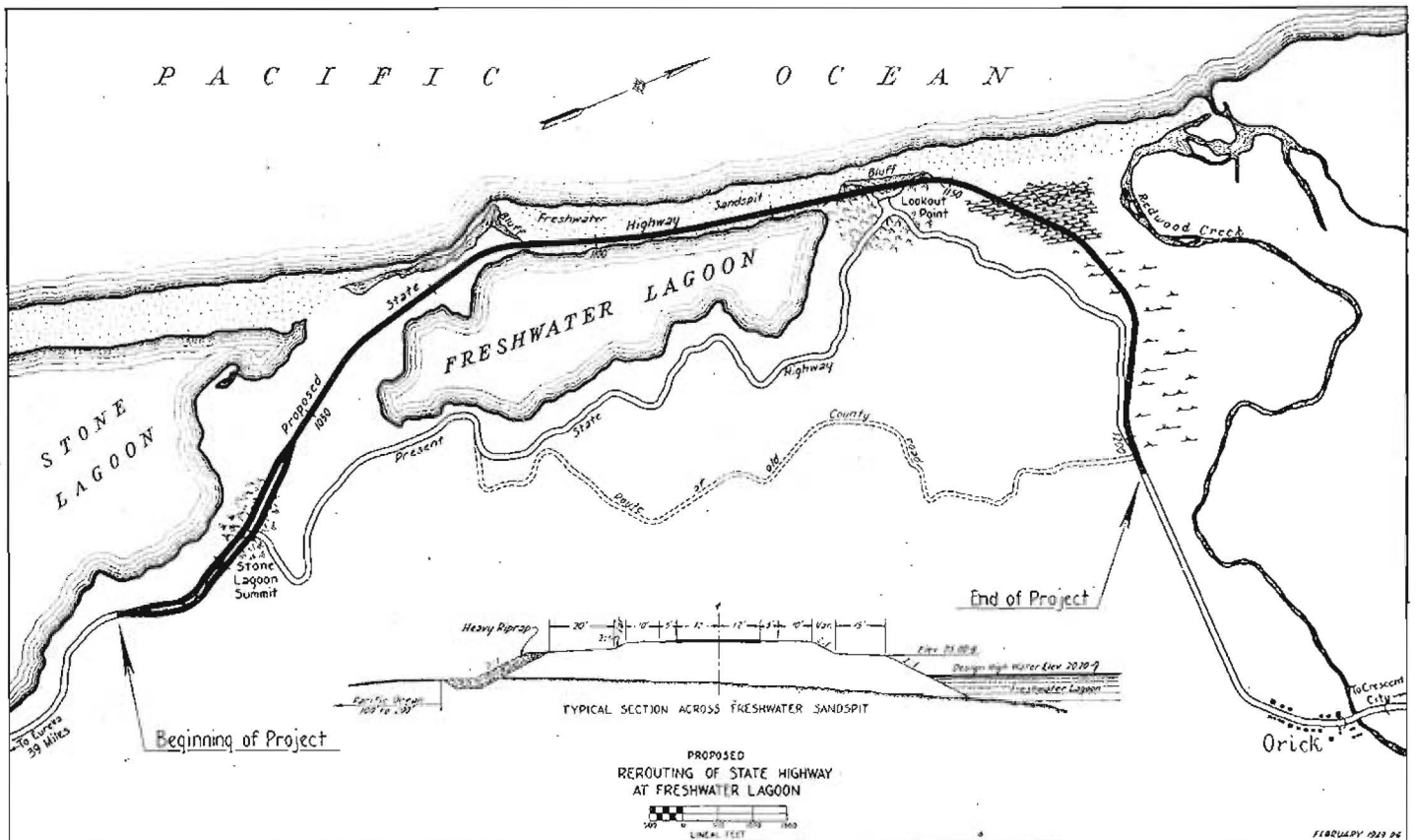
lumbering operations form a large and vital industry. Traffic contributed by those operations form an important part of the over-all traffic carried by the road.

The sandspit has always been an obvious route of coastwise travel in a terrain that is composed of rugged, densely forested mountains. The spit must have been used by early Indians and for many years, following the advent of pioneer white men into the country in 1849, it was the main route of land travel up and down the coast. It was only when roads began to be built that the travel route was moved inland to locations more secure from possible attacks by the ocean.

## Pioneer Route

Freshwater Sandspit was used as the main route of land travel up and down the coast until the middle 1880's, when Humboldt County constructed the first road in the area. That road was located away from the sandspit around the east side of the lagoon, climbing to a highland prairie and then dropping into Redwood Creek Valley. The road was used until 1919, when it was relocated as a state highway to its present location.

Even before the 1919 relocation, the state's engineers gave serious thought to construction via the sandspit. As early as 1914 such a route was investigated and surveyed. It would possibly





*Freshwater Lagoon as seen from Lookout Point. The sandspit is shown on the right and a portion of the existing highway on left*

have been adopted. However, the matter of getting around Lookout Point, at the north end of the spit, involved such prohibitive costs for that day as to rule out further consideration of the route.

Further consideration of the sandspit route was again studied in 1932, and again dropped.

#### **Many Bad Curves**

In the years before World War II it was evident that the existing highway was fast becoming obsolete in view of the increasing traffic, both passenger and freight, carried by the road. Much of the route is a succession of sharp radius curves, 43 of which fall in the 800-foot to 200-foot radius class, and nine of which contain more degrees of angle than a right-angle turn. Total amount of curvature amounts to approximately 3,980 degrees, or more than eleven full circles. Grade is, in part, undulating and it contains approximately one mile of steep, 5 percent to 7 percent grade, and crosses two summits. The roadway is narrow and offers almost no room for

maneuvering in case of accidents. The combination of a continuous succession of curves, steep grades, and slow-moving freight vehicles makes passing by fast-moving traffic either hazardous or virtually impossible. Such conditions have hastened the obsolescence of the road.

#### **Studies Continued**

As it became evident that a better road would have to be provided, more intensive continuing studies were again undertaken, beginning in 1942, to settle upon a rerouting. Reconstruction along the present road was discarded early in the study. To obtain an acceptable standard of alignment on the east side of the lagoon would require very extensive stabilization of fill foundations and benching of cuts, at an exorbitant cost and it would be impossible to eliminate either of the two summits.

The only other practicable route was via the sandspit. Such a route offered numerous desirable features not attainable on any other route, such as the elimination of one summit at Lookout

Point, provisions for long stretches of tangent line where safe passing sight distance would be available, the elimination of all short-radius curves, and a very large reduction in amount of curvature.

#### **Tide Observations**

Observations of the behavior of the sandspit were begun, and measurements taken to determine what effect the tides, the surf and ocean currents had upon the permanency of the beach. These observations and measurements were made periodically, at the time of the vernal and autumnal equinoxes, for a period of five years. It was found for that period that while the sandy foreshore was periodically built up and degraded a few feet, according to the season of the year, there was no measurable change in the crest, or central part, of the sandspit.

Other facts were also determined about the sandspit. It varies in width from 500 feet to 700 feet. Most of the crest lies between elevations 21 and 23 above sea level, with the northerly 1,000 feet at elevation 25.

#### Lagoon Sometimes Floods

The watershed tributary to the lagoon is a little less than two square miles, including the 0.43 square mile occupied by the lagoon. The runoff that accumulates in the lagoon ordinarily escapes either by evaporation or by percolation through the sandspit. Very occasionally, in periods of heavy rainfall, when the inflow is much greater than the loss by percolation and evaporation, the lagoon waters rise to such height as to overtop the spit. The most recent occurrence was in 1938, when a breach about four hundred feet long was made by escaping waters near the southern end of the spit. At present this part of the crest lies between elevations 18 and 19.

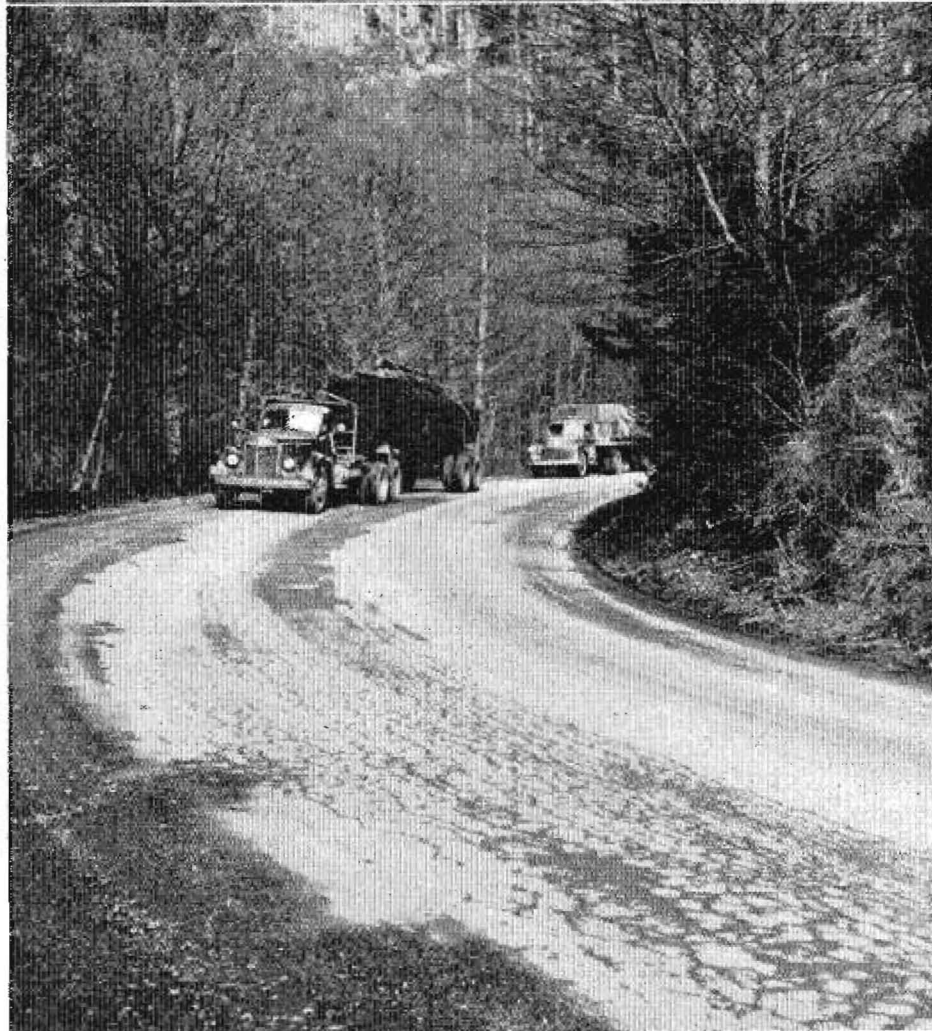
Although the crest of the spit varies between elevations 18 and 25 above sea level, the surge or run of the surf occasionally carries water over the crest into the lagoon, and on rare occasions the surge develops sufficient force to roll ocean-borne drift logs, stumps, and occasionally whole trees, two feet, three feet, and four feet in diameter, up onto the spit and even over it into the lagoon. Evidence of this force is the large amount of float strewn on the spit.

#### Design of Project

Studies and observations have led to the conclusion that such surf action occurs primarily near each end of the spit, and is less pronounced in the central part. It has also been concluded that the force of the surge is pretty well spent by the time the crest of the spit is reached, and that with reasonable protection, damage to the roadway can be prevented.

As a result of all the investigations and studies that have been made, the project has been designed on the following bases:

1. Construct a two-lane roadbed on the sandspit on a level grade, at elevation 30 above sea level, entirely on the lagoon side of the crest of the spit where the force of any surge of the tide will have been largely dissipated.
2. Construct wide protecting berms outside the central roadbed. Should surf action begin to erode the berms, there will be a period of time before the erosion reaches the roadway, during which time counter measures can be devised and executed.



*These photos show restricting alignment and heavy hauling on the present highway*





*Logs and debris have been carried onto Freshwater Sandspit by the ocean tide. White line shows where new highway is to be constructed  
A sample of some of the large drifts on the sandspit. Lookout Point and the existing highway lie on the skyline in the right background*



3. Near the ends of the sandspit, where surf action is expected to be more severe, construct a heavy riprap—up to two-ton stones—to serve as additional protection.

4. Construct a 6-inch by 6-inch concrete box culvert through the fill across the sandspit to control the elevation to which water level in the lagoon can rise. As it is expected that percolation and evaporation will take care of ordinary inflow into the lagoon, place a removable plank bulkhead over the outlet end of the culvert, to prevent plugging by surf and wind-borne sand.

#### Lookout Point Problem

The feasibility of locating the highway on the sandspit and the type of design to provide for such location have constituted the outstanding problems involved in the design of the project. There were numerous other problems, the chief one having to do with Lookout Point.

The problem at Lookout Point can

well be realized. The point is a headland some 1,100 feet long, rising abruptly from a rather narrow beach to a height of 260 feet above sea level.

Two alternatives for traversing the point were considered: One, placing the roadbed all in excavation, with cuts extending 220 feet above grade; and two, placing it almost entirely in fill, which would require an expensive and very heavy sea wall as protection against the direct beat of the surf.

#### Two Alternatives

In the study of the two alternatives, cross-sections taken in 1947 were superimposed upon those taken in 1932. No significant changes in ground line were observable, indicating that no significant erosion or washing away of the point by the surf had occurred in the intervening 15 years. The results obtained from four power borings in the point, ranging from 107 feet to

136 feet below ground and extending below probable cut slope lines, indicated that, with proper benching of the slope, stability for such a high cut could be reasonably assured.

These facts, plus the one that the all-cut line was less expensive, was slightly better in alignment and included in the form of the native ground itself, a ready-made, proven natural protection against erosion by the surf, resulted in the decision to adopt the all-cut alternative.

#### Three Benches Provided

The 220-foot high cut banks, as designed for the cut, are based on a 1:1 slope, with benches 25 feet wide at 60-foot intervals vertically. It thus was necessary to provide three benches in this rather high cut slope. Some 376,000 cubic yards of excavation occur in the cut. Of this amount, all is used in the

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Centerline shows route of the proposed highway looking north along Freshwater Sandspit toward Lookout Point



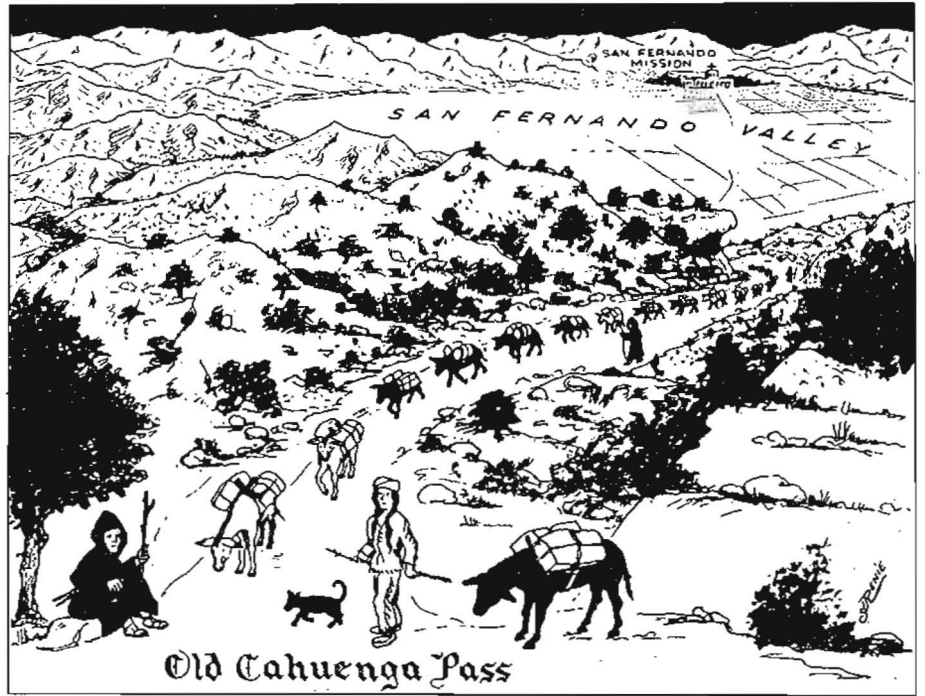
# Cahuenga Pass

Phenomenal Changes Since  
Days of Mission Padres

By HERBERT E. BELFORD, Resident Engineer, With C. P. MONTGOMERY, Collaborating

THROUGH the deepening shadows of a late September evening a black-robed figure is slowly plodding his weary way up a winding dusty trail. Early that morning he had set forth from the Pueblo of Los Angeles on his return to his charges at the Mission San Fernando and now, as darkness is overtaking him, he has reached the top of Cahuenga Pass. Before him is the smooth valley of San Fernando and across this valley, at the foot of the mountains, his destination, the mission.

In the shelter of an overhanging rock in a small canyon, just above the trail, the weary padre seeks a night's repose before resuming his journey on the morrow. Little does he realize as he lapses into a deep slumber that his sleep is to exceed that of Rip Van Winkle, nor does he realize the changes that will transpire while he reposes in the shelter of the rock.



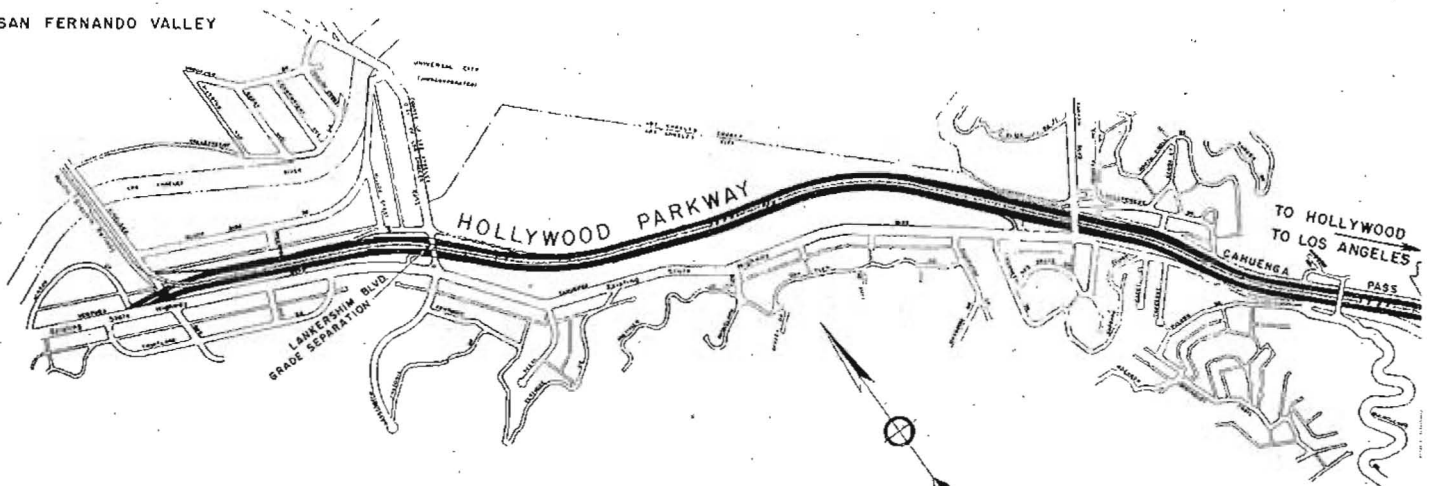
## Tranquil Mission Days

The padre's slumber is undisturbed as an occasional traveler, on foot or on horseback, passes by on his way to

the other side of the valley or westerly along the south side of the valley on his way to Santa Barbara, Monterey or other northern settlements.

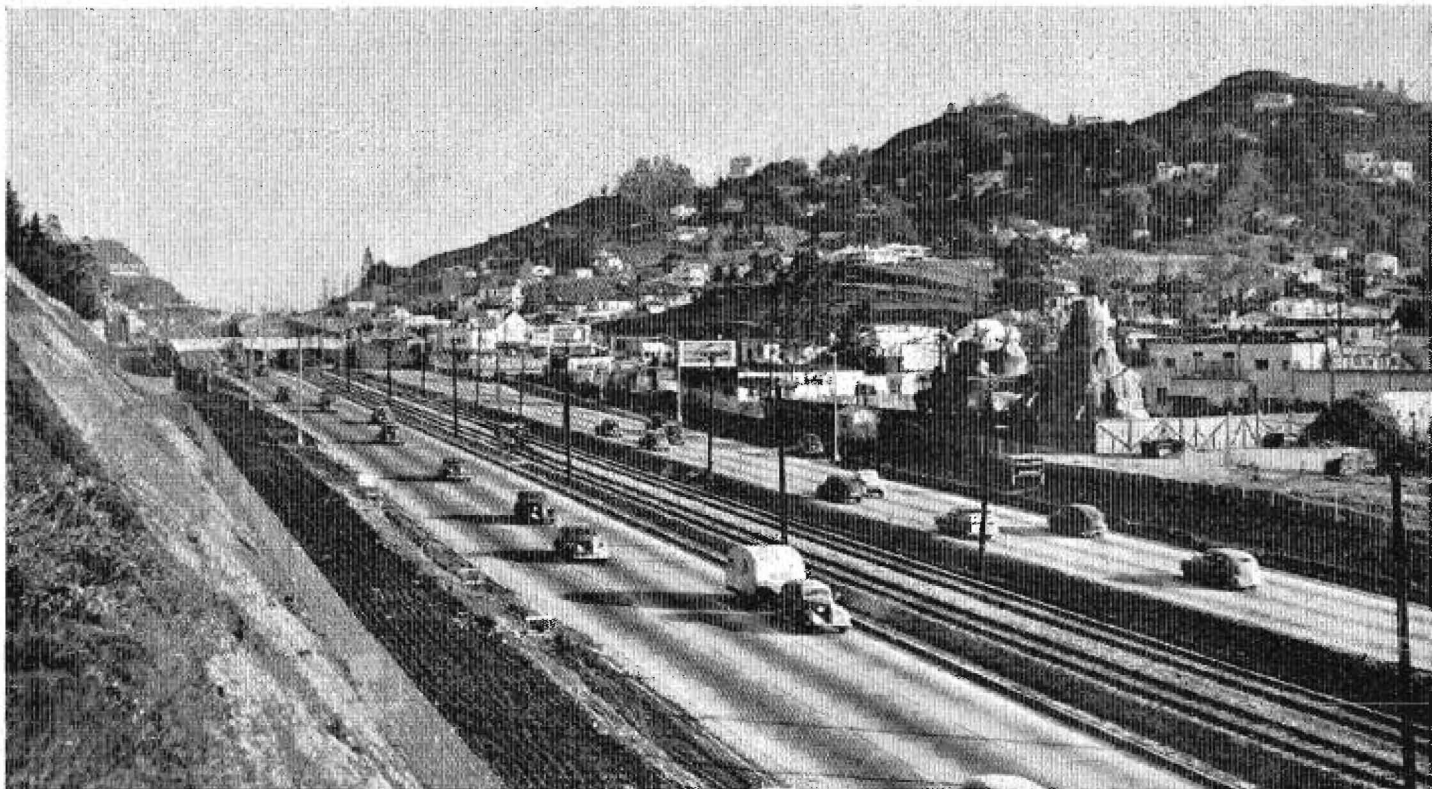
Under the supervision of the fathers at the mission across the valley, fields are being cultivated by the mission Indians and the produce of their toil is

SAN FERNANDO VALLEY



BARNHAM BOULEVARD TO VINELAND AVENUE SECTION OF HOLLYWOOD PARKWAY





Looking southeasterly along completed freeway showing Barham Boulevard grade separation overcrossing

being transported on the backs of patient burros to market in the Pueblo of Los Angeles. Gold is discovered near the mission and more pack trains creep back and forth through the pass, below the sleeping padre.

Then late in February, 1845, the Californians from the San Gabriel Valley, led by Castro and Alvarado, having defended the Pueblo of Los Angeles from the invading Mexican Army under General Micheltorena, meet the invaders again in the two-day battle of Cahuenga Pass. Supporting the infantry of Micheltorena's forces is an artillery battery of two cannons, while the army of Castro and Alvarado has a battery of three field pieces. For two days of furious attack and counter attack the battle wages, during which one horse is killed and a mule seriously wounded. The forces of Micheltorena retreat to Mexico and the last vestige of Mexican rule in California is gone. And through it all the padre sleeps.

#### Americans Come

The Americans are crossing the plains and the smooth valley to the north is being cleared. Grain fields are replacing chaparral and cattle are grazing where the antelope fed.

The pack trail through Cahuenga Pass is now widened to a steep, winding, still narrow, dusty road off of which the wagons of the rancheros are crowding the slow-moving burros. On the old trail of the padres, now the El Camino Real, stages carry passengers from the growing Pueblo of Los Angeles up the coast through Santa Barbara and Monterey to San Francisco.

Such travel is more than a trip; it is an adventure. Brewer, in his book "Up and Down California," states that on leaving Los Angeles in 1861 the first day's trip of 11 miles took him to Cahuenga Pass. His only comment: "It is not much of a pass." The breaking of a wagon wheel upon resuming his trip next day probably influenced his opinion.

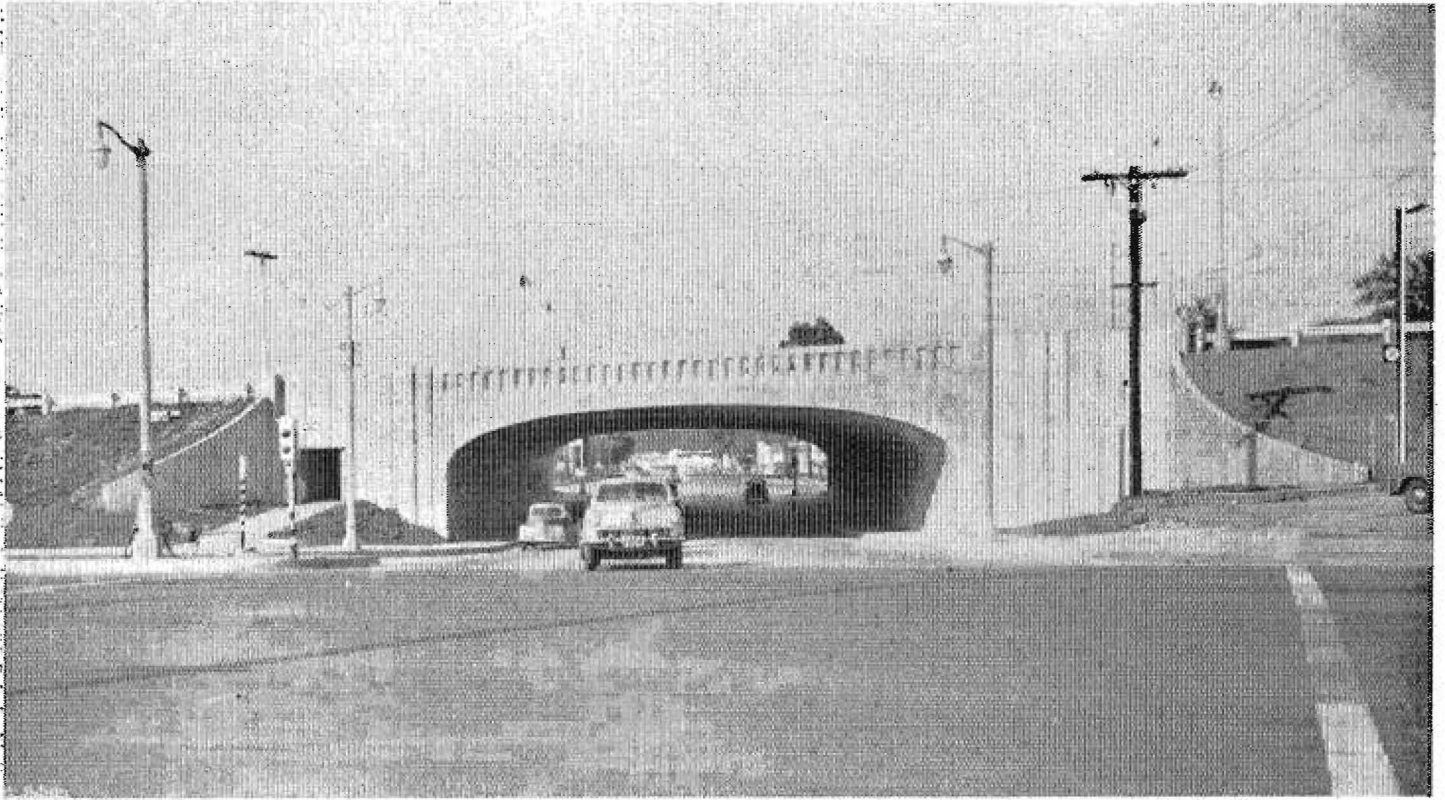
More Americans move into the valleys to the north. More of the rancheros' wagons are daily crossing the pass, raising increasing clouds of dust in the dry summer months and finally, at the turn of the century, noisy little automobiles are making their appearance, daring the dust of the summer and the mud and ruts of the pass in the winter.

#### Advent of Automobiles

It is due to the advent of these gasoline buggies that the long slumber of our padre comes to an end. These new-fangled vehicles are more temperamental than the donkey of the pack train or the wagons of the rancheros—much more exacting as to the condition of the roads they travel.

These contraptions are here to stay; so there is nothing left for the Los Angeles County Supervisors to do other than provide roads more to the liking of the automobile. Thus, having capitulated to the demands of modern transportation, in 1909 a grading crew is moved up to the top of Cahuenga Pass, holes are drilled into the rock, loaded with dynamite, and the resultant explosion is the start of the transition of the Cahuenga Pass of the padres to the Cahuenga Freeway of today.

Our venerable padre, awakening from his long sleep, looks out over an amazing scene. The valley to the north is no longer a vast expanse of chaparral. It is clotted with squares of apricot and peach orchards, and green alfalfa fields; only the mountains in the distance are familiar. To the south a city is spread out below him. The people



Completed underpass structure for Lankershim Boulevard. This bridge structure carries the six-lane Hollywood Freeway and the double track Pacific Electric Railway

are of a different race than those he met on this trail in the past. Surely he is a stranger in a strange land.

#### Many Changes

The changes that have been wrought in Cahuenga Pass and in the valleys at either end of Cahuenga Boulevard during the 40 years since this road was first paved are only slightly less startling than those observed by the padre.

The original paving, built by Los Angeles County, was oil macadam, built to the steep gradient and tortuous alignment prevailing at that time.

Incidentally, the first wreck on this grade occurred to a steam roller which, getting out of control near the top of the grade, careened crazily down toward Hollywood, till it crashed into a cut bank near the bottom.

With the development of the San Fernando Valley and the growth of Hollywood, this pavement which had been the source of so much pride in 1910 became inadequate to carry its rapidly increasing load. This area had become a part of greater Los Angeles, and it was under the Engineering Department of the city that the pavement

was rebuilt about twenty-five years ago.

#### Phenomenal Growth

The phenomenal growth on both sides of the pass, following this reconstruction, was responsible for the design and construction eight years ago by the City of Los Angeles of the southerly section of the Cahuenga Freeway from the intersection of Cahuenga Street and Highland Avenue to Barham Boulevard. This freeway was designed to collect and discharge the heavy flow of traffic to and from the converging streets at either end and carry it through the pass with maximum speed and safety. The traffic is carried in four-lane roadways lined with concrete curbs and separated by the Pacific Electric Railway.

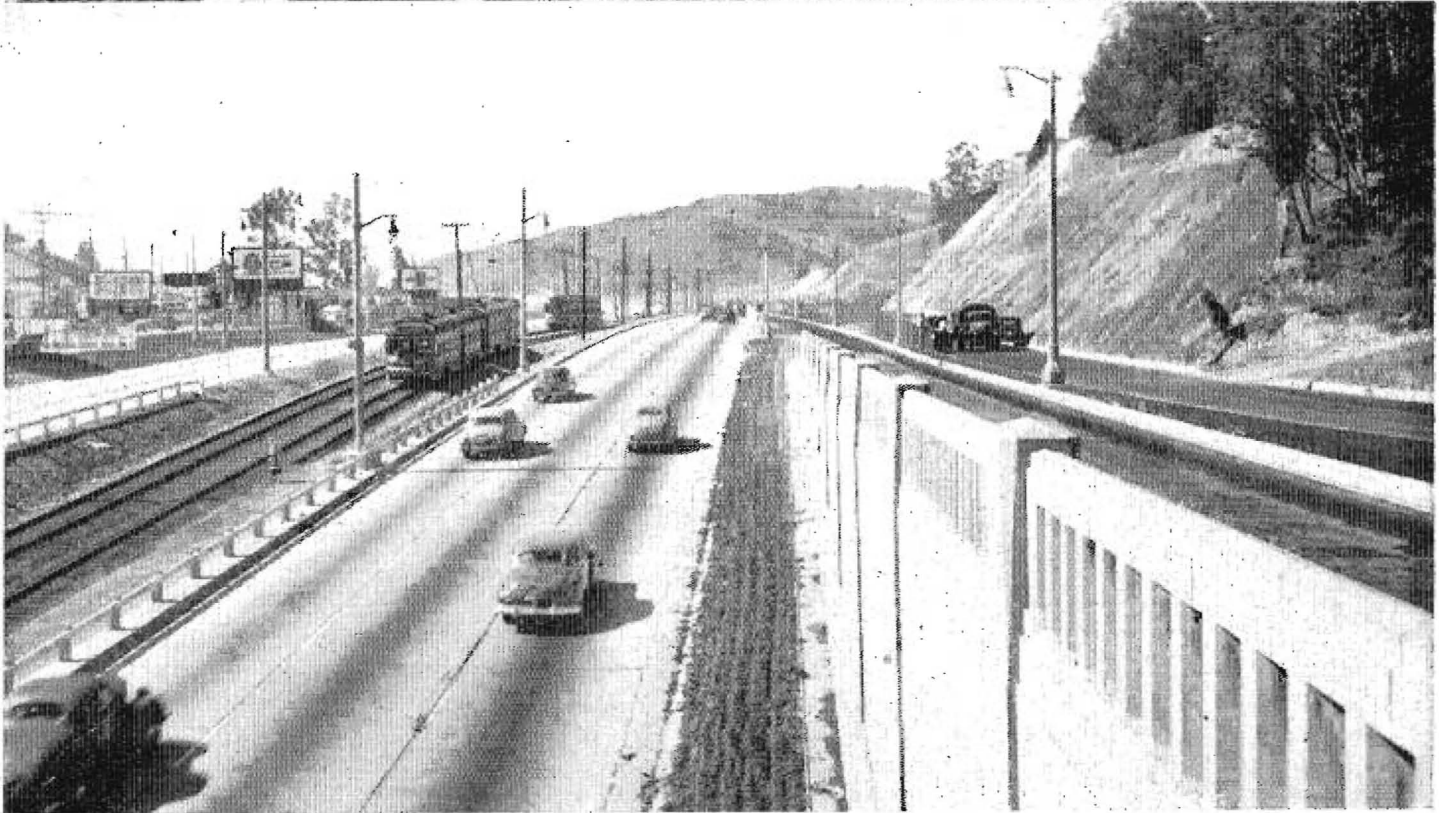
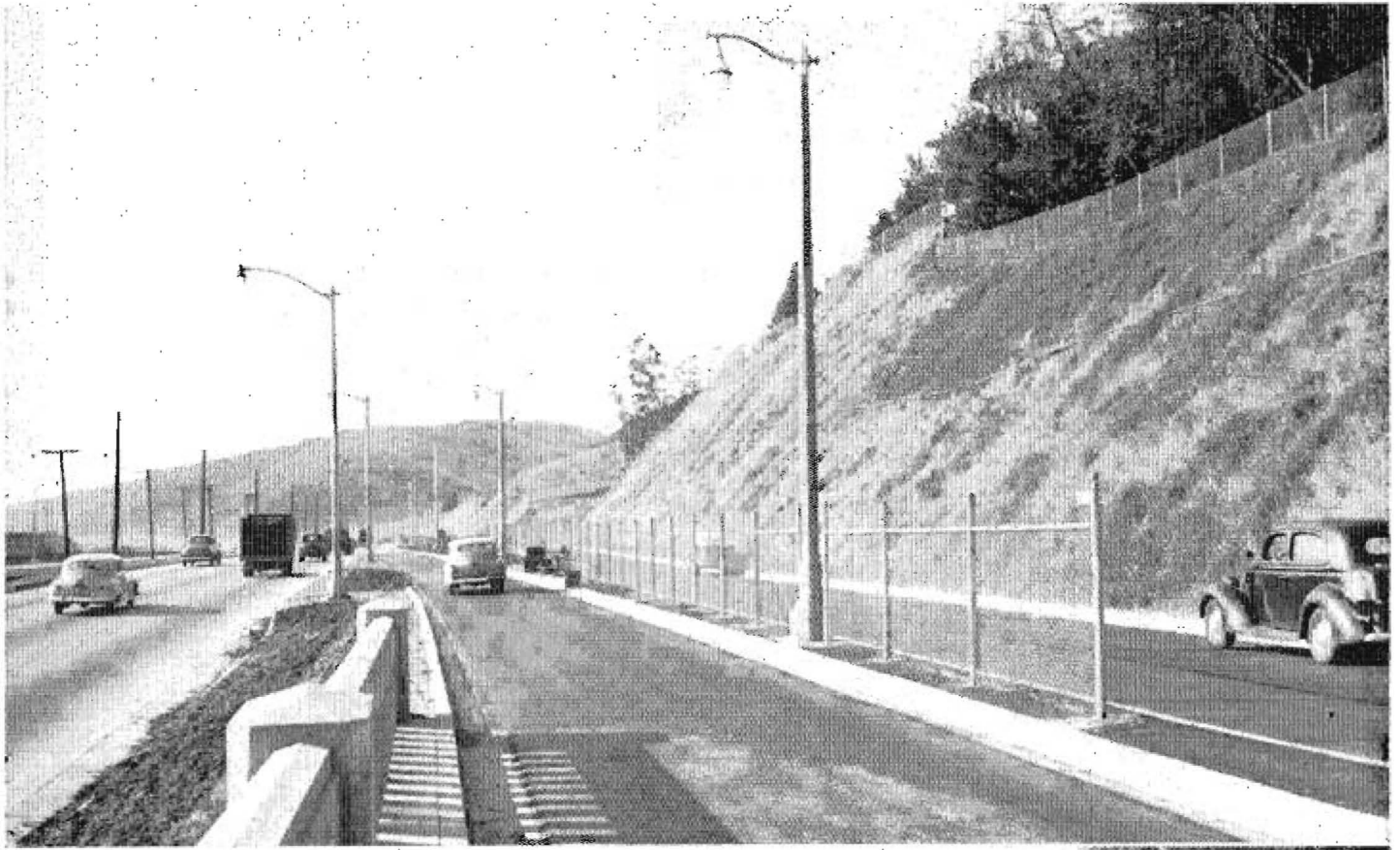
As a continuation to the northwest of the Cahuenga Freeway, now a part of the Hollywood Freeway, on January 15, 1949, a 1.8-mile extension of the Hollywood Freeway was completed and opened to traffic between its former terminus at Barham Boulevard and a new temporary connection with Ventura Boulevard just westerly of Vineland Avenue, consummating

1½ years' work at an expenditure of \$1,800,000.

#### Major Items of Work

Major items of work involved in this project consisted of moving 7,000 lineal feet of the Pacific Electric tracks to a newly prepared grade between the Inbound and Outbound Parkways, construction of a grade separation structure to carry the new six-lane freeway and double track of the Pacific Electric Railway over Lankershim Boulevard, moving 270,000 cubic yards of earth, installing 8,200 lineal feet of 58-inch reinforced concrete steel water pipe for the Los Angeles Water Department, installing 16,330 feet of reinforced concrete storm drains, ranging in size from 12 inches to 78 inches, constructing 164 Portland cement concrete storm drain catch basins, installing 38,320 feet of sprinkler system lines, erecting 16,000 feet of chain link fence, constructing 43,970 feet of various types of concrete curbs and dividing islands, and paving six 12-foot lanes of concrete, 8 inches thick on 12 inches of imported subgrade material, the top 4 inches of which was cement treated.

Work on this project was started on June 13, 1948, by Peter Kiewit Sons' Company and the progress was very slow for the first three months due to



Upper—Completed freeway looking northeasterly from Barham Boulevard and showing fence constructed to protect pedestrians. Lower—Looking northwesterly from Barham Boulevard showing completed freeway with provision in the center for rail rapid transit





*This is a closeup of the Barham Boulevard separation structure completed some years ago under a Los Angeles city contract*

nondelivery of the 58-inch reinforced concrete steel water line pipe which was caused by a shortage of steel at that time.

#### **Construction Starts**

Installation of the pipe was set up in the special provisions as work item No. 1 following clearing operations and a lot of valuable time was lost waiting for delivery of this pipe, the first shipment of four lengths not being received until September 19, 1947. However, construction operations were started in earnest about September 1, 1947, when the contractor began grading operations and the driving of 20,980 lineal feet of steel piles for the Lankershim Boulevard grade separation structure and the work has been in high gear ever since.

During construction of the Lankershim separation structure, traffic was carried over a detour one block westerly and the Pacific Electric trains were carried over a shoo-fly constructed adjacent to the southerly bridge portal.

The main portion of the structure was completed on July 29, 1948, and Pacific Electric trains routed over on August 5, 1948. Grading and paving operations on Lankershim Boulevard, under the separation structure, were started immediately and Lankershim Boulevard was opened to traffic on September 4, 1948.

#### **Paving Operations**

Concrete paving operations on the Outbound or North Parkway were started on September 3, 1948, and upon completion of asphaltic concrete off ramps at Lankershim Boulevard and Vineland Avenue the North Parkway was opened to traffic on November 12, 1948. Paving on the Inbound or South Parkway was completed on December 30, 1948, and the entire project was completed and opened to traffic on January 15, 1949.

The outstanding feature of this project is the fact that practically its entire length is on new location through open country, approximately two hundred feet northerly of Ventura Boulevard, which carries about ninety thousand vehicles per day, and therefore construction went forward with very little inconvenience to public traffic.

Probably the most difficult construction problems on the project occurred in reconstruction of 800 feet of Ventura Boulevard at the Lankershim Boulevard intersection where the existing 700-foot Portland cement concrete pavement had to be removed and a 45-inch R. C. storm drain, a 15-inch sewer line, a 12-inch water main, an 8-inch gas main installed across Ventura Boulevard, and the whole street area repaved to a new grade with 8 inches of asphalt concrete on a 12-inch disintegrated granite subbase, while handling

the tremendous traffic loads mentioned in the paragraph above.

Completion of this project has eliminated the former traffic congestion at Lankershim Boulevard and shortened the travel time between Hollywood and the San Fernando Valley. It has also provided a splendid local business area on Ventura Boulevard between Barham Boulevard and Vineland Avenue which is easily accessible to shoppers, sparing them the ever present Los Angeles parking problem.

### **In All Kinds of Weather**

Mountain Center

*Division of Highways  
Sacramento, Calif.*

DEAR SIR: I am a taxpayer in Riverside County and own a business and home on Highway 74, the Palm to Pines Highway.

I wish to commend the State Highway Department for the wonderful job it has done in keeping the road open through this last heavy snowfall; the boys worked night and day in subfreezing weather so the public could use that beautiful highway.

I especially refer to Chet Jolly, the foreman, and his crew, George, Mike, Joe, and Andy.

Yours truly,

CARROLL R. BUSCH

# U.S. 99

## New Section of Divided Highway Between Livingston and Atwater

By A. N. LUND, Assistant District Construction Engineer

IN OCTOBER, 1948, a contract was approved and construction operations were started on two additional lanes of Portland cement concrete pavement, 5.7 miles in length, between Atwater and Livingston on U. S. Highway 99 in Merced County, which will constitute another link toward the completion of this route as a divided highway.

The project connects on the north with a four-lane underpass under the Southern Pacific Railroad which was completed in 1940, and to the south there remains a gap of less than three miles through the city of Atwater, to the end of a 12-mile section of divided highway which starts about five miles south of Merced. The new construction parallels the existing highway and the Southern Pacific Railroad on the northeast on a tangent for the entire length except for a short distance where connection is made in Livingston to the underpass job. The country traversed is rolling orchard and vineyard land with sandy soil.

### Serves Livingston

The new construction will consist of balanced grading without imported borrow, two 12-foot lanes of Portland cement concrete pavement on four inches of cement-treated subgrade using the existing sand soil, two and three feet wide plant-mixed surfacing borders on 0.5 foot of untreated rock base, 0.76 feet thick at the shoulder point and tapering to meet the outside slope. An outer highway of 0.25 feet plant-mixed surfacing on 0.5 feet x 24 feet untreated rock base is to be constructed to serve traffic within Livingston.

The natural drainage on this project is from northeast to southwest and across the highway. To the southwest the highway is paralleled by the Southern Pacific Railroad and through the entire length of this section there are no openings under the railroad. During heavy storms the existing highway has been known to flood in several locations. However, within a short time

after the storm subsides, the sandy soils absorb this water.

### Drainage Problem

As this job is adding a considerable runoff due to the more than doubling of the pavement area, drainage has become a problem and in order to overcome this the district in constructing some thirty sumps. These sumps are not new in drainage work and have been constructed by the district in various locations, the most recent being in the section lying between Modesto and Keyes. However, the plan we are now using in their construction is being borrowed from District VI which is a considerable refinement on the sumps originally placed in District X.

These sumps will consist of a 5-foot diameter hole bored to hardpan at a depth of 15 to 20 feet and backfilled with filter rock, ¾-inch x No. 4, with a vertical 12-inch perforated metal pipe placed in the center and extending from about 6 inches below the

Looking toward Livingston from south city limits showing new four-lane divided highway





*This is a view looking southeasterly from Livingston, showing new improvement on U. S. 99*

ground surface to within a foot of the bottom of the sump. An intake structure to collect silt is to be built by using 36-inch corrugated metal pipe 3 feet long with necessary side openings, concrete bottom and wood cover. It is planned to clean the sump occasionally by jetting the silt from the filter rock into the center perforated pipe and removing the silt therefrom.

#### **Limited Access Freeway**

As the project is a freeway with limited access, a fence is being constructed at the option of the State for the entire length of the job, including returns at county road intersections, in order to restrict access to legal openings. Bordering agricultural land, the fence is to consist of five barbed wires on steel posts and through the urban sections a chain link fence will be used.

This section of highway is one of the busiest of U. S. Highway 99 and in 1948 the estimated daily average traffic was 7750, with a peak hour volume of 660.

The right-of-way involved in this project included 64 parcels. Nineteen parcels involved improvements consisting of five motels, four service stations, three cafes, three stores, one commercial garage, one church, fourteen dwellings, and nine cabins, all of which required removal.

#### **Church Moved**

The church, which was a fairly large Catholic Church, had faced this highway for many years. The resident priest when first contacted explained that because of this location on the highway the church had attracted many tourists who otherwise might not find a place to worship. However, it was possible to secure a lot which still left the church in good view of the highway, and since the move has been completed and the parish house, located beside the church as it was originally, the priest has expressed complete satisfaction with the new set-up, which was very gratifying to the right-of-way department.

Under 13 parcels, the owners moved the improvements. Under three parcels, the State purchased the improvements and later sold the improvements on two parcels, whereas the third involved improvements with no salvage.

The improvements moved by the State consisted of a church, rectory, store with service station facilities, three cabins, cafe, and orange stand.

Between Atwater and Livingston the frontage is 90 percent agricultural.

Three properties only had improvements which had been purposely constructed far enough back from the highway to allow for widening. They

consisted of a 14-unit motel, a 10-unit motel, and a manufacturing plant.

#### **Major Construction Items**

The major items of the job consist of 81,000 cubic yards roadway excavation, 92,000 square yards compacting original ground, 85,000 square yards mix and compact cement-treated subgrade which will require 3,100 barrels Portland cement, 40,000 tons untreated rock base, 6,750 tons mineral aggregate (plant-mixed surfacing), 345 tons paving asphalt, 18,900 cubic yards Class "B" Portland cement concrete (pavement), 13,230 each pavement tie bolt assemblies, 122 cubic yards Class "A" Portland cement concrete (structures), 330 cubic yards Class "A" Portland cement concrete (curbs and gutters), 270 each concrete barrier posts, 6 miles new property fence.

The total cost of this project is estimated to be approximately six hundred fourteen thousand dollars.

The work is under contract to Guy F. Atkinson Company of South San Francisco. The job is being supervised by George Barry, Resident Engineer, under the general direction of C. E. Waite, District Engineer, and M. C. Fosgate, District Construction Engineer.



# Major Project

Monterey Overhead in Fresno  
Eliminates Crossing Hazard

By P. A. BOULTON, Associate Highway Engineer, and  
T. W. ROGERS, Associate Bridge Engineer

FOR THOSE MOTORISTS who regularly used the Cherry Avenue crossing for a south entrance to Fresno, the opening of the Monterey Street Overhead to traffic on December 22, 1948, must have been particularly gratifying. It was not an uncommon sight to see vehicular traffic backed up for three or four city blocks during peak traffic periods when long slow freight trains were passing this crossing.

The elimination of this crossing brought to an end one more danger spot in our highway system; this one having a particularly unsavory past. This crossing had been the scene of many accidents with several fatalities, numerous injuries, not to mention extensive property damage. Several serious accidents occurred at this crossing during the time the new project was under construction.

The project required the construction of 1.2 miles of freeway consisting of four-lane and six-lane divided highway, two major structures as described

later in this article and the necessary on and off ramps and approaches.

#### Church Moved

One of the contract bid items of the project was to move an 1,800-ton brick church some 900 feet to a new location. This moving job attracted considerable interest, the details of which were covered by an article in this publication in February, 1948.

The pavement for main line traffic was eight inches of Class "B" (5 sack) Portland cement concrete over 1.8 feet of approximately 80 bearing ratio select material, the top four inches of which was stabilized with 4 percent cement. The ramps and speed change lanes were constructed of plant-mixed surfacing over cement treated base.

A 36-inch steel inverted siphon approximately 250 feet long was used to carry an existing irrigation line under the depressed section at California Avenue.

Practically all areas not used for travel were cultivated and equipped

with a sprinkling system to provide for future landscaping which is planned to be done under a separate contract to be let in the near future.

#### Outer Highways

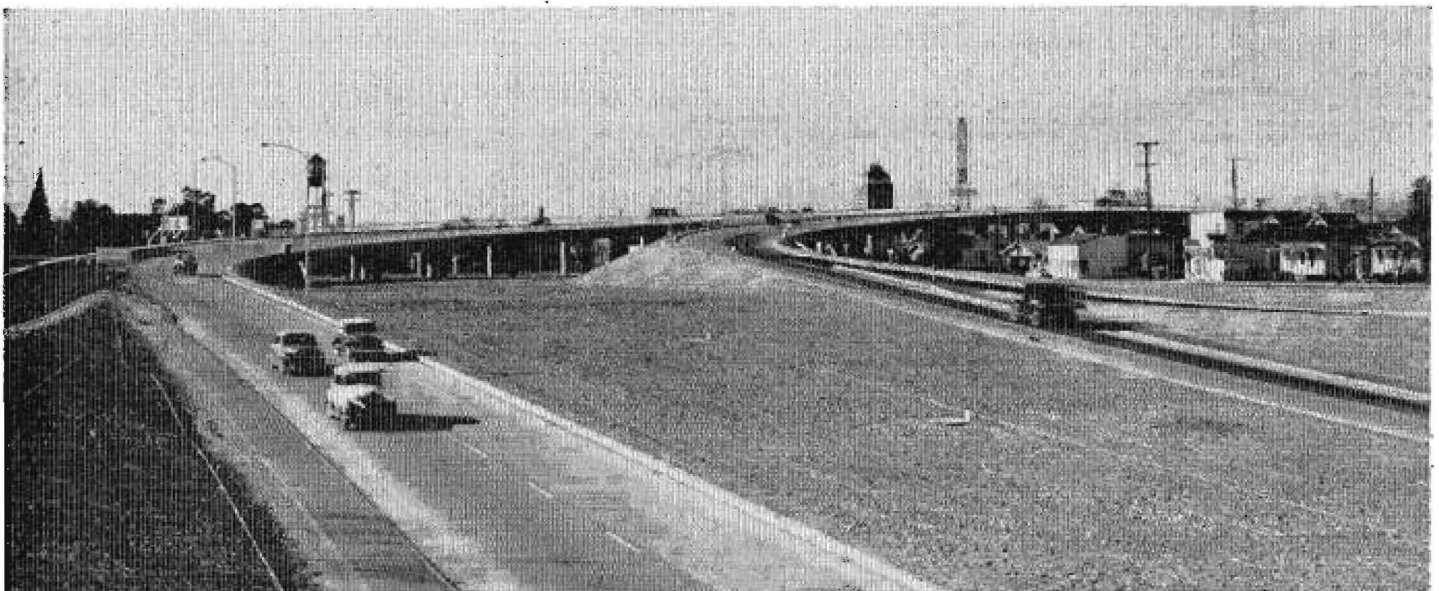
The 30-foot asphaltic concrete pavement between Church Avenue and Cherry Avenue which has served as a portion of Highway U. S. 99 since 1934 was reduced to two 12-foot lanes and serves as an outer highway along the easterly side of the new freeway. There are business houses, motor courts and drive-in eating places served by this road.

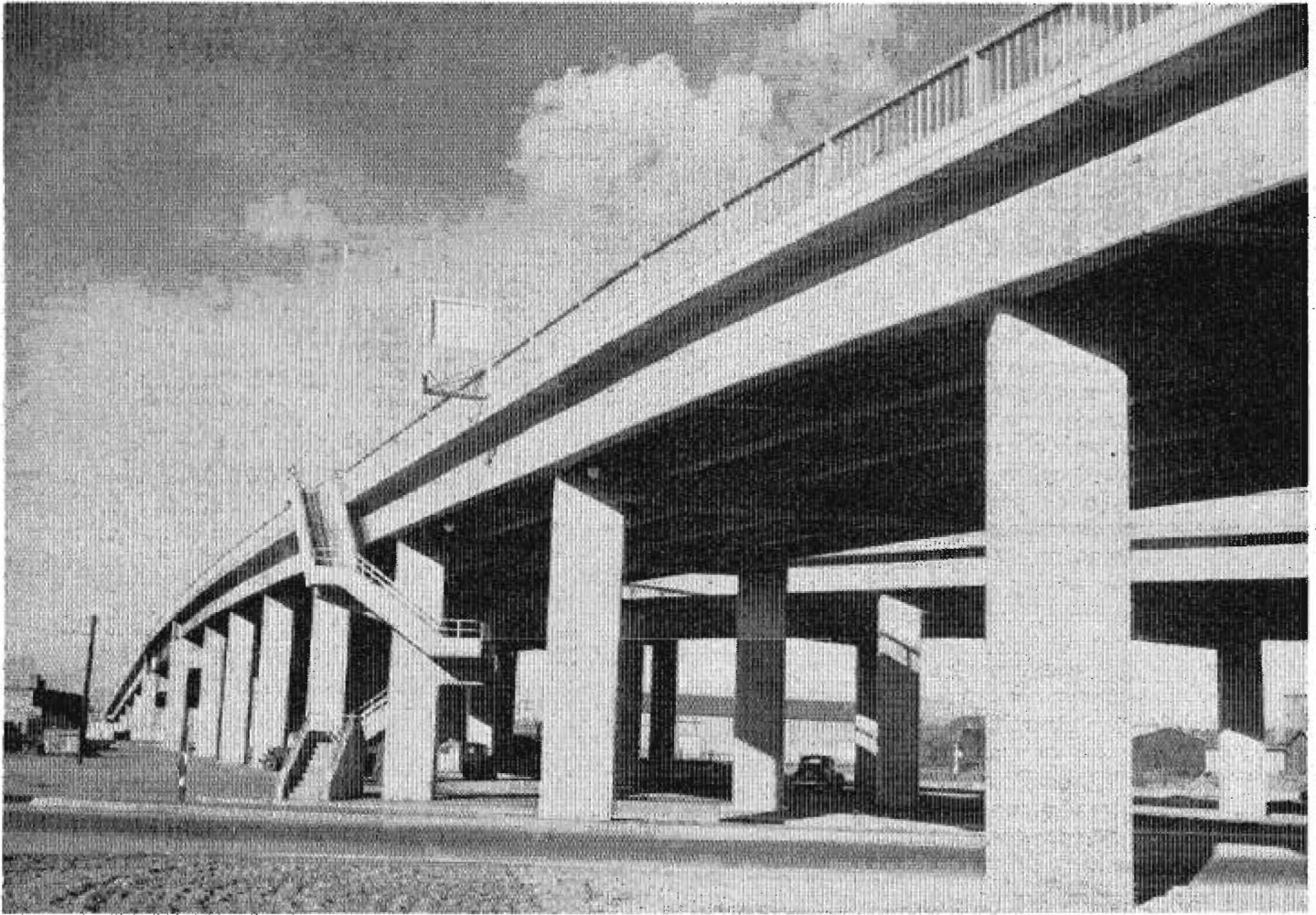
Along the westerly side of the freeway between Cherry Avenue and California Avenue, an outer highway was constructed to give access to the southwest section of Fresno.

#### San Benito Avenue Channelization

Before the new road was opened to traffic, some anxiety was expressed by local people that accidents would occur at the northerly end of the project be-

Looking from west end of California Avenue overcrossing. California Avenue off-ramp at left and on-ramp at right. Future West Fresno Bypass will pass under first and third span of structure at left center.





*Intricate stairway construction at G Street crossing of southbound Monterey Street overpass structure*

cause of the rapid transition from freeway speeds to city driving conditions. Indications are, however, that the intersection is properly channelized and that the speed change signing is adequate because after the usual confusion of the opening day, traffic has proceeded through the intersection without delay and without accident.

Two major bridge structures were built as part of the contract. They were the California Avenue Overcrossing and the Monterey Street Overhead.

#### **California Avenue Overcrossing**

The California Avenue Overcrossing was the smaller of the two structures, costing approximately \$100,000, including adjacent drainage and pumping facilities. It permits local vehicles to pass over the new highway, and provides a route by which traffic to and from nearby areas can make connec-

tions with U. S. 99 without conflict or delay.

The overcrossing is of a reinforced concrete slab rigid frame design and is composed of two 64-foot spans. In addition to the 28-foot clear roadway width, a safety curb and a five-foot sidewalk were provided along the two sides. The structure was founded on spread footings.

Three of the four abutment wing walls were laid out on short radius curves which complicated the form work. Plywood forms were used for all exterior surfaces on the entire overcrossing, thus lending to the pleasing appearance of the separation.

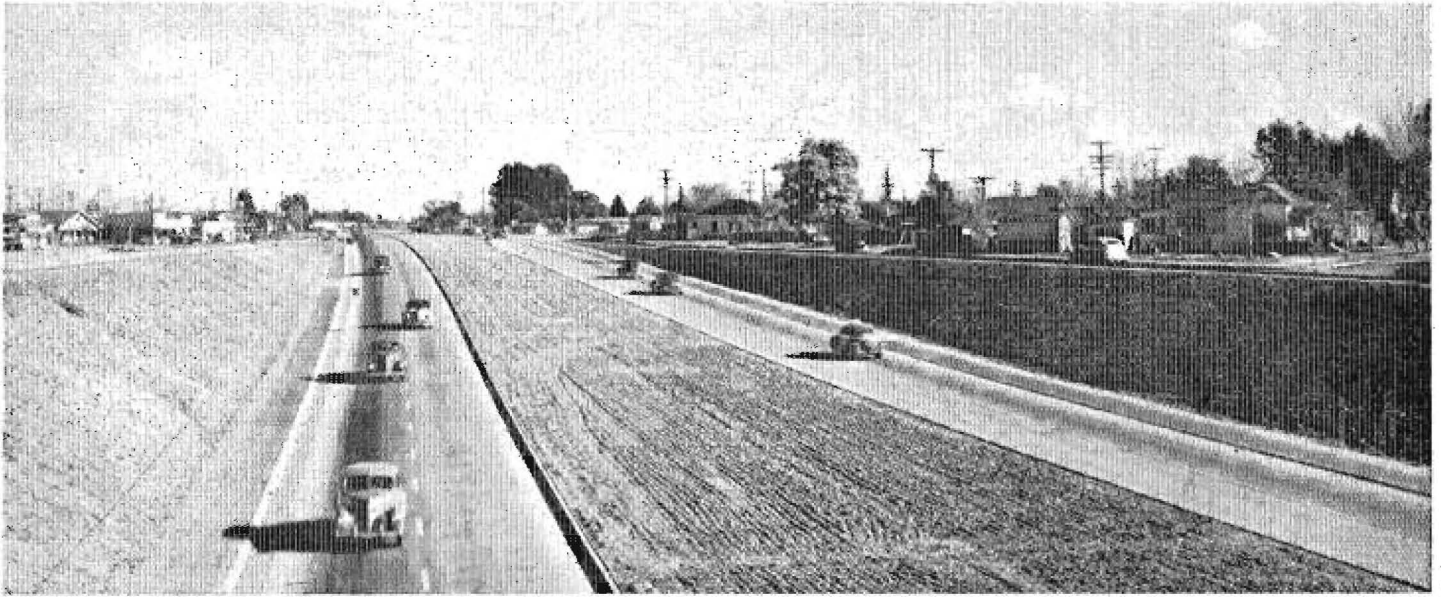
The depressed section of the main highway, over which the structure passes, was drained by a system of concrete pipes leading to a reinforced concrete pumphouse. The pumphouse was located just south of the overcross-

ing and at the west side of the highway and contains two electrically driven 15-horsepower centrifugal pumps capable of delivering 2,700 gallons per minute together. Although the excavation for the pumphouse was 30 feet deep, no shoring was required nor was ground water encountered.

#### **Monterey Street Overhead**

The six-lane Monterey Street Overhead was situated at the north end of the project and cost approximately \$760,000. Roughly, it forms the shape of a "Y" with the stem pointed north toward central Fresno and the other ends curved southeastward to Bakersfield. Actually the bridge is two structures, the East Lane and the West Lane, which touch along the stem, but are not otherwise connected.

Golden State Highway traffic is carried over "H" Street, "G" Street, and



Looking southerly at California Avenue overcrossing. Wide separation between lanes allows for later construction of West Fresno Bypass

nine main line and yard tracks of the Southern Pacific Company. In addition, the two southerly spans of the West Lane are designed to pass over the proposed highway known as the West Fresno Route, which is being planned to skirt the Fresno business district.

The East Lane was 882 feet long consisting of 14 spans and the West Lane was 1,128 feet long containing 19 spans. Each lane provides a clear roadway width of 36 feet and a six-foot dividing island separates them along the parallel section. Along the west side of the West Lane a four-foot sidewalk

is provided between the stairways down to "G" Street and "H" Street.

#### Piers on Spread Footings

The piers were founded on spread footings and consisted of two or three rectangular concrete columns, depending upon the skew. Except for the span over the railroad tracks, the superstructure for each lane consisted of six concrete tee beams.

Ten steel plate girders carry both lanes over the railroad tracks. The girders are 116 feet long, six feet deep and each weighs 25 tons. The erection work was coordinated to avoid delay

to main line trains. Only five days were required for erection of girders and their cross braces, and the riveting was completed in another four days.

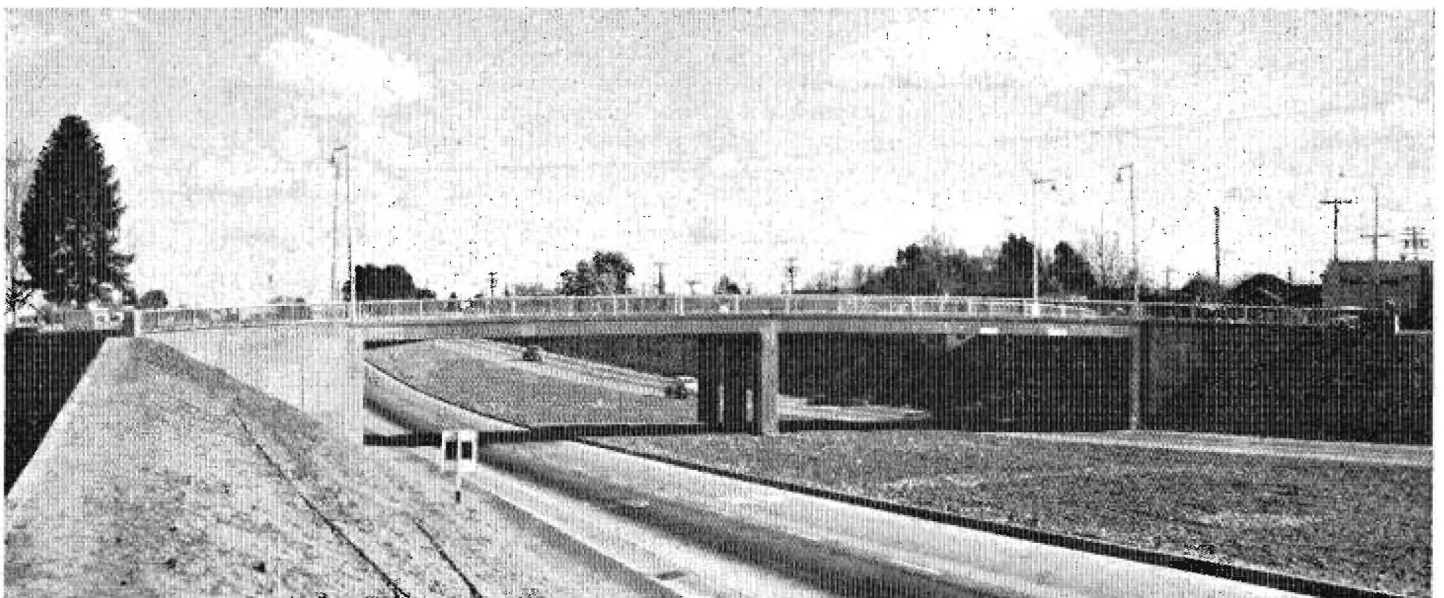
To simplify the finishing operation and improve the appearance of the structures, the contractor elected to use plywood forms on all of the outer girder and column faces. As a result the appearance and finish of the exposed concrete surfaces is very pleasing.

#### Major Items

At the north end of the structure the bridge passed over an asphalt paved

... Continued on page 50

Looking southerly from east end of California Avenue overcrossing





# Metallic Tapes

Experiments Show Need  
For New Specifications

By GLENN MORGAN, Assistant Physical Testing Engineer, and  
M. HARRIS, Stores Engineer

WOVEN METALLIC TAPES are used by the engineers of the California Division of Highways at the rate of approximately one thousand six hundred per year. These useful measuring tapes are desirable in many places where great accuracy is not required and where its inherent flexibility is of advantage for use in wooded country as well as in urban areas where tapes are subject to considerable wear from traffic.

In an effort to secure the best possible tape consistent with economy in price, the stores department has turned to the laboratory to investigate the commercial tapes now obtainable, to test these tapes in a manner consistent with field use and to derive tentative specifications whereby their purchase might be made in a rational manner irrespective of brand names.

The first step in analysis was to determine what physical properties a

metallic tape should possess and then to set up tests to cover these properties; finally to determine the variation permissible in order to provide a high grade article consistent with present manufacturing practice and to point out deficiencies.

## Resistance to Wear

Among the many physical properties that determine the quality of metallic tapes, probably the major factor is resistance to wear. By the very nature of its use, the tape that withstands wear the best is obviously the best qualified for purchase, provided the cost per hour of useage is lower than a competitor's. Other factors that should be considered are accuracy, tensile strength, readability as shown by height of numerals and color contrast as well as general construction to withstand various field conditions.

In order to determine wear resistance it was necessary to devise a machine to simulate field conditions. Research in testing methods and inquiry among the trade failed to produce any record of tests that could be evaluated numerically and comparisons made on a rational basis.

As a result of several conferences among interested parties and various attempts to use existing testing equipment, an accelerated testing device was developed.

## Testing Device

This device consists essentially of a system of standard abrasive wheels over which a 10-foot section of the tape is guided from one wheel to the next by means of hardwood dowels. The tape is sewn together by hand with stout linen thread to form an endless belt. A half twist in the belt reverses the tape at each revolution, which wears the tape uniformly on each side. The system is so devised that

the central wheel revolves *with* the tape in one direction and *against* it in the other. Figures No. 1 and 2 show in detail the construction of this machine.

A saturated sponge is placed in contact with the bottom or idler wheel. The test is run wet for two reasons; it is more severe when wet, and a slight excess of water keeps the wheels from clogging up which would change the rate of abrasion. A small motor drives the tape at 380 feet per minute, or approximately 4.3 miles per hour; slightly faster than obtained under field conditions.

A predetermining counter is attached to the driving wheel which turns off the machine at any number of cycles desired. A toggle switch is connected to the lower, or idler wheel, in such a manner that when the tape

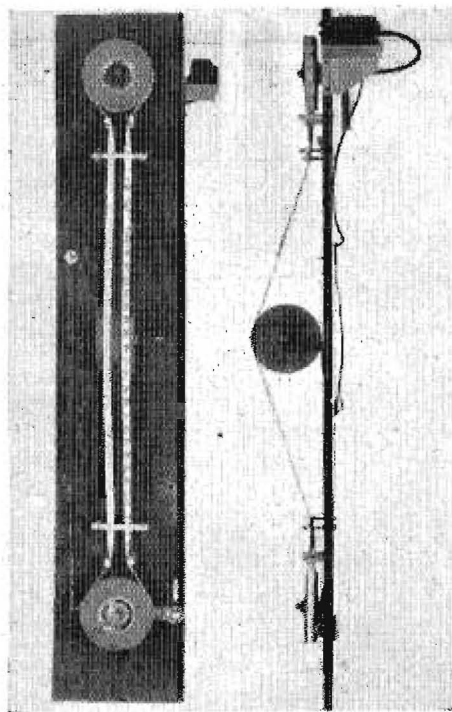
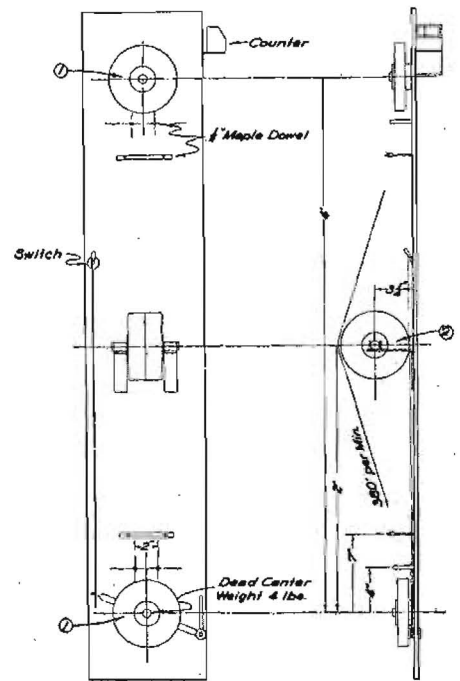


Fig. 1

Fig. 2



Carborundum Wheels  
A48-08-V30  
① Each 1" X 6" X 1/2"  
② Each 1 1/2" X 6" X 1/2"

Fig. 1

Fig. 2

breaks, the switch will open and the motor shut off.

**Procedure**

Three sections of tape, each 10.2 feet in length are cut from the test tape. Each section is measured over a nine-foot gauge length, avoiding the spliced area. This measurement is recorded to 0.005 feet using a three-pound tension. The tapes are then sewn together with stout linen thread in such a manner that there is a half twist in the endless belt thus formed. It is usually necessary to re sew the splice once during the test.

Samples are dried over night at 120 degrees Fahrenheit and weighed to 0.01 gram. They are then placed on the machine as pictured in Figure 1. The sponge is saturated and clearance allowed for the automatic shut-off switch to operate. Samples are removed at 1,500, 3,000 and 3,500 cycles, washed gently, dried and weighed. The average loss of weight of three samples are recorded to 0.5 percent. Any sample obviously in error should be discarded and rerun. A cycle is defined as one complete revolution of the tape. After completion of the test, the change in length due to abrasion, both wet and dry, is measured.

**Conclusions**

Typical results from four different tapes are shown in Table No. 1. Figure No. 3 shows in detail the progress of the loss in weight due to abrasion plotted against the number of cycles. Figure No. 4 shows before and after pictures of the samples tested at the end of 3,500 cycles.

Sample No. 4 is decidedly inferior due to the high abrasion loss and to the fact that the reinforcement, composed of round wires woven lengthwise of the tape, broke easily. These broken

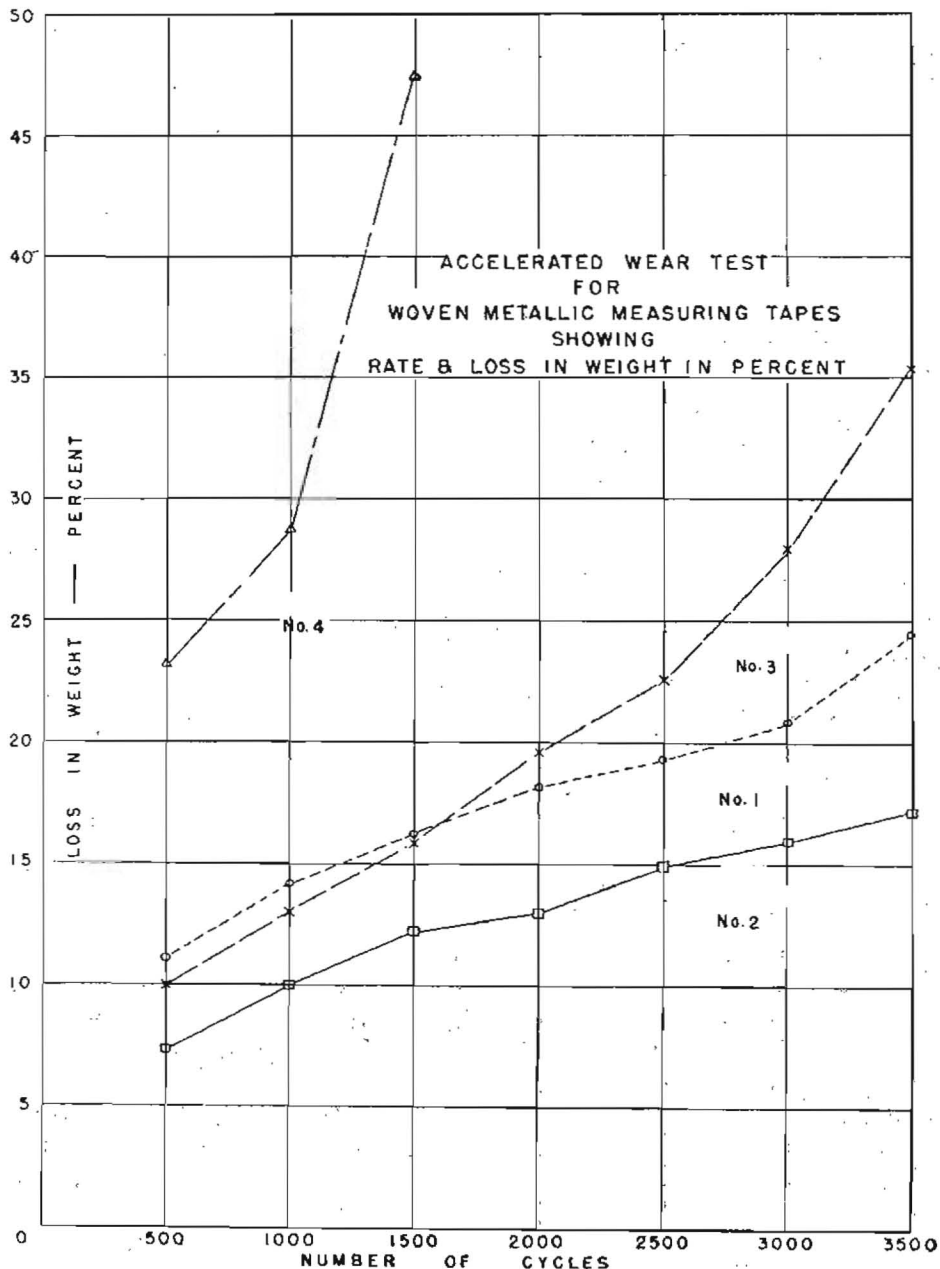


Fig. 3

wires made the tape very disagreeable to handle.

Accuracy of all of the tapes tested were such as to be within reasonable

limits consistent to the use which "rag" tapes are usually put. Of all the samples tested, No. 1 and No. 2 are superior in respect to abrasion.

... Continued on page 47

TABLE No. 1

	Sample number					Sample number			
	1	2	3	4		1	2	3	4
Accuracy, 50-foot length	50.035'	50.025'	50.055'	50.010'	Change in length due to abrasion				
Tensile strength, pounds						Wet .....	+ .15%	- .15%	- .05%
Tape .....	110	165	125	155	Dry .....	- .25%	- .25%	- .35%	+ .30%
Finger ring .....	75	75	85	70	Width .....	3/8"	3/8"	9/16"	3/8"
Abrasion					Height of numerals.....	7/16"	5/16"	1/2"	1/2"
Loss in weight at 3,500 cycles .....	24.5%	17.2%	35.4%	* 47.5%					

\* No. 4 failed at 1,500 cycles.

# Malibu Project

Improvement on Coast  
Highway Traffic Benefit

By RAY A. COLLINS, Associate Highway Engineer

ANOTHER traffic bottleneck in the Coast Highway is now in process of being eliminated. Construction was started November 15, 1948, under a half-million dollar contract, for the improvement by widening and resurfacing of the Coast Highway from Malibu Creek to Las Flores Creek, a distance of 2.9 miles. This improvement starts about 500 feet westerly of the Malibu Creek Bridge where the recently completed four-lane divided highway connects with the old 30-foot wide three-lane pavement.

At this location a delightful vista meets the eye. To the north, colorful

fields of flowers to supply the florist trade extend to the banks of Malibu Creek, where, on a high eminence, against a background of rugged mountains, glisten the white walls and turrets of the old Rindge mansion, now a monastery of the Franciscan Friars. From Malibu Creek to Las Flores Creek, fine homes and deluxe motor hotels are scattered along the north side of the road, while on the south side are imposing beach homes supported on piles sunk into the ocean sands. Just west of Las Flores Creek, on the north side of the highway, an outer highway is flanked by the Los

Angeles County sheriff's office, the post office, and many attractive stores and restaurants. This is the nearest business center for the celebrated Malibu Beach Colony of the Hollywood movie stars.

## Bridge Widened

The existing Malibu Creek Bridge is being widened approximately 20 feet for its length of 537 feet by means of 16 reinforced concrete girder spans set on reinforced concrete piers and abutments. The finished structure will have two 26-foot clear roadways separated by a central dividing strip formed by two lines of concrete curbs spaced four feet apart, with a planting strip between them. This bridge, when completed, will have five-foot wide concrete sidewalks and ornamental concrete handrails. To install the footing foundations for this bridge, attempt was made to dewater the creek by means of well points. This was not successful because too many large boulders were encountered. Trenches for each pier were dug by dragline methods, and pumps were installed to overcome the water problem.

The existing bridge at Coal Creek will also be widened 20 feet on the land side of the highway. This bridge has a span of 22 feet. Due to alignment improvement on the inside of the curve around Carbon Point, the bridge over Coal Creek requires extension only on one end.

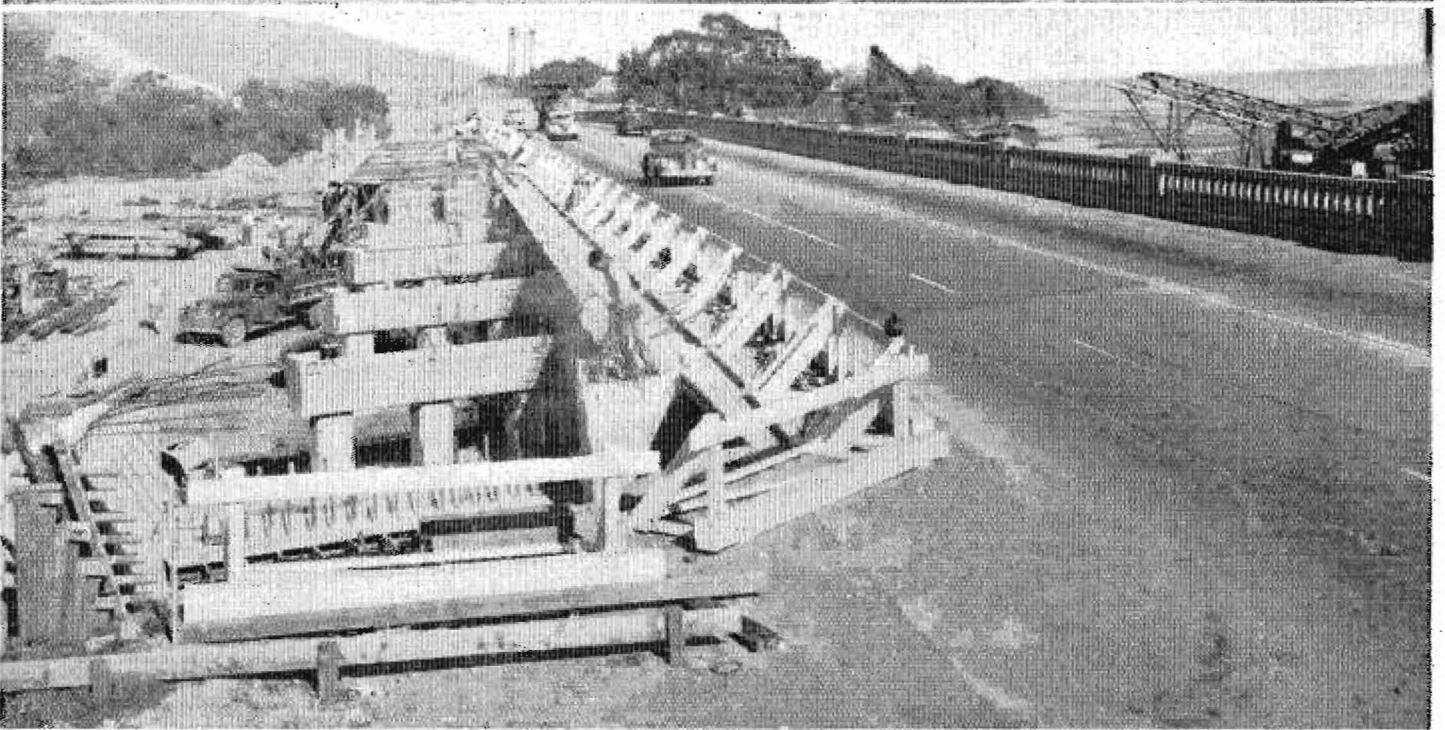
## Central Dividing Strip

From the westerly end of the present improvement at Malibu Creek for about one-half mile, a central dividing strip will be formed by doweling concrete curbs spaced four feet apart to the existing concrete pavement. The existing concrete pavement 30 feet in width will be surfaced with plant mix of varying thickness. Additional pavement width to provide a paved roadway 77 and 84 feet in width between curbs will be obtained by placing four

View from Carbon Point looking easterly and showing widening operations in progress







Upper—Showing oil treatment of portion of sandy slope where widening was carried out along high cut bank easterly of Malibu Creek. The dark portion of the cut slope indicates the portion that has been oil treated. Lower—Looking easterly along the Coast Highway, showing widening operations under way on Malibu Creek Bridge

inches of plant mixed surfacing laid on 16-inch thicknesses of selected pavement base material treated with Class C medium seal coat.

The selected material used for the pavement base course is being excavated from the cut on the north side of the highway at Carbon Point. After

the removal of about 2,500 cubic yards of unsuitable clayey overburden above elevation 100 feet, the material from

... Continued on page 59

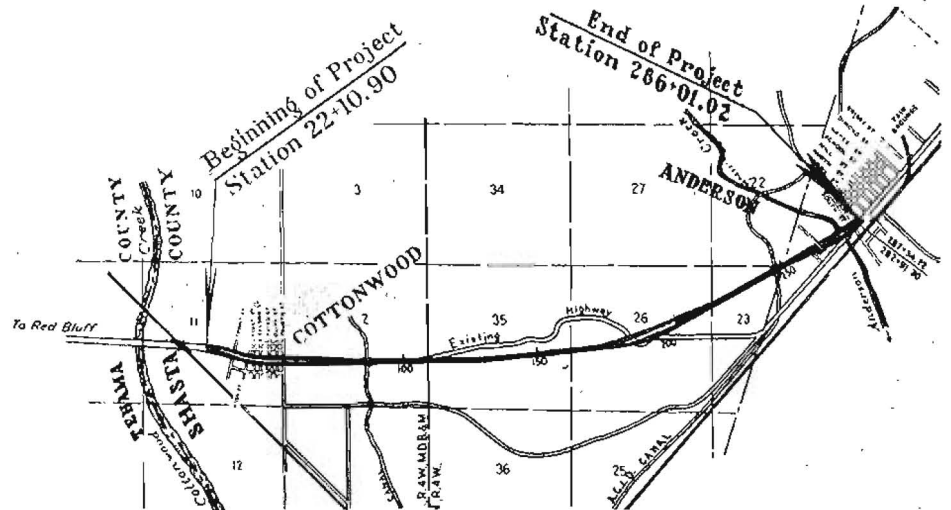
# Relocation

U. S. 99 From Cottonwood  
To Anderson Is Freeway

By J. H. CREED, Associate Highway Engineer

ON DECEMBER 23, 1948, another five-mile section of modern highway was added to U. S. 99 with the completion of work on the Cottonwood to Anderson relocation in southern Shasta County. This section of the Pacific Highway was constructed in 1923, and was entirely adequate for the 35 miles per hour speed limit and the light traffic of the time. However, it has long since been obsolete, and has been scheduled for reconstruction for some time, but the war and lack of funds have delayed the work until now.

The old highway consisted of a Portland cement concrete pavement 15 feet wide and five inches thick, to which has been added three feet of bituminous treated borders. No attempt had been made during construction to reinforce the subgrade, which consisted of local material with mediocre bearing value and high plasticity. Under modern heavy traffic the concrete was progressively breaking up, and maintenance cost was very high.



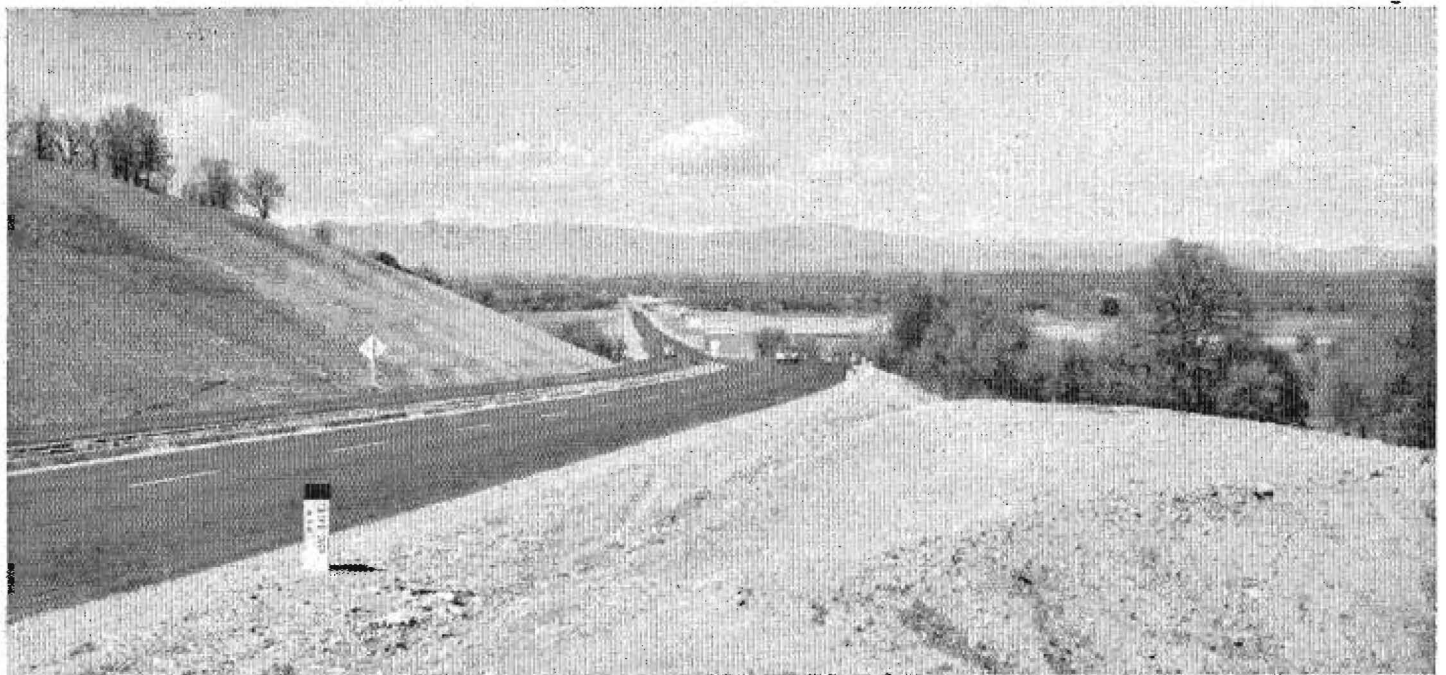
### Sharp Curves Eliminated

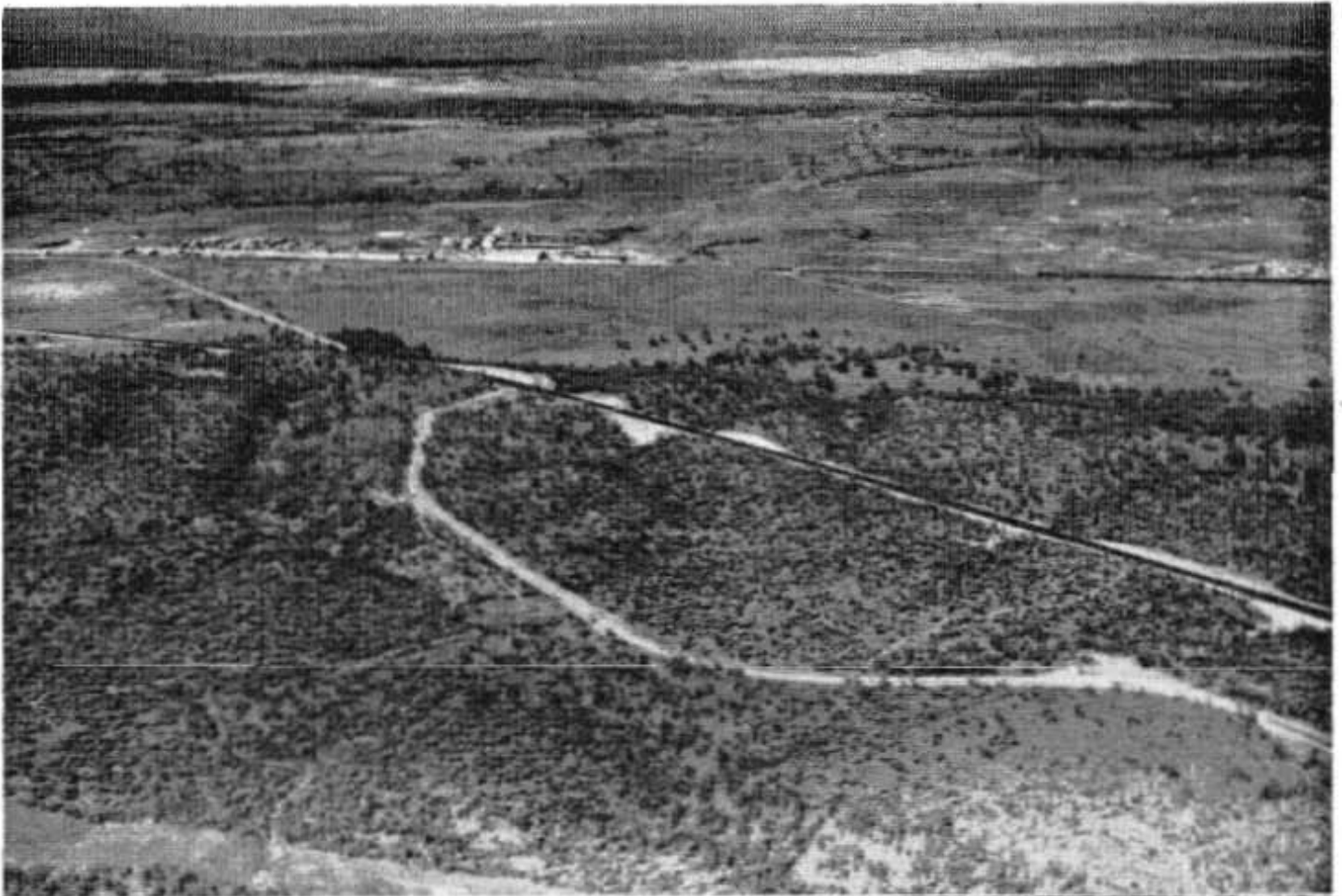
The old alignment, particularly over the hill in the middle of the project, was indirect and had thirteen curves, many of which were sharp with radii of only 300 feet. Sight distance was severely restricted due to the horizontal and vertical curvature, and attempts

to pass slow moving trucks on the short tangents were hazardous. In spite of posting for safe speeds of 30 miles per hour many accidents occurred on the notorious Cottonwood Hill.

In contrast, the new highway is on a much more direct location, with only two flat curves with radii of 30,000

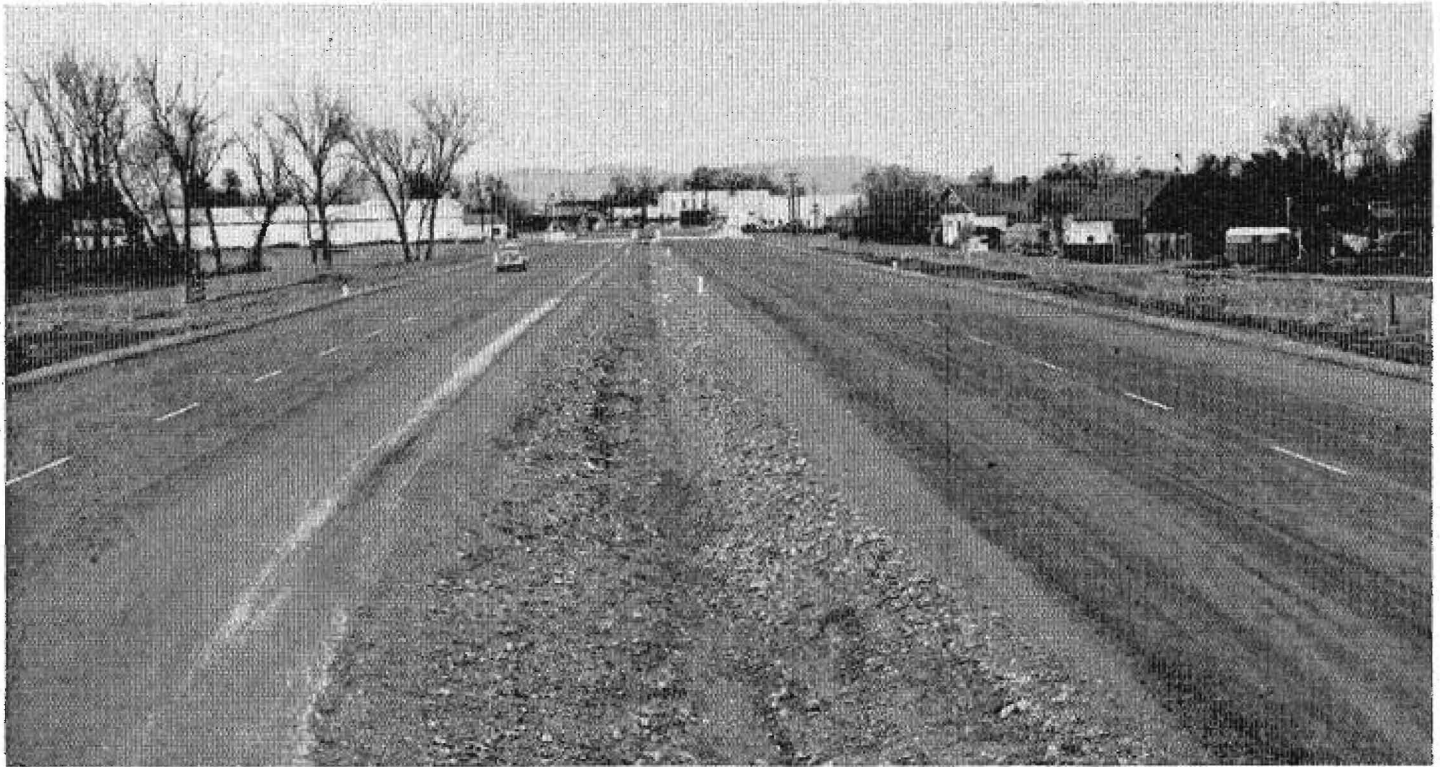
End of four-lane highway on north side of Cottonwood Hill. Anderson at far end of highway





Upper—Aerial view showing old, winding road on left and new highway on right on top of Cottonwood Hill. Lower—Four-lane divided highway into Cottonwood





View of new highway entering Anderson. Bridges across Anderson Creek in background

feet and 3,000 feet between Cottonwood and Anderson. The minimum sight distance on two-lane sections is 1,900 feet, which was achieved by a vertical curve 6,600 feet long over the top of the hill. Where sight distance was restricted on the north brow of the hill a section of four-lane highway with center division strip was constructed.

#### New Location Shorter

The new location is 0.32 miles shorter than the old highway, and driving time has been almost cut in half. Several people have commented on the noticeable difference in driving time, and it has been stated by some that when driving from Cottonwood to Anderson on the new highway, they are in Anderson before they are hardly aware they have left Cottonwood.

Through the town of Cottonwood a full street section was constructed with four driving lanes, parking lanes, curbs and gutters, and central median strip. The section of new highway entering Anderson is also four-lane divided type. Although the remainder of the project is a wide two-lane highway with 12-foot driving lanes and

eight-foot shoulders, it is designed, and right of way has been acquired, for future expansion to a four-lane divided highway throughout.

Except through Cottonwood, access rights have been acquired, and the highway is a freeway with access at designated points only.

#### Cost \$630,000

Pavement consists of three inches of plant-mix surface on six inches of cement-treated base. The subgrade is reinforced with 15 inches of select imported borrow having high bearing value, low plasticity and low swell.

Principal construction items consisted of 290,000 cubic yards of roadway excavation, 190,000 tons of imported borrow, 30,000 tons of cement-treated base, 19,000 tons of plant-mixed surfacing, and 2,000 cubic yards of portland cement concrete. A double 122-foot flat slab bridge was constructed across Anderson Creek at a cost of \$60,000. Total cost of construction was \$630,000.

The project was scheduled for completion in the early summer of 1949, but due to the contractor's exceptionally good organization and prosecution

of the work, was completed on December 23, 1948, coming as a welcome Christmas present for the traveling public.

#### Construction Record

An illustration of the efficient prosecution of the work is revealed by the following incident. One of the concrete box culverts to be lengthened was a 12 feet x 6 feet box culvert serving a major canal of the Anderson-Cottonwood Irrigation District. This culvert was to be lengthened 37 feet without interfering with the flow in the canal. This meant that the work must be done before the water was turned into the canal in the spring or after it was turned out in the late fall. To have waited until fall would have seriously affected the planned completion of the project in one season. Normally water is turned into the canal late in March. Bids were opened March 31st. The contractor's representative immediately asked the district manager when water would be turned into the canal. The answer was in eleven days. The site of the extension was soft mud which had to be removed and replaced

... Continued on page 38

# Weitchpec Span

New Bridge on Klamath River Carrying Traffic

By ALTON F. KAY, Assistant Bridge Engineer

THE SUPERSTRUCTURE OF the new Klamath River Bridge at Weitchpec in Humboldt County has now been completed to the point where heavy traffic can be routed over the new structure.

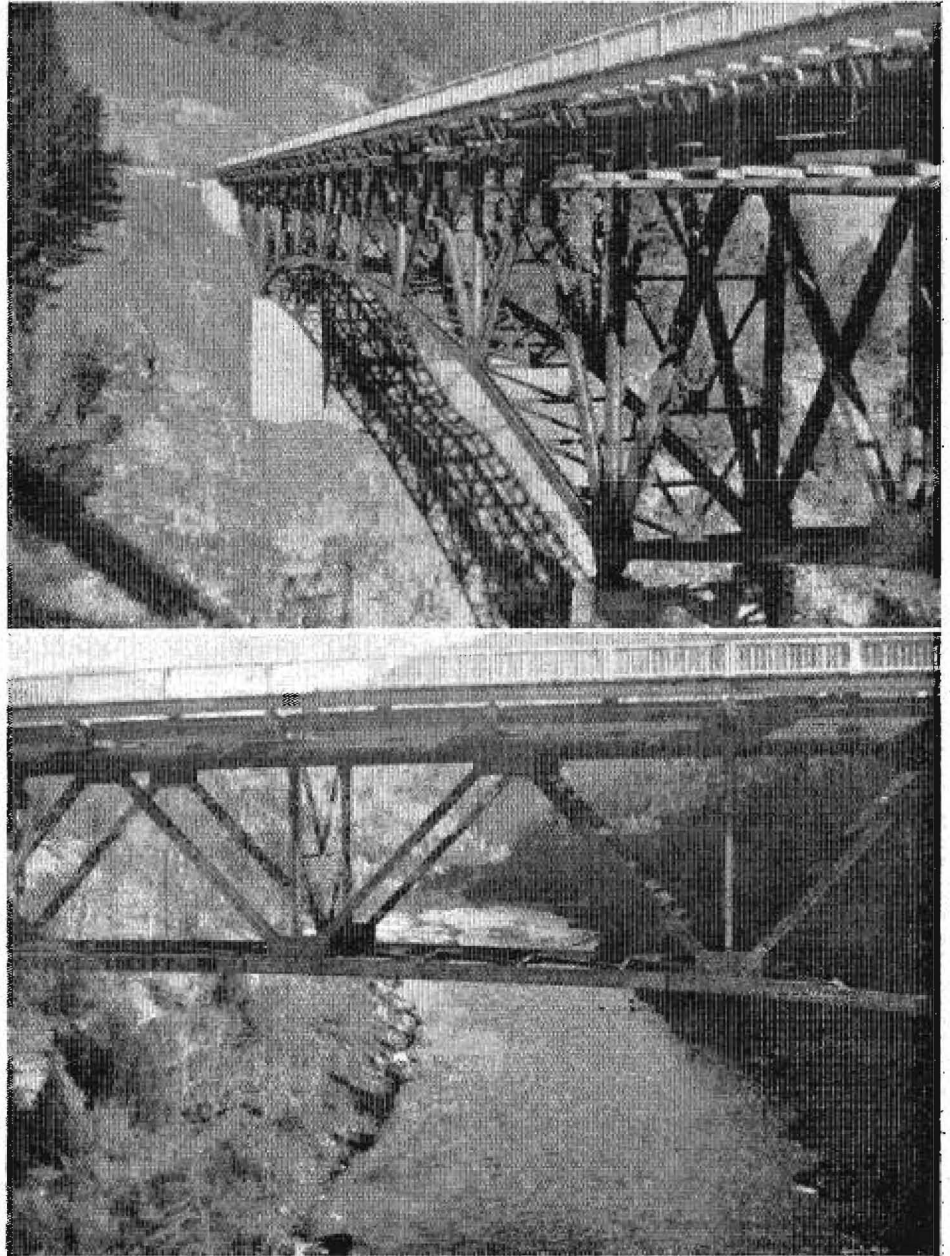
The old bridge with its narrow width and hazardous sharply curved approach on the north end has for years formed a barrier to the development of the Klamath River Valley in this section. In addition to the very difficult north approach, the old suspension span has for years been posted for a 10-ton gross limit for all traffic. The cantilever steel bridge, costing a total of \$650,000, therefore, will remove the bottleneck at this point on the river.

The new structure is a 500-foot steel cantilever deck truss, constructed on a new alignment slightly upstream from the confluence of the Trinity and Klamath Rivers near the town of Weitchpec in the Hoopa Reservation. Owing to the fact that construction was started during the period of steel shortage, the work was divided into two contracts. The substructure contract was completed in 1948 and the superstructure work will be completed this spring.

The substructure consists of two 90-foot reinforced concrete piers and two U-type reinforced concrete abutments. The footings of the piers were founded on bedrock and rock was also found in the foundations of the abutments.

The superstructure consists of two 103-foot cantilever spans with a main span of 294 feet; a 26-foot roadway is provided with two sidewalks.

The structural steel deck truss was erected by cantilever method and proceeded very rapidly. The south half of the bridge was erected first and the north half was erected and moved into final position by means of four 50-ton hydraulic jacks to make the closure between the two extended arms. The jacking operations and the pinning of all the center connections were accomplished in a total time of only two hours.

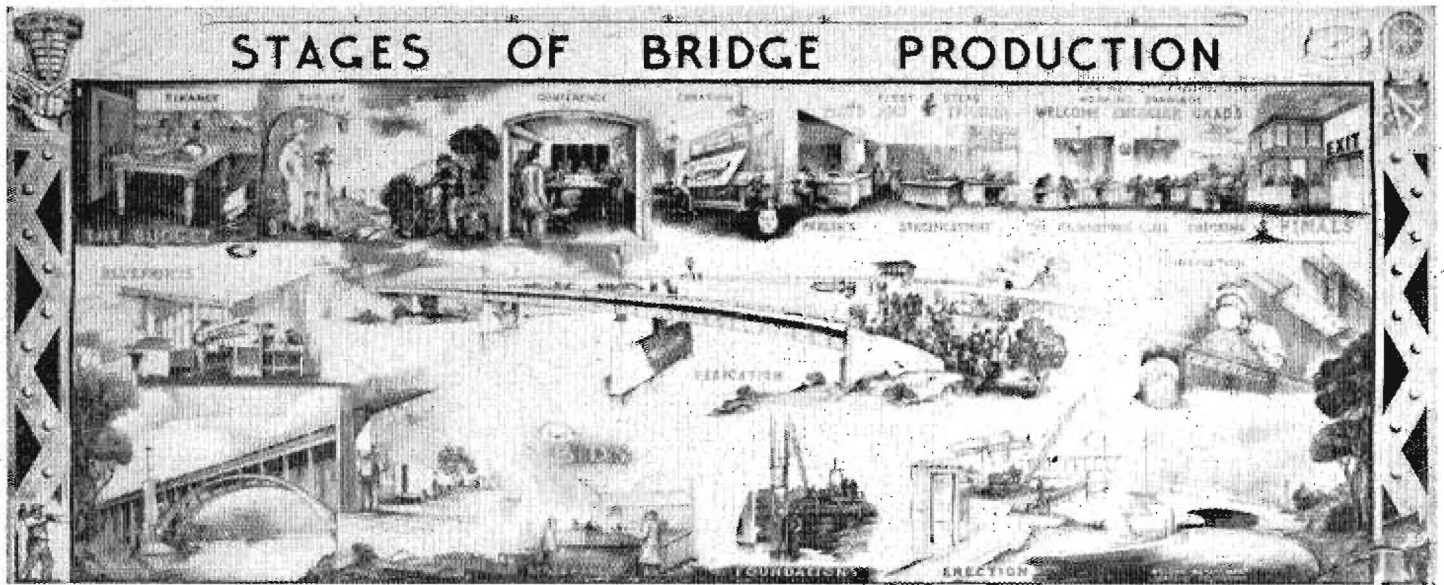


These are views of new Klamath River Bridge at Weitchpec in Humboldt County

The structural steel had a total weight of 618 tons. It was erected and riveted within a period of 10 weeks by Judson Pacific Murphy Corporation, without a loss of time accident. The substructure work was done by Clifford A. Dunn, of Klamath Falls, and the superstructure portion of the con-

tract was done by the Guy F. Atkinson Company of San Francisco.

The structure was designed and erected under a bridge department contract under the direction of F. W. Panhorst, Assistant State Highway Engineer, and the author.



The impression of some laymen is that when a bridge is required it is only necessary to contact the Bridge Department which immediately withdraws from a pigeonhole a standard plan that will fit a given number of circumstances. Some people would assume that a request for a bridge would cause it to be drawn without delay and in complete form.

It is with the idea of clarifying these and other matters that the accompanying illustration was prepared, entitled, "Stages of Bridge Construction."

Pictorially and in logical sequence it shows the many steps required to develop a bridge project from the time of its inception and position on the budget until it is finally dedicated as a structure ready for the service of California motorists.

Another interesting use of the picture is that copies of it have been circulated in engineering schools to demonstrate the department's operations.

## Idaho Trucker Gets Fine, Jail Term On Overlimit Charges

Lowell W. Kloppenburg of Twin Falls, Idaho, dubbed the Overload King by state highway patrolmen, is in the county jail here with a total of 180 days or a \$500 fine facing him.

Kloppenburg, a trucker, was arrested Tuesday night on Stockton Road near Elk Grove by Officers Cather Jasper and Harry Starr.

They charged him with having a load weighing 107,400 pounds on his truck when the state limit for this size vehicle is 76,000 pounds. They also charged him with exceeding the length limit by six feet.

Captain Floyd Yoder dug into Kloppenburg's record and reported:

Kloppenburg has been cited 15 times since January 17, 1947, for having loads which exceeded the limit by from 21,000 to 36,000 pounds.

Nine times he has been issued citations for violating the length regulation.

He has been ticketed a total of 45 times for these and other traffic violations in the State, including the fact he has an out-of-state truck registration.

Justice of the Peace G. F. Mix, Jr., of San Joaquin Township, sentenced him to serve 10 days in the county jail for the excessive load length. Then he ordered him to serve an additional 180 days or pay \$500 fine for the overloading. Kloppenburg has started serving the jail term.

*Sacramento Bee, March 17, 1949.*

## Relocation

*Continued from page 36 . . .*

with suitable foundation material. Work began on the structure April 5th and was completed April 13th. There was rain every day but one while the work was in progress. By reason of this rain there was delay in turning water into the canal, but a construction record had been made.

Work was done under the general direction of Mr. F. W. Haselwood, District Engineer, and Mr. H. Clyde Amesbury, District Construction Engineer, with the writer as Resident Engineer. The Contractor was the Frederickson and Watson Construction Company of Oakland. Mr. W. V. Galbraith was job superintendent for the contractor throughout most of the work.



# Exchange Ideas

California and Oregon Right  
of Way Agents Get Together

By J. M. DEVERS, Chief Counsel, Oregon State Highway Commission\*

AS A RESULT of considerable correspondence back and forth between my office and the office of the Chief Right of Way Agent, California Division of Highways, it was my pleasure to recommend to Mr. R. H. Baldock, State Highway Engineer, that arrangements be made for a special committee of right of way agents from our regular staff to visit California for the purpose of conferences with right of way personnel in that State and to study the operation, policy and procedure of California's Right of Way Department.

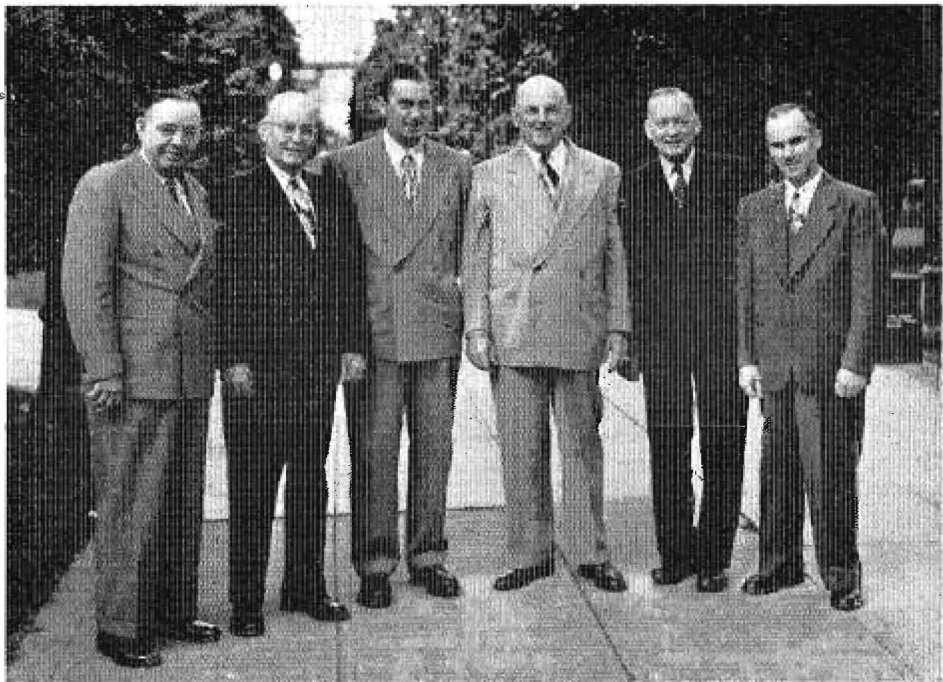
The trip was authorized by the State Highway Commission and Right of Way Agents W. F. Collins, W. H. Haskin, S. N. Mayhew, D. L. Norlin and C. W. Parker were selected and arrived in California on Sunday, February 27, 1949. Our men split into two groups, with one group going to Los Angeles and the other to San Francisco, where metropolitan district right of way problems including the acquisition of right of way for metropolitan freeway projects through heavily built-up business, industrial and residential areas were given careful field study in company with California right of way agents. There followed conferences and further study in the District IV office at San Francisco and the District VII office at Los Angeles.

#### Field and Office Studies

George S. Pingry, Assistant Chief Right of Way Agent attached to the District IV office at San Francisco and in charge of field supervision in the northern half of the State, and Assistant Chief Right of Way Agent E. F. Wagner attached to the District VII office and in charge of field supervision in the southern half of the State, together with their able assistants, were most courteous and cooperative and gave freely of their time.

Following several days in the two

\* Mr. Devers is Chief Counsel and also head of the Oregon State Highway Right of Way Department.



Visiting right of way agents from Oregon. Left to right: C. W. Parker, W. F. Collins, Don Norlin, Frank C. Balfour, Chief Right of Way Agent, California Division of Highways; S. N. Mayhew, Wm. H. Haskins

large California metropolitan districts, the two Oregon groups met at the District VI office in Fresno for further review and study of the various semi-metropolitan and rural right of way acquisition projects in that area, again including both field and office study.

The two groups then continued on to Sacramento, the headquarters of the Division of Highways, where Chief Right of Way Agent Frank C. Balfour, Assistant Chief Right of Way Agent E. M. MacDonald in charge of valuations, and Assistant Chief Right of Way Agent Ray Pianezzi in charge of administration, gave our Oregon group a complete summation of the inner proceedings of the headquarters right of way office and a complete explanation of the over-all policy and procedure.

#### Policy and Procedures

Policy, procedure and ideas pertaining to methods of operation of the two

states were gone over very carefully and the various merits were brought out to the mutual benefit of both state highway right of way organizations.

Our Oregon right of way agents were deeply impressed with California's method of complete appraisal on each and every property on the before-and-after-taking basis, and the very scientifically prepared appraisal report including photographs and statistics on each parcel which constitute the working tools of the negotiator and a permanent record for both the district office and headquarters office, which should be adopted by every state highway right of way organization.

#### Oregonians Impressed

Our representatives were impressed with the very important emphasis that is placed on the appraisal by the California Right of Way Department. As

... Continued on page 48

# Good Work

Ebell Society of Santa Ana  
Seeks Cleaner State Highways

The following article was prepared by Mrs. Adelaide Walker of the Garden Section of the Ebell Society of the Santa Ana Valley in Orange County. It is considered worthy of publication in *California Highways and Public Works*. ED.

THE GARDEN SECTION OF THE EBELL SOCIETY OF THE SANTA ANA VALLEY, located in Santa Ana, Orange County, California, has initiated a unique educational program, one destined to affect everyone with civic pride and one which it is hoped will become state-wide in operation.

California has some of the finest scenery in the Nation and some of the finest highways. Both are marred by the thoughtless dumping of trash—much of which is on main routes approaching cities where it can be seen by visitors. This unsightly appearance of highways can be corrected if educational programs are instituted in communities and clean-up campaigns are organized.

The educational campaign as conceived by the Santa Ana Ebell Garden Section is aimed not only at highway malefactors, the careless, the "I-don't-cares" who ride in cars and blithely toss bottles, tin cans, empty cigarette packages, paper bags and tissues out onto the highway, but pedestrians who thoughtlessly throw gum and candy

wrappers, ice cream cups and bits of paper onto the streets and sidewalks.

The garden clubs of Orange County, of which there are some twenty-five or thirty, are being brought into the movement to educate the public. Letters sent to them and to many other civic organizations are bringing an astonishing number of replies endorsing the project and offering to assist.

Mayor R. Carson Smith set aside the week of April 3d to 9th as City Clean-Up Week and the Orange County Board of Supervisors set the same week as County Clean-Up Week. In giving the plan its official blessing, the board of supervisors pointed out that rubbish which litters the sides of the roads has long been a source of trouble to the county's highway department.

As evidence of the awakening consciousness of many persons to the unattractive garnishing of highways with trash, the 200 garden clubs comprising the membership of California Garden Clubs, Inc., adopted a resolution at first quarterly board meeting held at Sacramento last September which stated as their objective " \* \* \* civic beautification, roadside development, outdoor cleanliness and abolition of the scorched earth policy." The purpose of the Santa Ana group is to implement the resolution of the state organization by providing definite methods for accomplishing its purpose.

Members of the Garden Section note that trash containers are placed at convenient intervals along the sidewalks of most cities, but that unobservant public prefers to scatter papers haphazardly instead of using these receptacles. Moreover, it is the policy of many counties to establish public trash dumps at various points for the disposal of rubbish. Orange County has 10 such rubbish-disposal areas. There are usually city and county ordinances regulating the problem of trash disposal, and Section 374b of the Penal Code of the State of California specifically states that it is unlawful to deposit cans, bottles, papers, trash or rubbish on public or private highways and declares it a misdemeanor so to do.

Bringing these and other pertinent facts to the attention of pedestrians and drivers, children and adults—to citizens of all ages and classes—is the ambitious aim of the members of the Santa Ana Ebell Garden Section, their ultimate goal being to make California's magnificent highways clean and beautiful.

The Garden Section of Ebell Society of the Santa Ana Valley was organized 24 years ago and its commendable purpose of sponsoring a state-wide effort for cleaner streets and highways through educating the public is based on a record of successful local achievements.

## COUNTY ROAD

Continued from page 14 . . .

east of Point Reyes Station, subject to periodic flooding, the grade was raised four feet.

Imported base material was placed in varying thicknesses as required to insure a satisfactory base and adequate shoulder reinforcement. Pavement consisted of plant-mixed surfacing 2 inches thick and 20 feet wide for the entire length of the project, finished with a seal coat. Shoulders were constructed three feet or more in width

and finished with penetration treatment.

A. G. Raisch Company of San Francisco was the contractor, represented on the job by Mr. William A. Russell, superintendent. Plant-mixed surfacing was furnished by the Marin Gravel Company of Point Reyes Station.

The cost of the contract was financed in whole with federal aid secondary funds provided by the Federal Highway Act of 1944, and state matching funds provided by the County Highway Act of 1945. Construction engineering costs incurred by the State

were financed with FAS and state matching funds. Construction engineering costs incurred by the county were paid from county funds, but may be partially recoverable from the unexpended balance of funds allotted.

Total cost of the project exclusive of engineering was \$216,677.84, an average of \$21,899.92 per mile for the 9.894 miles of actual construction.

The excellent cooperation of the state and federal personnel and of the contractor were of inestimable value in securing the highly satisfactory results attained and in holding expenses at a minimum.

## ACCESS RIGHTS

*Continued from page 11 . . .*

State. Both of these witnesses were men familiar with the entire region, and thoroughly capable of appraising agricultural land and familiar with the values thereof. Both testified that in their opinion, the land in question was adaptable to varied agricultural uses, and the taking of access rights did not reduce the fair market value of the ranch one iota. Their conclusion was based upon the fact that the present operation of the property was carried on from the adjacent county road and that its present utilization only required one 20-foot opening on the state highway side.

The attorney for the State in his closing argument to the judge and jury pointed out the prohibitive cost of constructing freeways which would result if unwarranted excessive payments were made for access rights in agricultural areas. He contended that the ultimate result of this would be a decrease of highway projects because of the increased cost of right of way.

### Verdict for State

The jury rendered a decision that no damage was done to the property by the taking of the 5,900 feet of highway access and leaving the one 20-foot opening and its verdict awarded no payment to Mr. Myers.

During the trial the State stipulated that it would relocate at its expense an 82-foot harvester gate which was located on the state highway at the northeast corner of the property. This gate was to be moved to a new location on the county road.

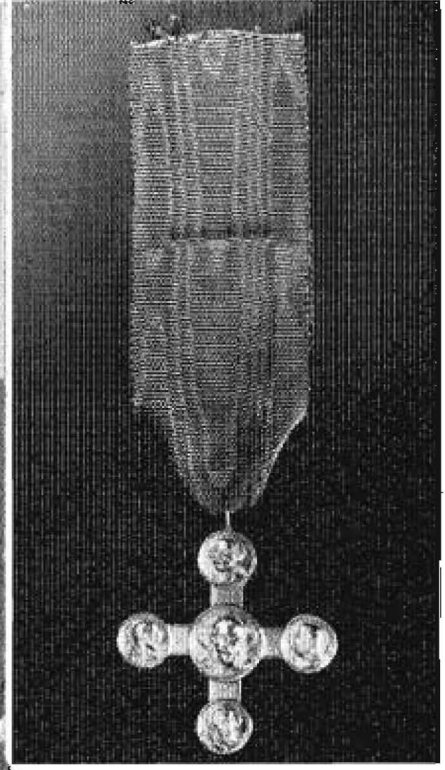
This decision is indicative of a trend of thought that highway access should be limited, and that this limitation does not necessarily decrease the value of the lands affected. It is believed that as more and more of the State's major highways become freeways the truth of the statement that abutting lands are not necessarily decreased in value by the limitation of access will become more apparent to the general public.

*and Public Works*

## Pope Bestows Lateran Cross Upon Milton Harris, Highway Engineer



*Milton Harris*



*The Lateran Cross*

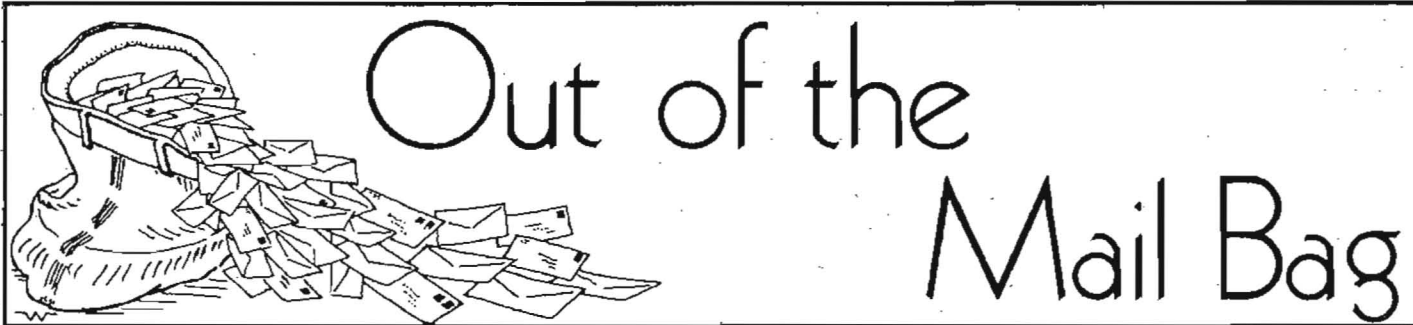
A MEDAL rarely awarded to non-Catholics, the Lateran Cross has been bestowed by Pope Pius XII upon Milton Harris, Stores Engineer of the Division of Highways, Sacramento. The honor was in recognition of service rendered the Vatican and the City of Rome during World War II by Harris who was a Lieutenant Colonel in the U. S. Corps of Engineers attached to the Allied Military Government in Italy.

While in Rome, Harris and Monsignor Umberto Dionisi, rector of St. Cecelia's Church in Rome, became close friends. The Monsignor was confronted with the problem of obtaining automotive equipment to distribute food and supplies to 30 ecclesiastical institutions scattered throughout the city. Harris obtained the necessary equipment and later enabled the Vatican to operate a large fleet of supply trucks throughout Italy. Through his activities he became known to His Holiness and was invited to two audiences with the Pope.

Harris entered Army service in July, 1942, and spent 29 months overseas, 25 of which were in Italy. For a time he was on the staff of General Mark Clark as Assistant G-5 attached to the Military Government section of the General Staff. In World War I, Harris was a first lieutenant with the Ninth Field Artillery.

Pope Leo XIII created the Lateran Cross decoration on February 18, 1903, to be awarded to "all those men and women who prove themselves worthy of the Catholic traditions by their noble life and outstanding services to the Church." The Papal decoration is in the form of a Byzantine cross bearing in the center the image of Our Blessed Lord and on the arms the images of St. John the Baptist and St. John the Evangelist and the protectors of Rome, Saints Peter and Paul.





### EROSION CONTROL WORK

UNITED STATES DEPARTMENT OF AGRICULTURE  
FOREST SERVICE  
WASHINGTON, D. C.

DEAR MR. SULLIVAN: My attention has recently been called to two articles. One of these was in the September-October, 1948, issue of *California Highways and Public Works*, by L. M. Barnett and the other in *Western Construction News* by S. C. Gunter.

Both of these articles deal with a new two-lane City Creek Road now under construction by the California Division of Highways in the San Bernardino National Forest. Both of these articles describe very vividly the very fine erosion control work which is being carried out on this road. We in the Forest Service have been very greatly concerned over the possible production of much erosional debris as a result of this road. The very excellent way in which you are constructing this road, the care that you are giving to it will be reflected in the lack of material damage to downstream values as a result.

I am very glad indeed to pay tribute to the engineers who are doing such a fine piece of work. I hope that it will be possible for me on my next visit to Southern California to see for myself this road. In the meantime I am calling it to the attention of other members of my staff so that they too may be able to see directly this fine piece of work. Congratulations!

Very truly yours,

LYLE F. WATTS, Chief  
Forest Service  
U. S. Department of  
Agriculture

### MODOC APPRECIATIVE

MODOC COUNTY BOARD OF SUPERVISORS  
ALTURAS, CALIFORNIA

HON. CHARLES H. PURCELL, Director  
*Department of Public Works*  
*Sacramento, California*

HONORABLE SIR: The Board of Supervisors of Modoc County, California, express deepest appreciation for the cooperation your department rendered in the removal of snow in Modoc County.

Roads were blocked to such an extent that schools were closed and travel between the county seat and other places was completely cut off.

Without the assistance given by your department great damage would have resulted.

In appreciation,  
MODOC COUNTY BOARD  
OF SUPERVISORS  
By ELLA C. SLOSS, County Clerk

### IN RAIN OR SUNSHINE

PINE GROVE RESORT  
COBB POSTOFFICE, LAKE COUNTY,  
CALIFORNIA

DIVISION OF HIGHWAYS  
*Eureka, California*

GENTLEMEN: We want you to know how we at Pine Grove appreciate the effort of the foreman on Route 29 to keep this road by Whispering Pines passable—especially over the Washington Birthday holiday, when the maintenance crew worked in the pouring rain.

Sincerely,

H. A. EGAN

### SNOW REMOVAL

JULIAN CHAMBER OF COMMERCE  
JULIAN, CALIFORNIA

MR. E. E. WALLACE, *District Engineer*  
*State of California Road Department*  
*1365 Harbor Boulevard*  
*San Diego, California*

DEAR MR. WALLACE: The Board of Directors of the Julian Chamber of Commerce wishes to express its appreciation for the fine manner in which the state highway crews carried on during the snow storms here in the mountains.

We wish to commend Mr. G. S. Kibby, project engineer, Mr. Robert Garmire, local maintenance foreman, and Mr. E. C. Young, contractor on the highway realignment here at Julian, for their untiring efforts and sacrifices to keep the roads open and to help the community and local people.

Very truly yours,

FRED A. GRAND  
President

### NO THANKS NECESSARY

CALIFORNIA NATIONAL GUARD  
Headquarters 49th Infantry Division

CALIFORNIA NATIONAL  
GUARD CENTER  
ALAMEDA, CALIFORNIA

SAN FRANCISCO-OAKLAND BAY BRIDGE  
*Toll Plaza, Oakland, California*

GENTLEMEN: Following an accident on the Bay Bridge in which my family and I were injured, we were admitted and given emergency treatment at Permanente Hospital. I wish to compliment the Bay Bridge personnel and express my appreciation for the very complete and able assistance that we

received immediately following the incident.

My family joins me in congratulating the bridge authorities and the responsible individuals who made it possible for us to have such prompt care.

Sincerely yours,

H. A. MEYER  
Colonel, G. S. C., Calif. N. G.  
Chief of Staff

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### COOPERATION

CITY OF GLENDALE  
GLENDALE, CALIFORNIA

MR. C. H. PURCELL  
*Director of Public Works*  
*Sacramento, California*

DEAR SIR: This is to acknowledge the receipt of your Second Annual Report to the Governor of California by the Director of Public Works.

I have looked over same and the information is of great interest to me and I will appreciate receiving any future reports.

The City of Glendale's connection with your office in the City of Los Angeles has been very good and your engineers have been very courteous in the different projects submitted by the City of Glendale to the Division of Highways.

Very truly yours,

J. C. ALBERS  
City Engineer and  
Street Superintendent

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### THANK YOU, CAPTAIN

CALIFORNIA HIGHWAY PATROL  
HAYWARD, CALIFORNIA

MR. JACK C. CAMPBELL,  
*Superintendent*  
*Division of Highways*  
*Hayward, California*

DEAR MR. CAMPBELL: I am in receipt of a report from Officers Wheeler and Wood, in which they stated that Foreman H. E. Nahhas was very prompt in response to a call for material to be put on icy highways for the prevention of accidents in Dublin Canyon on January 28th, at 4.10 a.m.

It is this writer's pleasure to extend his compliments to you and your per-

sonnel for the very efficient manner in which this was handled.

Thanking you kindly for the splendid cooperation, I am

Cordially yours,

R. C. WILKINSON  
Captain No. 54

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DIPL. ING. OTTO KAHRS  
Av Oslo Bilsakkyndige

Oslo, January 26, 1949

DIVISION OF HIGHWAYS  
*Department of Public Works*  
*Sacramento, California*

GENTLEMEN: I am much obliged to you for your kind letter with enclosures, and I must say that your book, "Engineering Facts," is a most interesting publication, and very splendidly made up. Regarding your First Annual Report, may I call your attention to the fact that Sweden is building a big new airport some thirty miles north of Stockholm. There they have developed a brand new system of vertical paper drains and semiautomatic machinery for putting those drains quickly and cheaply in place. On a visit in Sweden last summer, I saw the machinery in use. It is something reminiscent of a pile driver in appearance. It appears to me that it works cheaply and efficiently and I wonder if it might not be worth while for you to send somebody over to study it.

If you approach Kungliga Väg och Vattenbyggnadsstyrelsen, Stockholm (the Swedish equivalent to your Public Roads Administration), they will give you any information desired, and if I can be of any assistance, please let me know.

Yours very truly,

OTTO KAHRS

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M. H. LUMMERZHEIM & CO.  
107 Rue Due Navire  
Gand, Belgium

4th March 1949

MR. KENNETH C. ADAMS, *Editor*  
*California Highways and*  
*Public Works,*  
*Sacramento, California, U. S. A.*

DEAR SIR: I very much appreciate your sending me the periodical *California Highways and Public Works*.

It is certainly one of the most interesting publications that we can imagine on roads and highways, and it is indeed of a very great importance to us as well as to our country, where all roads urgently need improvements and renewals.

Thanking you for your kindness, I am, Dear Sir,

Very truly yours,  
(Signed)

F. LOUWERS, Manager  
Zeeschipstraat, 107  
Gent, Belgium

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DIVISIONAL OFFICE  
County Roads Board  
63 McKillop Street

Victoria, Australia.

*California Highways and*  
*Public Works*  
P. O. Box 1499  
*Sacramento, California, U. S. A.*

DEAR SIR: My attention has been drawn to your excellent publication, *California Highways and Public Works*, with its concise definitions and clear technical solution of the many problems and developments associated with highway engineering.

To keep abreast of overseas trends and developments, I would be appreciative if you would place my name on your mailing list, so privileging me to benefit from your works and investigations.

Yours faithfully,

J. W. HEID

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BERGENS MUSEUMS BIBLIOTEK  
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BERGEN, NORWAY

DEPARTMENT OF PUBLIC WORKS  
*Sacramento, California*

GENTLEMEN: Having seen your publication, *California Highways and Public Works*, mentioned in Ulrichs periodical directory, and considering it to be useful reading for the civil engineers visiting this library, I ask you, kindly, to place me on your mailing list and, if possible, to send some back numbers.

Sincerely yours,

R. SOLLIED  
Librarian

# HIGHWAY CONTRACTS TOTALING MILLIONS AWARDED

**U**NDER provisions of the Collier-Burns Highway Act authorizing him to take such action, Director of Public Works C. H. Purcell on April 1st awarded for the Division of Highways, 29 contracts for projects in the 1949-50 Budget, which covers the fiscal year between July 1, 1949, and June 30, 1950.

In addition to these 29 projects, there are seven projects on which bids were opened before April 1st and contracts for which were pending award as California Highways and Public Works went to press.

The total construction value of these 36 projects amounts to \$8,418,200, which total includes construction engineering, supplemental work and contingencies.

Purcell's action meant that these projects, for which the California Highway Commission made allocation for the fiscal year beginning next July 1st, could be undertaken immediately.

As of April 1st bids on highway projects outstanding and awaiting formal opening amounted to approximately \$13,190,800.

The Collier-Burns Highway Act of 1947 became effective on July 1, 1947. For the three fiscal years between that date and June 30, 1950, the Highway Commission has budgeted a total of \$234,895,000 for construction, construction engineering, and right of way on state highways, streets and bridges. These budgets represent improvement of 1,456 miles of highways and 375 structures.

The contracts awarded are:

County	Location	Amount (including construction engineering)	Description
Alameda.....	Between Castro Valley Junction and San Leandro.....	\$286 600	On U. S. 50; place plant-mixed surfacing on crusher run base and barrier posts; length 3.3 miles.
Alameda.....	Between Alvarado and San Leandro (portions).....	189 300	On State Sign Route 17; place plant-mixed surfacing on crusher run base; length 5.4 miles.
Alameda.....	Across S. P. Co. tracks on Eastshore Freeway at High Street.....	821,900	On State Sign Route 17; construct overhead grade separation.
Alameda.....	In Hayward.....	99,900	On State Sign Route 9 and U. S. 50; place plant-mixed surfacing on cement treated base; length 1.8 miles.
Contra Costa.....	Between 3.5 miles S. E. of Brentwood and Byron Road.....	71,600	On State Sign Route 4; place plant-mixed surfacing; length 1.4 miles.
Contra Costa.....	Between Martinez Road and Willow Pass (portions).....	183,900	On State Sign Route 4; place plant-mixed surfacing on crusher run base; length 3.6 miles.
Del Norte.....	Richardson Creek to Klamath (portions) and between 10.6 miles and 6.3 miles south of Crescent City.....	294,600	On U. S. 101; place plant-mixed surfacing on cement treated base; length 4.8 miles.
*Del Norte.....	At Bear Creek, N. E. of Crescent City.....	38,800	On State Sign Route 81; grade roadway and place culvert; length 0.3 miles.
Glenn.....	Glenn-Colusa Canal at Hamilton City.....	13,200	On State Sign Route 32; redeck bridge.
Humboldt.....	7.6 miles to 10.4 miles north of Orick.....	122,600	On U. S. 101; place plant-mixed surfacing on cement treated base; length 2.8 miles.
*Humboldt.....	0.5 mile south of Stone Lagoon Summit to one mile south of Orick.....	802,400	On U. S. 101; grade roadway and place culvert; length 3.8 miles. Replaces winding hillside road with direct road across sand spit.
Humboldt.....	Camp Creek near Orleans.....	55,500	On State Sign Route 96; construct bridge.
Kern.....	Snow Road to Cawelo (portions).....	124,400	On U. S. 99; place plant-mixed surfacing on untreated rock base; length 7.6 miles.
Kern.....	Jerry Slough, 19 miles west of Bakersfield.....	15,400	On State Sign Route 178; construct bridge and two culverts.
Kern.....	At Cow Creek about 11 miles N. E. of Bakersfield.....	10,100	Construct culvert and approaches; length 0.1 mile.
Lake.....	1.3 miles to 6.9 miles north of Putah Creek.....	165,500	On State Sign Route 53; grade roadway and place seal coat; length 1.4 miles.
Los Angeles.....	Carson Street, across San Gabriel River.....	329,300	On State Sign Route 18; construct bridge and approaches; length 0.6 mile.
Marin.....	Petaluma Creek at Green Point.....	23,500	On State Sign Route 37; redeck bridge.
Mendocino.....	Sherwood Road to Sapp Creek.....	340,700	On U. S. 101; place plant mixed surfacing on cement treated base; length 8.4 miles.
Merced-Stanislaus.....	Merced River to Delbi and Merced-Stanislaus County Line to Hatch Crossing.....	105,300	On U. S. 99; place plant mixed surfacing; length 7.3 miles.
Merced.....	Highline Canal Bridge to Los Banos (portions).....	57,400	On State Sign Route 152; place plant mixed surfacing on untreated rock base; length 2.0 miles.
Riverside.....	1.5 miles east of Garnet to Edom.....	147,500	On U. S. 60, 70, 99; place plant mixed surfacing and seal coat; length 10.4 miles.
Riverside.....	In Hemet.....	23,900	On State Sign Routes 74 and 79; place plant mixed surfacing; length 1.5 miles.
*Riverside.....	Palm Springs to 0.4 mile south of city limits.....	25,700	On State Sign Route 111; place plant mixed surfacing; length 2.5 miles.
*San Bernardino.....	Arrow Highway to 0.1 mile north of 14th Street in Upland.....	16,000	Place plant mixed surfacing; length 1.1 miles.
San Bernardino.....	Long Point to 1.3 miles west of Running Springs.....	934,900	On State Sign Route 18; grading roadway, plant mixed surfacing; length 4.0 miles. Will open this highway to traffic and relieve congestion on Waterman Canyon Road.
San Joaquin.....	Mariposa Road to Calaveras River and Wilson Way to Route 4.....	1,280,600	On U. S. 99 and U. S. 50; Portland cement concrete paving and



San Joaquin.....	Southerly boundry to junction with Route 5.....	141,100	plant-mixed surfacing; 4-lane construction on U. S. 99; length 7.2 miles (grading and structures under previous contract). On State Sign Route 33; place plant-mixed surfacing on untreated rock base; length 8.3 miles.
San Joaquin.....	Potato Slough at Terminus.....	54,600	On State Sign Route 12; reconstruct bridge.
Santa Clara.....	Ford Road to Morgan Hill.....	125,500	On U. S. 101; place plant-mixed surfacing; length 5.1 miles.
*Shasta.....	Anderson to Clear Creek.....	890,900	On U. S. 99; grade roadway and place plant-mixed surfacing on cement treated base, structures; length 5.8 miles.
Siskiyou.....	Camp Lowe at Bailey Hill.....	315,400	On U. S. 99; place plant-mixed surfacing on crusher run base; length 7.8 miles.
Siskiyou.....	At Dillon Creek, 27 miles north of Orleans.....	199,700	On State Sign Route 96; construct steel bridge and approaches.
Stanislaus-San Joaquin.....	Salida to Lodi (portions).....	10,100	On U. S. 99; landscaping.
Tulare.....	Route 134 to Packwood Creek.....	63,800	Place plant mixed surfacing and seal coat; length 5.8 miles.
Yolo.....	Across Sacramento River at Knights Landing.....	36,700	On State Sign Route 24; redeck bridge.
1949-50 Budget.....		\$8,418,200	

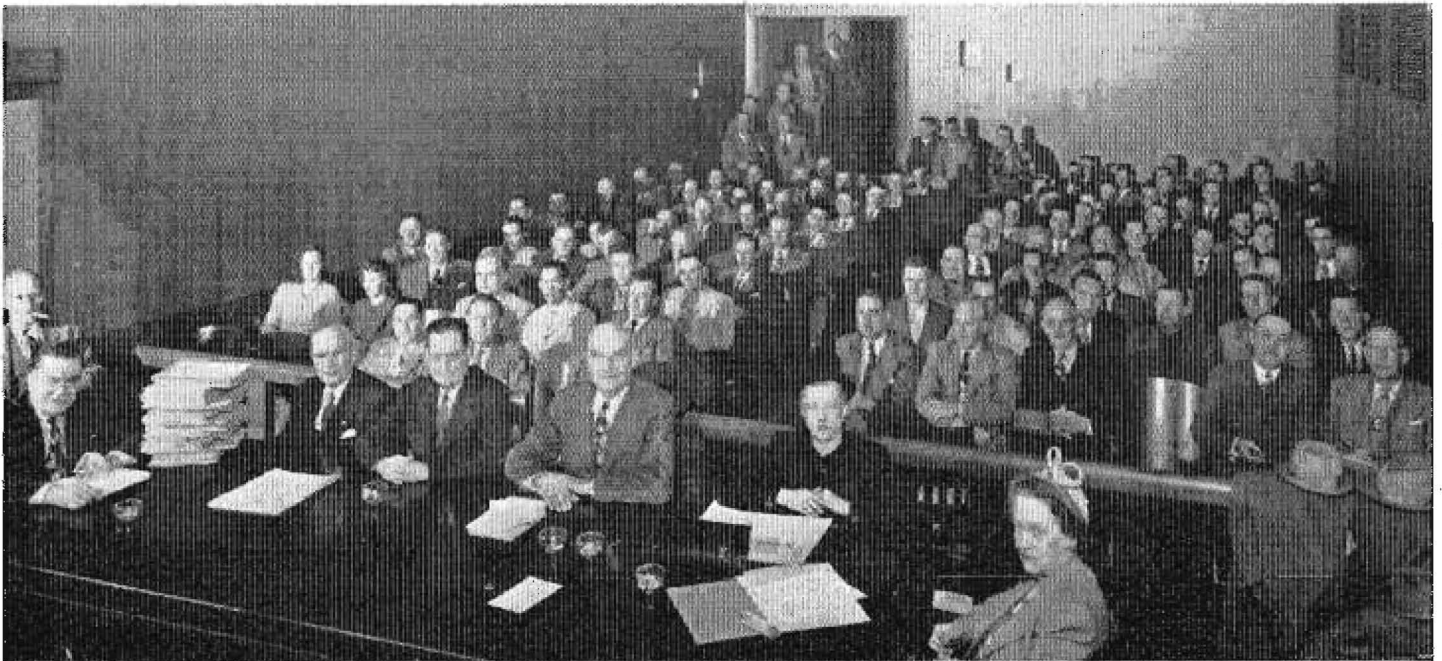
\* These projects were temporarily pending award on April 1st.

### Projects in 1949-50 Budget for Which Calls for Bids Were Outstanding April 1, 1949

County	Location	Amount (including construction engineering)	Description
Alameda.....	On Eastshore Freeway in Oakland, between south city limits of Oakland and High Street.....	\$1,994,000	On State Sign Route 17; grading and paving six lane freeway with structures, 3.2 miles in length. Will open this important freeway to traffic from Sixth and Oak Streets to south city limits.
Butte.....	East city limits of Oroville to Feather River Bridge.....	92,700	On State Sign Route 24; untreated rock base and seal coat 4.1 miles.
Colusa-Glenn.....	4 miles south of Williams to 0.3 mile south of Willows.....	59,300	On U. S. 99W; 26.3 miles bituminous surface treatment.
Contra Costa.....	3.5 miles east of Broadway Tunnel to Route 107 in Walnut Creek.....	862,700	On State Sign Route 24; 5.6 miles grade and plant mixed surface to provide 4-lane highway.
Fresno.....	Between Church Avenue and Broadway in Fresno.....	25,800	Landscaping recently constructed freeway on U. S. 99—1.2 miles in length.
Imperial.....	Between Plaster City and El Centro.....	70,900	On U. S. 80; 6.0 miles road-mixed surfacing.
Imperial.....	Between Holtville and Brawley and between Heber and Brawley.....	56,600	3.4 miles road-mixed surfacing.
Inyo.....	Between 1 1/4 miles south of Lone Pine and Bishop.....	77,400	On U. S. 6, 396; road mixed surfacing on 18.1 miles between these limits.
Inyo.....	At Owens River and Lower McNally Canal.....	64,900	On U. S. 6; bridges and approaches.
Kings.....	Between five miles north of Kettleman City and Fifth Standard Parallel south.....	154,000	On State Sign Route 14; 5.3 miles grade and bituminous surface treatment.
Kern.....	Between Fort Tejon and 1.4 miles north of Grapevine.....	295,200	Installing traffic deflectors on 5 miles of Grapevine grade on U. S. 99.
Kern.....	Between Naval Ordnance Test Station Gate and San Bernardino County Line.....	39,700	4 miles roadmix surfacing.
*Los Angeles.....	On Santa Ana Parkway at Los Angeles Street in Los Angeles.....	572,300	On U. S. 101; two reinforced concrete overcrossings as units of Hollywood and Santa Ana Parkway development.
*Los Angeles.....	Between 0.3 mile north of Los Alamos Creek and 2.3 miles south of Junction of Route 59 near Gorman.....	1,213,900	On U. S. 99; widening to divided four-lane standards 6.7 miles of Ridge Route.
Los Angeles.....	On Sepulveda Boulevard between Playa Street and east city limits of Culver City.....	94,500	On State Sign Route 7; grading and plant mixed surfacing on 1.0 miles.
Los Angeles.....	Between Orangethorpe Avenue and Firestone Blvd.....	92,200	On State Sign Route 35; 3.4 miles of plant mixed surfacing on Pioneer Boulevard south of Norwalk.
Madera.....	Between Dry Creek and 0.5 mile north of Berenda.....	449,500	On U. S. 99; 2.4 miles grading and paving and reinforced concrete bridge.
Placer.....	One mile east of Auburn to one mile west of Applegate.....	1,390,000	Constructing 6.1 miles of 4-lane divided highway on U. S. 40 east of Auburn including 2 major structures.
Riverside.....	Shavers Well to Desert Center and 4 miles west of Hopkins Well to Black Butte.....	124,000	Road-mixed surfacing on 10.9 miles of U. S. 60-70.
San Diego.....	Across Sweetwater River.....	89,700	On State Sign Route 79; bridge and approaches 16 miles south of Julian.
San Diego.....	East of Santa Ysabel and west of Ramona.....	87,400	On State Sign Routes 78 and 79; grade and bituminous surface treatment on 1.3 miles.
San Francisco.....	On Bay Shore Freeway between Augusta Street and 25th Street.....	3,912,100	On U. S. 101, A14; development of six-lane freeway on 1.3 miles of Route of the Bay Shore in the city of San Francisco, including structures.
San Joaquin.....	Brennan Road to Easterly County Boundary.....	121,900	On State Sign Route 120; plant mixed surfacing on 5.2 miles near Escalon.
San Luis Obispo.....	Between Cuesta Siding and 1 mile south of Santa Margarita.....	606,200	4-lane divided highway development on 2.1 miles of U. S. 101 north of San Luis Obispo.
Santa Barbara.....	Between Jalama Road and Route 149.....	495,700	On State Sign Route 1; grade and plant mixed surfacing on 4.3 miles on San Julian Road near Lompoc.
Siskiyou.....	Between Spring Hill and Weed.....	424,800	On U. S. 99; Black Butte overhead crossing and 4.3 miles grade and plant mixed surfacing.
Yolo.....	Between Winters and Route 7.....	223,500	Grade and bituminous surface treatment of Dunnigan cut-off.
Total.....		\$13,190,800	
1949-50 Budget only.....		\$11,404,600	

\* These are financed from 1948-49 Fiscal Year Budget but are included in this list because of their size and importance.

## CONTRACTORS SHOW INTEREST IN HIGHWAY BID OPENINGS



Upper—Bid opening in Public Works Building, Sacramento. Seated at table, left to right: Assistant State Highway Engineer Richard H. Wilson, Assistant Office Engineer John D. Gallagher, Office Engineer H. C. McCarty, William Bock, Assistant Office Engineer; Mrs. Austin Brumley, Daily Pacific Builder and Southwest Builder and Contractor; Helen Gardner, Daily Construction Service. Lower—Tabulating and checking bids. From left to right: O. T. Easterday, Duane G. Fountain, Leland Roberts, M. Fredericksen, Office Engineer H. C. McCarty, Lloyd B. Reynolds, Walter Landers, Herbert S. Marshall, Joseph C. Lacey, Sr.

**S**PRING brought a rush of work to the personnel in the office of Richard H. Wilson, Assistant State Highway Engineer, who has charge of the advertising and opening of highway bids.

On March 9th, some 150 contractors and materials men attended bid opening of the Division of Highways in Sacramento. Eighty-one proposals on 11 projects were received on an estimated \$1,351,400 worth of construction work. Again on March 16th, attendance at bid opening was 125. Proposals on seven projects involving \$781,169 worth of construction were received. The total number of bids was 64. On March 23d, contractors and materials men at the bid opening numbered 190. A total of 67 bids were received on seven projects of an estimated construction value of \$2,822,758. That contractors are being more careful in the preparation of their bids was indicated, Wilson said, by the fact that out of a total of 212 bids opened on these three dates, only two bids were found to be irregular and both of these involved license irregularities.

# Metallic Tapes

Continued from page 31 . . .

## Common Fault

The common fault of all four tapes is the weak end section. See Figure No. 5. It will be noted that tapes Nos. 1, 3 and 4 broke at the rivet hole. Sample No. 2 failed at the diagonal stitching at the end of the leather reinforcement; seemingly because of the sewing operation.

Tape No. 5 was made up at the laboratory. It consists of a one foot loop with a double row of stitching. The finger ring clip was riveted on using two solid rivets 0.050 inch in diameter instead of one hollow rivet 0.160 inch in diameter. This end developed the full strength of the tape, 110 pounds. Inasmuch as the original ring pulled out at 85 pounds, a sturdy replacement was necessary.

Laboratory tests were extended by means of field tests conducted by survey parties in the northern, central and southern sections of California. In general, the field tests bore out the laboratory findings in that the end sections of the tapes wore out soonest and that sample No. 4 was unsatisfactory. In ad-



Fig. 4

dition, it was determined that the average life of a metallic tape under field conditions was 100 hours of actual use.

## Recommendations

1. *Numerals*
  - a. The main numerals should be approximately one-half inch in height and imprinted with a medium that will withstand wear consistent with body of the tape.
2. *End Section*
  - a. The ring portion should be redesigned so that its tensile strength will be equal to that of the remainder of the tape.
  - b. The first two feet should be reinforced with the same material as is used in the body of the tape.

## Specifications

Proposed tentative specifications for the ribbon element of metallic tapes are promulgated as follows for the express purpose of arousing interest in this matter.

### Proposed Tentative Specifications for Metallic Tapes

#### Ribbon

- a. Each metallic tape shall be composed of a woven ribbon not less than five-eighths inch nor more than twenty-one thirty-seconds inch in width with selvage edges and of a length capable of measuring 50 or 100

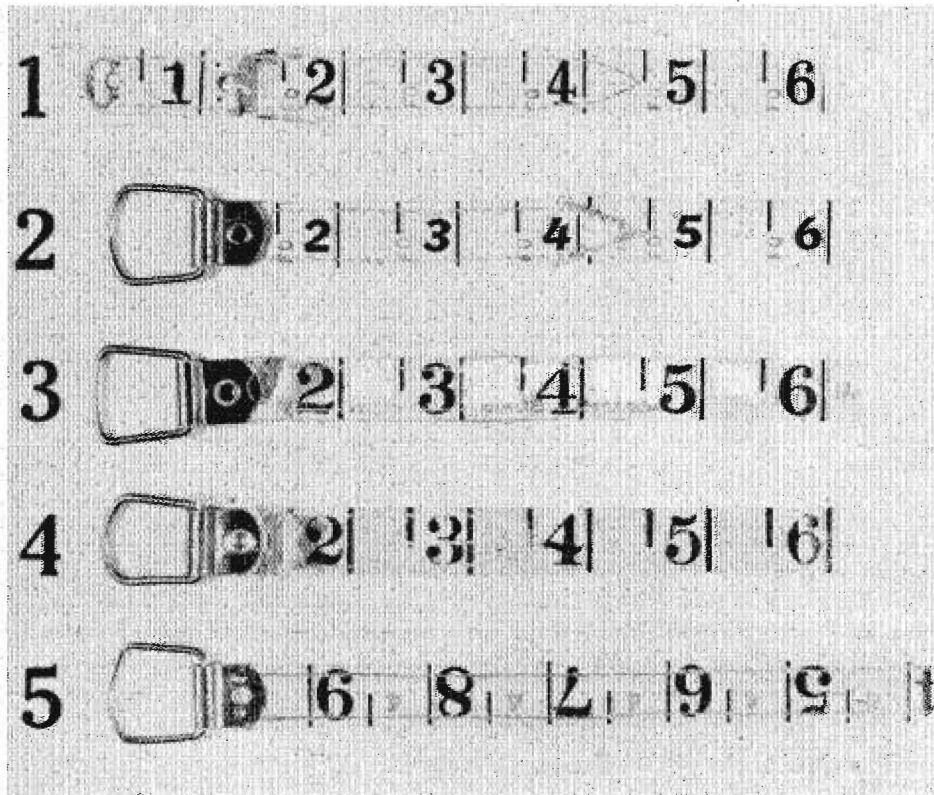


Fig. 5



feet as may be specified in the purchase order. Additional length of at least three inches shall be provided at the 50- or 100-foot end to provide for attachment to the case. The ribbon shall be completely impregnated and covered with a moisture resistant coating and shall have a breaking strength of not less than 115 pounds. There shall be a metal ring attached to the zero end of the ribbon in such a manner that when tested in tension in conjunction with the initial two feet of the ribbon shall develop a breaking strength of not less than 115 pounds. The initial two feet of the ribbon shall be reinforced with a portion of the ribbon material sewn, woven or attached to the body of the tape in such a manner that raveling of the edges shall not occur during the useful life of the tape. The reinforced portion when tested in tension in conjunction with the body of the tape shall develop a minimum breaking strength as stated above. The ribbon shall be so constructed at the 50- or 100-foot end so as to be readily attached or detached from case or reel by means of an ordinary hand tool such as a screwdriver.

#### **Graduations**

a. The ribbon shall be graduated on one side only in feet and tenths of feet or in feet and inches, as may be specified. Additional graduations of half tenths or half inches are optional with the vendor. Numerals shall be a minimum of seven-sixteenths inch in height with a minimum stroke of one-sixteenth inch except as noted below.

Graduation markings shall be a minimum of one thirty-second inch in stroke and shall extend the full width of the ribbon, except in the case of marking half tenths or half inches. Numerals shall be imprinted on the ribbon in such a manner so as to be readable throughout the abrasion test and will be printed in ink or other medium that will not fade, crack or scale off in storage. Graduations and numerals indicating portions of a foot shall be in black and shall contrast sharply with the background coloration of the ribbon. Foot mark numerals shall be in red. Intermediate foot mark numerals in red not to exceed one-fourth inch in height may be imprinted between numerals indicating tenths or inches, but shall not interfere in the legibility of these numerals.

The zero or point of beginning of graduation shall be at the outside end of the ring, unless otherwise specified.

#### **Accuracy**

a. The error in length of the ribbon fully supported and under a tension of three pounds shall not be more than 0.170 foot per 100 feet. Tapes shall be stressed at 10 pounds for one minute before this test. United States Bureau of Standard's calibrated steel tape shall be used as a means of comparison and results recorded to 0.005 foot.

#### **Abrasion**

a. Three sample tapes taken from vendor's stock shall be submitted for test at time of submission of bid. The abrasion test shall be conducted in con-

formity with test procedure promulgated by the California Division of Highways using their metallic tape abrasion machine. After 3,500 cycles on this machine, the tape shall be cut apart and measured wet for length. After drying for at least eight hours at not more than 150 degrees Fahrenheit the loss in weight and change in length is determined.

Loss in weight, expressed in percent after 3,500 cycles, shall not exceed 25 percent. Error due to change in length after abrasion, both wet and dry, shall not exceed 0.75 percent. Tapes shall be legible and in serviceable condition after test.

#### **General**

a. All tests shall be made in triplicate and the average results reported. Any result obviously in error shall be discarded and the test rerun.

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## **Motorists in State Pay 115 Million in 1948 Federal Taxes**

California motorists paid an estimated \$115,250,000 in federal excise taxes during 1948, according to the Automobile Club of Southern California.

This represents an approximate 10 percent of the total amount of \$1,179,865,417 paid by motorists in the entire Nation last year.

California again topped all other States in the amount of such motorists' taxes collected during the year.

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## **Exchange Ideas**

*Continued from page 39 . . .*

a matter of fact, in that organization the appraisal report is considered as the very foundation upon which successful right of way negotiations are carried on, and they feel that this procedure represents the only known method that is entirely fair to both the property owner and the State.

California's approach to access restrictions and construction of outer highways on freeways and limited freeways is a study in itself, well worth the time and expense required by any state highway organization personnel to afford them an opportunity to see

the manner in which California has attacked and overcome these difficult problems.

I concur in the feeling of the five Oregon right of way representatives who visited California, that the mutual benefits that have accrued to both right of way organizations because of this opportunity to exchange views on right of way problems well justify a nation-wide policy under which every right of way department from time to time would arrange for special groups to visit other states for the purpose of studying the procedure and field results, and frankly discussing mutual problems.

The adoption of a program of this kind even on a regional scale certainly would offer the several state highway

right of way agents and their organizations the opportunity to take advantage of new trends and new ideas.

The concluding paragraph of a report submitted to me by our special right of way committee, which I quote below, is a fine indication of the friendship that now exists between these two great right of way organizations:

"We wish to say that the friendly cooperation received from each and every member of the California Highway Department and its right of way organization with whom we came in contact, was a real gesture of friendship, exemplifying the efficient organization that has been built up for the people of the State of California."

# Annual Meeting

District Right of Way  
Agents Discuss Problems

By RUDOLF HESS, Headquarters Right of Way Agent

THE DISTRICT Right of Way Agents of the Division of Highways convened this year with the set purpose of thoroughly discussing and digesting an 18-subject agenda.

The meeting was held in Sacramento on February 24th-25th under the guidance of Frank C. Balfour, Chief Right of Way Agent, who was assisted in the presentation of the subjects by Assistant Chief Right of Way Agents R. S. J. Pianezzi on Administration, E. M. MacDonald on Appraisals, E. M. Wagner and George Pingry on Supervision.

As the entire right of way organization swings into full stride in every section of the State on an acquisition program unparalleled in highway con-

struction annals, the importance of the annual meeting was forcibly brought to light.

#### Large Attendance

The attendance at this session included 11 district right of way agents, the assistant district right of way agents from the metropolitan areas, and headquarters staff. In addition, all matters pertaining to the legal, construction, planning and administration phases were handled by representation from those departments.

It was obvious at all times during the session that the gathering and dissemination of information gained from current solutions of the varied problems confronted in the purchasing and clearing of right-of-way can be han-

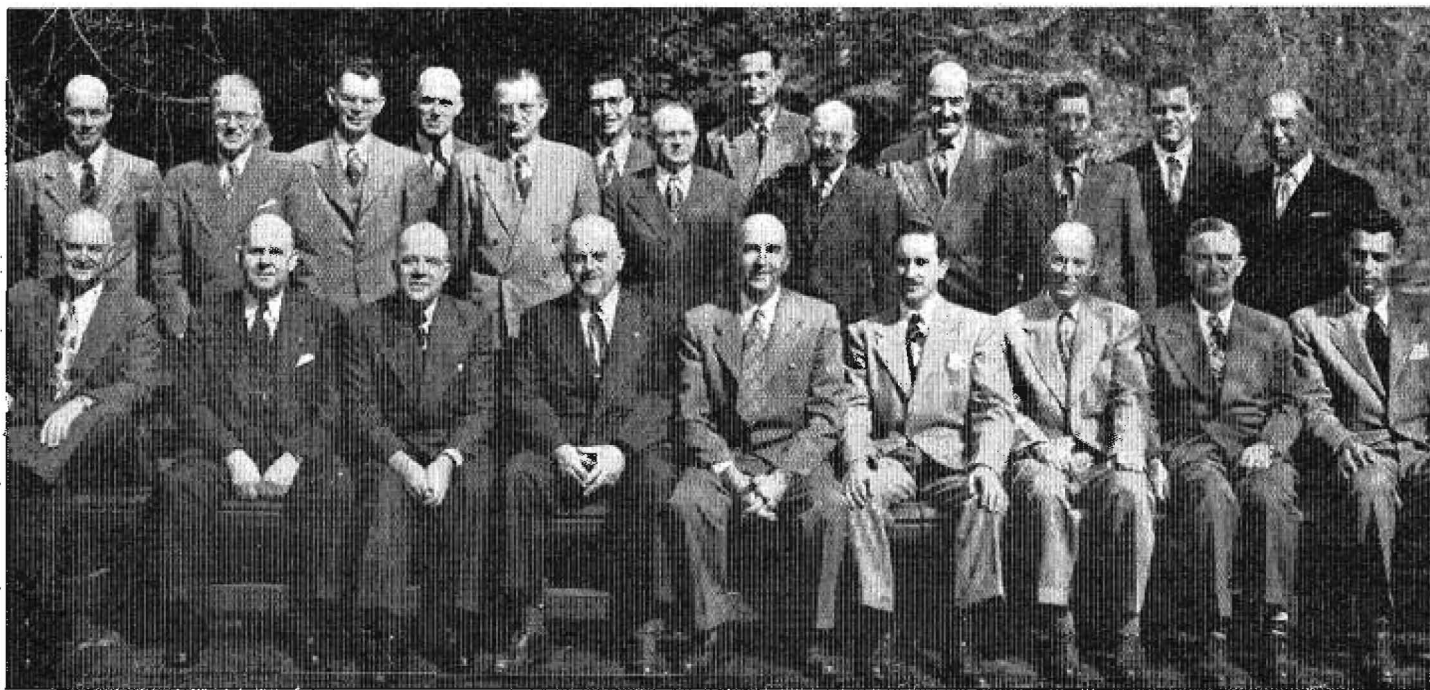
dled only by a meeting of this kind.

The discussion of appraisals, a number one item on our agenda, was conducted by Mr. MacDonald, and a simplified form of appraisal submission was presented for comments and review. Special emphasis was placed on the rapidly developing factual information in the determination of access values. This phase of appraisal work was later augmented by the viewing and study of slides showing how the reestablishment of business and residential property had been accomplished.

#### Many Subjects Discussed

No aspect of right of way acquisition program presents so many problems

... Continued on page 14



**RIGHT OF WAY REPRESENTATIVES ATTENDING ANNUAL STATE HIGHWAY RIGHT OF WAY AGENTS' MEETING IN SACRAMENTO, FEBRUARY 24-25, 1949. Front row, reading left to right:** E. M. MacDonald, Assistant Chief Right of Way Agent, Appraisals; George S. Pingry, Assistant Chief Right of Way Agent, Supervision (Northern); E. F. Wagner, Assistant Chief Right of Way Agent, Supervision (Southern); Frank C. Balfour, Chief Right of Way Agent; R. S. J. Pianezzi, Assistant Chief Right of Way Agent, Administration (Headquarters Office); Rudolf Hess, Headquarters Right of Way Agent; J. T. Zeeman, Headquarters Right of Way Agent; Fred C. Moore, District Right of Way Agent, District V, San Luis Obispo; Wayne Hubbard, District Right of Way Agent, District X, Stockton. **Standing, left to right:** John C. Webb, District Right of Way Agent, District XI, San Diego; R. H. Ramsey, District Right of Way Agent, District I, Eureka; J. W. Groathead, Office Right of Way Agent, District VII, Los Angeles; Newell Grover, Senior Right of Way Agent, District IV, San Francisco; John S. Daniels, Metropolitan District Right of Way Agent, District IV, San Francisco; Clarence Piper, District Right of Way Agent, District II, Redding; Harold W. Leonard, Metropolitan District Right of Way Agent, District VII, Los Angeles; Gilbert Mulcahy, District Right of Way Agent, District III, Marysville; George Grohman, Headquarters Right of Way Engineer; Earle R. Bunker, District Right of Way Agent, District VI, Fresno; Ray E. O'Bier, District Right of Way Agent, District VIII, San Bernardino; Alfred Lynch, Headquarters Right of Way Agent; Serge Ray, District Right of Way Agent, District IX, Bishop



*Aerial view of recently completed Monterey overhead in Fresno. Cherry Avenue now closed at Southern Pacific Railroad grade crossing*

## Major Project

*Continued from page 29 . . .*

storage yard which the contractor was able to make use of to very good advantage. Having this level paved area to use for a working platform, it was possible to construct moveable falsework which could be reused with a minimum of work to make the change. Falsework and forms were used first on the east lane span then were lowered and slid over and wedged up to be reused on the west lane spans. Follow-

ing are the approximate quantities of the major items for the construction of the two bridges: 10,900 cubic yards structure concrete; 7,300 cubic yards structure excavation; 3,800 cubic yards structure backfill; 2,325,000 pounds reinforcing steel; 546,000 pounds structural steel.

The construction of this section of freeway with the two structures traversing one of the most congested and difficult sections of Fresno, has immeasurably facilitated the passage of

through traffic through this area. With the completion of these units, another section of substandard and hazardous highway has been removed from the State Highway System.

The Guy F. Atkinson Company of San Francisco was the contractor on both the bridges and road work and the contract was administered by District VI of the Division of Highways, with P. A. Boulton acting as Resident Engineer and T. W. Rodgers as Bridge Department representative.



# Highway Bids and Awards for January, February, March, 1949

## January, 1949—Continued

**LOS ANGELES COUNTY**—On Valley Boulevard, between San Bernardino Road and Garvey Avenue, furnishing and installing full traffic actuated traffic signal system with highway lighting at one intersection, furnishing and installing fixed-time traffic signal system with highway lighting at one intersection and reconstructing fixed-time traffic signal system at one intersection. District VII, Route 77. Clinton Electric Corp., Los Angeles, \$14,885; Ed Seymour, Long Beach, \$15,740; C. D. Draucker Inc., Los Angeles, \$15,840; Tri-Cities Electrical Service, Inc., Los Angeles, \$16,377; Ets-Hokin & Galvan, San Diego, \$16,446; Econolite Corp., Los Angeles, \$16,762; Paul Gardner, Ontario, \$17,187; Electric & Machinery Service, Inc., South Gate, \$18,619. Contract awarded to Prescott Electric & Mfg. Co., Los Angeles, \$14,000.

**LOS ANGELES COUNTY**—In connection with the Arroyo Seco Parkway at Fair Oaks Avenue in South Pasadena and at State Street in Pasadena, a new off-ramp to be graded and surfaced with plant-mixed surfacing on untreated rock base and the existing off-ramp to be closed. District VII, Route 205. A. A. Edmondson, Glendale, \$19,868; Griffith Co., Los Angeles, \$21,725; Parker Engineering Co., Claremont, \$23,235. Contract awarded to J. E. Haddock, Pasadena, \$19,666.

**SANTA CRUZ AND SAN MATEO COUNTIES**—Between Waddell Creek and Finney Creek, a distance of about 1.3 miles, 12-inch welded steel water pipe line to be installed. District IV, Route 56, Sections C, A. George Stout, Merced, \$20,922; Granite Construction Co., Watsonville, \$21,780; E. T. Haas Co., Belmont, \$23,100; Pisano Bros., San Jose, \$23,232; Martin Bros., Concord, \$32,340; Pacific Pipeline & Engineers, Ltd., El Cerrito, \$32,406; McGuires & Hester, Oakland, \$34,848; Baldwin, Straub Corp., San Rafael, \$38,610; Associated Engineers, Inc., Palo Alto, \$40,590. Contract awarded to Underground Construction Co., Oakland, \$14,322.

## F. A. S. County Projects

**EL DORADO COUNTY**—Between Diamond Springs and Bell Ranch, about 4.7 miles to be graded and penetration treatment and seal coat applied. District III, Route 1095. P. J. Moore & Son, North Sacramento, \$96,271; Rice Bros. Inc., Marysville, \$100,751; Westbrook & Pope, Sacramento, \$106,144; H. W. Ruby, Sacramento, \$110,320; A. Teichert & Son, Inc., Sacramento, \$112,930; Frederickson Bros., Emeryville, \$114,219; Jensen & Pitts, San Rafael, \$116,026; Nevada Construction, Inc., Reno, \$131,775; Chittenden & Chittenden Auburn, \$136,060; Arthur B. Siri, Inc., San Rafael, \$138,529; O. C. Jones & Sons, Berkeley, \$142,103; Oilfields Trucking Co. & Phoenix Construction Co., Bakersfield, \$144,277; Brighton Sand & Gravel Co., Sacramento, \$145,290; McGillivray Construction Co., Sacramento, \$154,388; J. Henry Harris, Berkeley, \$172,367. Contract awarded to M. W. Brown, Redding, \$88,547.

**FRESNO COUNTY**—On Highland Avenue, between Elkhorn Avenue and State Highway Route 4, about 6.4 miles to be graded and surfaced with plant-mixed surfacing on untreated rock base. District VI, Route 568. Brown & Doko, Pismo Beach, \$222,571; Granite Construction Co., Watsonville, \$229,426; P. J. Moore & Son & Harms Bros., Sacramento, \$235,235; Gene Richards, Fresno, \$235,856; Westbrook & Pope & A. G. Raisch Co., Sacramento, \$237,446; A. Teichert & Son, Inc., Sacramento, \$239,898; Ted F. Baun, Fresno, \$239,471; Volpa Bros., Fresno, \$239,762; N. M. Bali Sons, Berkeley, \$254,545; Frederickson Bros., Emeryville, \$256,198; M. J. Ruddy & Son, Modesto, \$261,675; Guy F. Atkinson Co., So. San Francisco, \$269,401. Contract awarded to Oilfields Trucking Co. & Phoenix Construction Co., Bakersfield, \$212,968.

## February, 1949

**CONTRA COSTA COUNTY**—Between Forty-seventh Street and Garrard Boulevard in Richmond, furnishing and installing traffic signals and highway lighting systems. District IV, Route 69. Scott Butner Electric Co., Inc., Oakland, \$48,165; L. H. Leonard Electric Construction Co., San Rafael, \$48,285; H. C. Reid & Co., San Francisco, \$49,925; Del Monte

Electric Co., Oakland, \$50,548; R. Gould & Son, Stockton, \$50,690; Abbott Electric Corp., San Francisco, \$50,730; Severin Electric Co., San Francisco, \$51,057. Contract awarded to Tri-Cities Electrical Service, Inc., Los Angeles, \$48,109.

**KERN COUNTY**—Installing metal guard railing and constructing walkways in Mojave. District IX, Route 23. Anderson Co., Visalia, \$8,999; Browne & Krull, Hayward, \$9,312; Edward Green, Los Angeles, \$10,468; Dimmitt & Taylor, Monrovia, \$11,662; Bishop Engineering & Construction Co., Bishop, \$12,947; R. A. Erwin, Colton, \$13,903. Contract awarded to G. & H. Paving Co., Los Angeles, \$5,769.

**LOS ANGELES COUNTY**—On Hollywood Parkway at Heliotrope Drive, in the City of Los Angeles, a reinforced concrete box girder overcrossing to be constructed. District VII, Route 2. W. J. Disteli & R. J. Daum Construction Co., Los Angeles, \$509,497; Spencer Webb Co., Los Angeles, \$514,559; Chas. J. Rounds & Lars Oberg Contractors, Los Angeles, \$516,013; C. B. Tuttle Co., Long Beach, \$527,586; J. E. Haddock, Ltd., Pasadena, \$528,519; Guy F. Atkinson Co., Long Beach, \$536,613; Peter Kiewit Sons Co., Arcadia, \$553,729; Granite Construction Co., Watsonville, \$564,826; Davies, Keusder & Brown, Los Angeles, \$570,271. Contract awarded to Chas. MacClosky Co., San Francisco, \$506,752.

**LOS ANGELES COUNTY**—On Santa Ana Parkway between La Verne Avenue and Eastland Avenue, including the Atlantic Boulevard interchange, furnish and install full traffic actuated signal systems and highway lighting. District VII, Routes 166, 167, Sections A.A. C. D. Draucker, Inc., Los Angeles, \$79,990; Ets-Hokin & Galvan, San Diego, \$82,030. Contract awarded to Econolite Corp., Los Angeles, \$76,840.

**RIVERSIDE COUNTY**—Across Sleepy Draw, about 13.5 miles southeast of Indio, a reinforced concrete slab bridge to be constructed. District XI, Route 64, Section H. E. G. Perham, Los Angeles, \$28,993; Troy Construction, Inc., Los Angeles, \$29,309; Thomas Construction Co., Newhall, \$30,434; Hensler Construction Corp., Glendale, \$31,594; E. L. Thorsten, Santa Monica, \$31,746; J. A. Payton, Riverside, \$32,260; Threewitt & Webb, Bakersfield, \$32,468; Geo. W. Peterson, Los Angeles, \$32,590; Clifford C. Bong & Co., Arcadia, \$32,660; Northrup Construction Co., Long Beach, \$32,923; R. M. Price & O. B. Pierson, Altadena, \$33,201; C. B. Tuttle Co., Long Beach, \$34,105; Byerts & Sons, Los Angeles, \$34,707; T. A. Kvale, Alhambra, \$35,871; Peterson Construction Co., Montevia, \$36,030; Claude Fisher Co. Ltd., Los Angeles, \$36,329; K. B. Nicholas, Ontario, \$38,349. Contract awarded to John Stroza, Pomona, \$28,155.

**VENTURA COUNTY**—At Montalvo truck scales, furnish and install lighting system and truck height gauges. District VII, Route 2, Section C. R. E. Ziebarth, Torrance, \$2,700. Contract awarded to Electric & Machinery Service, Inc., South Gate, \$2,613.

## F. A. S. County Projects

**SANTA CLARA COUNTY**—On Story Road between McLaughlin Avenue and White Road, about 2.5 miles to be graded and surfaced with plant-mixed surfacing on existing pavement and on imported base material. District IV, Route 1012. A. J. Raisch Paving Co., San Jose, \$83,285; Gene Richards, Fresno, \$84,330; Browne & Krull, Hayward, \$85,915; J. Henry Harris, Berkeley, \$95,096; Jensen & Pitts, San Rafael, \$98,020; Guerin & Morgan, Los Gatos, \$106,318. Contract awarded to Leo F. Piazza, San Jose, \$72,907.

**SUTTER COUNTY**—Between Sacramento County line and one mile south of Striplin Road, about 7.9 miles to be graded, imported borrow and imported base material to be placed and penetration treatment and seal coat applied. District III, Route 926. A. Teichert & Son, Inc., Sacramento, \$241,338; Peter L. Ferry & Son and John M. Ferry, Glendale, \$258,334; McGillivray Construction Co., Sacramento, \$269,608; Rice Bros. Inc., Marysville, \$278,347; W. H. O'Hair Co., Colusa, \$279,954; J. R. Reeves, Sacramento, \$285,960; Granite Construction Co., Watsonville, \$286,987; Brighton Sand & Gravel Co., Sacramento, \$327,210; Frederickson Bros., Emeryville, \$327,350; Clyde W. Wood, Inc., North Hollywood, \$357,171. Contract awarded to

P. J. Moore & Son & Harms Bros., Sacramento, \$234,033.

## March, 1949

**CONTRA COSTA COUNTY**—Between Cutting Boulevard and 24th Street, in the City of Richmond, about one mile to be resurfaced. District IV, Route 69. E. A. Fordc. San Anselmo, \$22,446; J. R. Armstrong, El Cerrito, \$22,479; Ransome Company, Emeryville, \$22,587; Jensen & Pitts, San Rafael, \$25,930; O. C. Jones & Sons, Berkeley, \$26,648. Contract awarded to Lee J. Immel, San Pablo, \$21,462.

**FRESNO COUNTY**—At maintenance station at junction of Cedar Avenue and U. S. 99, erection of prefabricated steel buildings. District VI, Route 4, Section B. Hub City Erection Co., Compton, \$2,350; Loren B. Pipes, Fresno, \$2,363; Pascoe Construction Co., Pomona, \$4,830. Contract awarded to Fresno Rigging Co., Fresno, \$1,943.

**KERN COUNTY**—Between Ittner's and Ricardo, portions about 0.4 mile in length, embankment protection to be installed consisting of railroad rail, torpedo netting, rock backfill and anchor blocks. District IX, Route 23, Section C. George Stout, Merced, \$18,857; Huntington Bros., San Anselmo, \$19,377; G. & H. Paving Co., Los Angeles, \$24,659; Thomas Construction Co., Newhall, \$25,645; W. C. Lefever & Westbrook & Pope, Sacramento, \$26,905; Oilfields Trucking Co. and Phoenix Construction Co., Inc., Bakersfield, \$29,564; Nevada Constructors, Inc., Reno, \$29,782; Bishop Engineering & Construction Co., Bishop, \$31,366; Anderson Company, Visalia, \$36,022; Cox Bros. Construction Co., Stanton, \$36,430; Dimmitt & Taylor, Monrovia, \$38,221; Paul E. Woolf, Fresno, \$38,897; Edward Green, Los Angeles, \$44,442. Contract awarded to Peterson Construction Co., Monrovia, \$15,449.

**LOS ANGELES COUNTY**—On Hollywood Parkway, at East Edgeware Road in the City of Los Angeles, a reinforced concrete box girder overcrossing to be constructed and approaches thereto to be graded and surfaced with asphalt concrete and Portland cement concrete. District VII, Route 2. Charles MacClosky Co., San Francisco, \$123,984; Geo. W. Peterson, Los Angeles, \$124,192; Byerts & Sons, Los Angeles, \$124,878; Chittenden & Chittenden, Auburn, \$133,063; W. J. Disteli, Los Angeles, \$133,179; E. G. Perham, Los Angeles, \$133,543; Lars Oberg, Contractor, Los Angeles, \$137,289; C. B. Tuttle Co., Long Beach, \$137,937; N. M. Saliba Co., Los Angeles, \$148,525; Guy F. Atkinson Co., Long Beach, \$158,308. Contract awarded to J. E. Haddock, Ltd., Pasadena, \$118,697.50.

**SONOMA COUNTY**—At Laguna de Santa Rosa and at Purple Draw, between east city limits of Sebastopol and one-third mile east of Sebastopol, a bridge and culvert to be widened and about three-tenths mile to be widened and surfaced with plant-mixed surfacing on crusher run base. District IV, Route 51, Section C. C. B. Tuttle Co., Long Beach, \$63,082; G. M. Carr & Bati Rocca, Santa Rosa, \$65,285; H. Earl Parker, Inc., Marysville, \$67,361; Baldwin Straub Corp., San Rafael, \$68,618; Chittenden & Chittenden, Auburn, \$68,661; R. G. Clifford, South San Francisco, \$69,611. Contract awarded to A. G. Raisch Co., San Francisco, \$58,880.30.

**SOLANO AND YOLO COUNTIES**—Across Putah Creek about 2.5 miles east of Davis and about 2.5 miles south of State Highway Route 6, a reinforced concrete slab bridge to be constructed. District X. C. B. Tuttle Co., Long Beach, \$82,183; H. Earl Parker, Inc., Marysville, \$83,537; Thomas Construction Co., Newhall, \$87,175; H. W. Ruby, Sacramento, \$88,265; Chittenden & Chittenden, Auburn, \$88,301; Lew Jones Construction Co., San Jose, \$89,405; Brighton Sand and Gravel Co., Sacramento, \$91,072; E. G. Perham, Los Angeles, \$92,451; Dan Caputo, San Jose, \$92,595; A. L. Miller, Sacramento, \$93,002; Lord & Bishop, Sacramento, \$94,321; Granite Construction Co., Watsonville, \$94,355; E. H. Peterson & Son, Richmond, \$96,191; Underground Construction Co., Oakland, \$97,050; Frederickson and Watson Construction Co., Oakland, \$99,947; Baldwin, Straub Corp., San Rafael, \$100,820; Metzger Co., Los Angeles, \$102,618; O'Connor Bros., Red Bluff, \$108,737; Bates & Rogers Construction Corp., San Francisco, \$117,151. Contract awarded to Frederickson Bros., Emeryville, \$80,111.

# Unique Span

Rock Creek Bridge Created  
Problems for Engineers

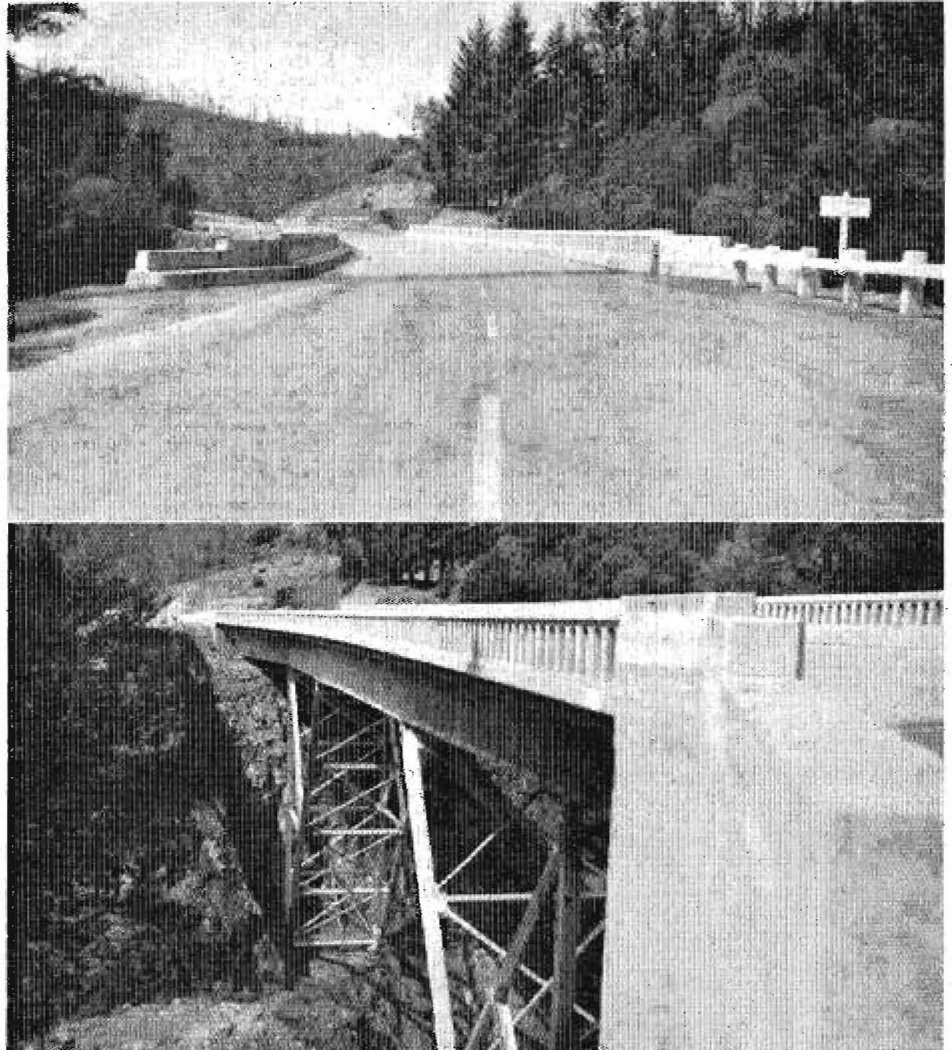
By WENDELL F. POND, Associate Bridge Engineer

WITH THE completion of the Rock Creek Bridge on the Redwood Highway in Mendocino County, a new and unique type of bridge has been added to the California Highway System. This bridge is a satisfactory solution to the problem of spanning a deep, narrow canyon without having to resort to the use of one of the more conventional and relatively expensive types of bridge structures.

The need for this crossing of Rock Creek goes back to 1937, when it was discovered that an existing timber arch, located approximately on the site of the new bridge, was in danger of immediate collapse. A temporary timber trestle was constructed about forty feet upstream and connected to the highway by means of approaches having fairly sharp reversing curves. The trestle was posted for a load limit of 10 tons at 10 miles per hour and, with its abrupt curves at each end, presented a very substandard combination of structure and alignment. It was intended that this temporary structure would be replaced by a permanent bridge as soon as funds were available, but with the advent of the war, it became necessary to defer construction until this past year.

The terrain of the bridge site is such that a reinforced concrete arch would ordinarily be given first consideration in selecting an economical type of bridge to span the creek. Arch construction, however, requires a considerable amount of labor and lumber to erect the necessary falsework. At present prices, the extensive falsework is such an expensive item that consideration of an arch is less desirable than heretofore.

Some other types of bridges were also out of the question. A truss or ordinary plate girder would have required the use of large expensive equipment or the erection of an overhead highline to handle the large sections of steel. The cost of this special equip-



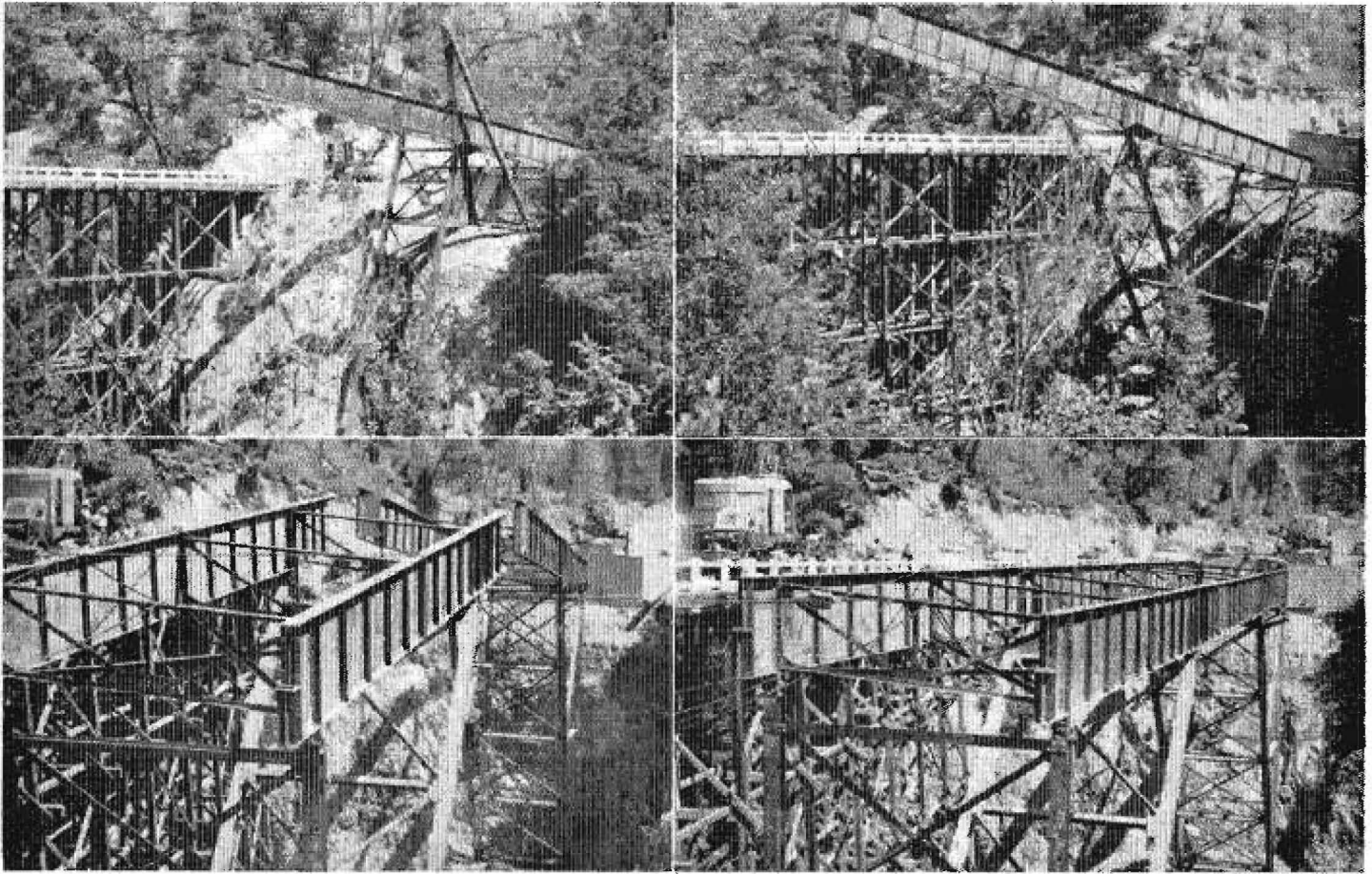
Upper—Approach to new Rock Creek Bridge, looking north. Lower—Looking north at downstream side of span

ment would represent a large item in the construction of a relatively small structure such as this one.

The problem then confronting the Bridge Department of the Division of Highways was to design a bridge that could be constructed across a canyon 250 feet wide and 145 feet deep without requiring the use of expensive equipment or the labor consuming erection of temporary falsework. The present bridge proved to be a satisfac-

tory solution to the problem. Due to the simplicity of design and the use of pin connections at the tops and bottoms of the columns, it was possible to assemble half the bridge on each bank and then lower the two halves to meet at the center. The various steps in the erection of the steel are illustrated by the accompanying photographs.

A mobile 20-ton crane was used to assemble the members on the ground and to set them in place. The only



Upper left—Columns and bracing were assembled on the ground back of the abutments and lowered to bearings by means of the mobile crane shown in background. Girder sections were spliced and then set on columns. Cross-bracing between the girders was temporarily bolted in place. Note portion of existing timber trestle at left. Upper right—The portion of the structure shown in preceding photograph was moved forward by means of a winch on the opposite bank until the back ends of the girders rested on the abutment wall. The remaining set of columns was lowered to the bearings and the girders lowered to the tops of these columns. Lower left—the two halves of the bridge were allowed to move forward by slackening on the two winches. Lower right—The two halves of the bridge are shown just after the connection was made. After erection pins and bolts had been placed in the girder splices, the two approach spans were placed with the crane. Final riveting of connections was then started

pieces of special equipment required were a pair of two-drum winches. These two winches were set up on the ground back of the abutments and were used to bring the two halves of the bridge together.

The new bridge is primarily a deck plate girder, continuous over three central spans and having two hinged approach spans. Due to the inclination of the two central supports, however, the structure is also a modification of a steel arch. The bridge is 252 feet long and is composed of five spans of 32 feet 6 inches, 50 feet, 66 feet, 50 feet and 53 feet 6 inches. A reinforced concrete deck provides for a roadway width of

26 feet between curbs. The deck is carried by two plate girders 6 feet in depth and spaced at 18-foot 6-inch centers.

Although the roadway at the site is on a 1,350-foot radius curve, it caused no special complications in design or erection. The girders of the three central continuous spans are necessarily in a straight line, but the ends of the girders of the approach spans are shifted over so that they are approximately centered under the deck.

The construction of 0.6 mile of new roadway was also included in this contract. The new alignment not only eliminates the substandard approaches

to the old bridge but also considerably improves the line and grade for approximately one-fourth of a mile from each end of the new bridge.

The total cost of this contract was \$174,500. Bridge construction accounted for \$118,000 of this amount, and the remainder was for road work.

H. W. Ruby of Sacramento was the general contractor, and J. D. O'Brien of Stockton erected the steel. The structure was designed and the contract administered by the Bridge Department of the Division of Highways with the writer acting as resident engineer.



## Annual Meeting

Continued from page 49 . . .

as the purchase and reestablishment of residential, business and industrial properties on freeways. Because of this fact, this phase of acquisition could have dominated the session. However, all other essential subjects were also covered.

Complete review and establishment of policy were made on items which have proven a constant source of difficulty, each being handled as a separate unit in the agenda. These items included unrecorded leasehold interests, contract change orders, clearing of right of way prior to the certifying of projects for advertising, salvage values and project reports.

The training program for junior and assistant right of way agents, which has been the groundwork in the establishment of our entire organization was a most important part of the session. From the experience gathered to date, it was agreed that a complete outline course to be uniformly used throughout the State would immediately be established.

### Training Program

This decision was reached after a thorough review of the results of our training program to date. Although it has proved highly successful, there is a natural tendency within each district to concentrate on the problems peculiar to its locale. By standardizing the training program it was felt that the organization would develop a greater flexibility of right of way manpower.

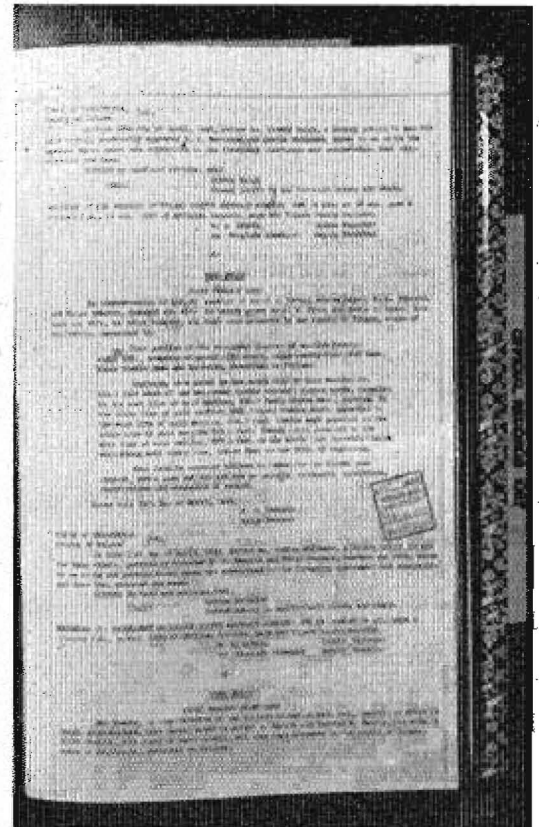
A committee was appointed, consisting of George S. Pingry, Chairman; E. M. MacDonald, Secretary; E. F. Wagner, H. W. Leonard, and J. C. Webb, to study and review the methods and material now used in all the districts, to coordinate all this material and to report with the proposed training program by May 1, 1949.

Under the agenda item of Condemnations, the district right of way agents brought up the inherent danger of the rapidly diminishing time allowed for right of way acquisition between the completion of plans and the project advertising.

. . . Continued on page 58

# Title Searching With Camera

By J. HOWARD LANG, Associate Highway Engineer



Left—Eastman 9x12 cm. Recomar camera and accessories set up for photographing records. Note scotch tape marking position of books to be photographed. Photos were taken at 1/50 sec. at f-11 on super XX film using a No. 2 photoflash. Focusing was done with the aid of a ground glass. The above "I" stop gives sufficient depth of focus to cover various book thicknesses. Right—Note ease with which photo may be read with a two power lens. A 5"x7" print can be easily read with the unaided eye

THE RIGHT OF WAY engineer is faced with the problem of correlating property lines as described in the official records with field ties of land corners and other evidence. Copies of the official records are essential to carry out this work.

In the past, these records have been abstracted longhand. This is a time consuming job. In many cases, insufficient detail is obtained and important errors in copying occur.

District VI has found that photographing the records will overcome the disadvantages mentioned above. The photographs will also show the recording data and the value of Internal Revenue stamps affixed. The latter information is helpful to the Right of Way Agent in making his "Sales and Listing Maps."

A comparative cost analysis is presented below. It is based upon an actual job using a camera to photograph the records of ownership along VI-Tul-10-B. The combined hourly rates for the middle step of an Associate Highway Engineer and of a Junior Civil Engineer are used for comparison.

COST PER 100 PARCELS		
Photography:		
Number of film used	110 at \$0.12 1/3	\$13.57
Developing film	9 1/6 packs at 0.25	2.29
Number of prints 5 x 7		
inches	105 at 0.20	21.00
Man hours—		
Photographer—J. C. E.	8 at 2.09	16.72
Long-hand:		\$53.58
Man hours—A. H. E.	16 at \$3.08	\$49.28

The necessary equipment for obtaining the information for the above analysis was assembled by Robert B. Parker, Assistant Highway Engineer.

. . . Continued on page 59

# Convict Labor

Continued from page 6 . . .

## Act of 1923

This act established the essentials of the present modern prison road camp pay-system.

Desirable and satisfactory features of the more important provisions of the 1923 act provided:

(a) That the Division of Highways of the Department of Public Works designate, supervise and maintain necessary camps and commissariat.

(b) That the State Board of Prison Directors<sup>5</sup> have full jurisdiction over the discipline and control of prisoners assigned to the road camp.

(c) That road camp prisoners be paid a wage by the Division of Highways for each day prisoners performed labor upon highway work, from which all expenses of prisoner's maintenance in the camp is to be deducted. It was also provided that the Division of Highways administer prisoner accounts, direct camp maintenance, and prisoner work activities.

(d) For payment of a reward for the capture of escaped road camp prisoners, to be taken from the earnings of other prisoners in the camp.

(e) For compulsory payment of two-thirds of a prisoner's earnings to dependents who may be receiving state aid, and voluntary allotments to dependents not receiving state aid.

(f) For retention of prisoners' earnings until release from prison, at which time earnings held to their credit are paid to them.

(g) Establishment of a fund entitled, "The Prisoner's Fund," to be used for recreational and educational purposes.

## 1915 Act Modified

The most important feature of the 1923 statutes, insofar as administration of the camps was concerned, was clarification and modification of the dual control provisions of the experimental 1915 act. The 1923 act placed responsibility for camp maintenance and prisoner work assignments with the Division of Highways.

An important feature of the 1923 statute, insofar as economic management and labor production is concerned, was the provision for paying prisoners a daily wage for their work and deducting the cost and maintenance from that wage. It was intended

<sup>5</sup> Now Director of Department of Corrections.

to serve a three-fold purpose and was planned to:

(1) Encourage a prisoner to work and to discourage layoffs, since he was paid only for the time that he actually worked for the highway—if the prisoner did not work, he was returned to prison.

(2) Encourage economy in camp maintenance, inasmuch as the prisoner's net earnings are the residue of his wages after expense of maintaining the camp, the cookhouse, care and welfare, and camp maintenance activities are deducted therefrom.

(3) Encourage the prisoner to accumulate cash savings for the time when he most needed money—upon release.

## Wage Paid Prisoners

The 1923 act provided that prisoners assigned to highway road camps be paid not to exceed \$2.50 per day for each day work was performed in the road camp. A wage of \$2.10 per working day was paid to prisoners for the 19-year period from 1923 to 1942. From this wage, all expense of camp maintenance was deducted, including food, clothing, medicine, medical attention, toilet articles, transportation<sup>6</sup> to the camp, commissary drawings, guarding,<sup>8</sup> and construction tools.<sup>7</sup>

With the increased cost of food-stuffs, clothing and other camp maintenance items, it became necessary for the State Legislature to raise the ceiling wage to \$3<sup>8</sup> in 1943 and to \$3.50<sup>9</sup> in 1947.

The average net prisoner earnings for the last 25 years since the pay system became effective in 1923, is 33 $\frac{1}{10}$  cents per working day, or \$8.74 per month, on the basis of 26 working days per month the present day earnings being approximately 50 cents per day. The maximum amount a prisoner is permitted to retain under the statutes is 75 cents per working day.

## Reward for Escapees

A reward of \$200 was authorized under the 1923 act for the capture and return of each escaped road camp prisoner. Provision was made for deduct-

<sup>6</sup> Cost of transportation and guarding transferred to Department of Corrections, Chapter 1380, 1947.

<sup>7</sup> Eliminated by 1935 Legislature.

<sup>8</sup> Chapter 642, Statutes 1943.

<sup>9</sup> Chapter 1380, Statutes 1947.

ing the reward amount from the earnings of the other prisoners in the camp, on the theory that it would act as a deterrent to escapes, since the remaining prisoners in the camp at the time of the escape had to pay the reward.

A time limit was placed on outstanding rewards for escaped prisoners by the 1935<sup>10</sup> Legislature, which was fixed at four years. Unclaimed rewards at the end of that period, which had already been deducted from prisoners' earnings on a pro rata basis, were deposited in the Prisoner's Fund, as provided in the law.

By 1941, the efficacy of the reward provisions of the 1923 statutes began to be questioned by both highway and prison authorities, with the result that the reward amount was reduced to \$150 by the 1941 Legislature.<sup>11</sup> A change in the amount to be assessed against the remaining prisoners in the camp was also made, wherein the amount to be assessed on a pro rata basis was reduced to the difference between the \$150 reward and the earnings held to the credit of the escaped prisoner.

Reward provisions were finally dropped from the statutes by the 1947 Legislature.

Provisions were made in the 1923 act for compulsory monthly allotment of two-thirds of a prisoner's net earnings to his dependents who are receiving state aid. Provision was also made for voluntary allotment to dependents, not to exceed two-thirds of a prisoner's net earnings, further limited to a minimum balance of \$25 in the prisoner's account.<sup>12</sup>

## Prisoner's Fund

A fund was set up for recreational and educational purposes, known as the "Prisoner's Fund," which was funded by forfeited prisoner earnings and escape rewards unclaimed after a period of four years.

The Prisoner's Fund was abolished as an entity by the 1947 Legislature<sup>13</sup> and combined with other recreational and educational funds under jurisdiction of the Department of Corrections,

. . . Continued on page 56

<sup>10</sup> Chapter 733, Statutes 1935.

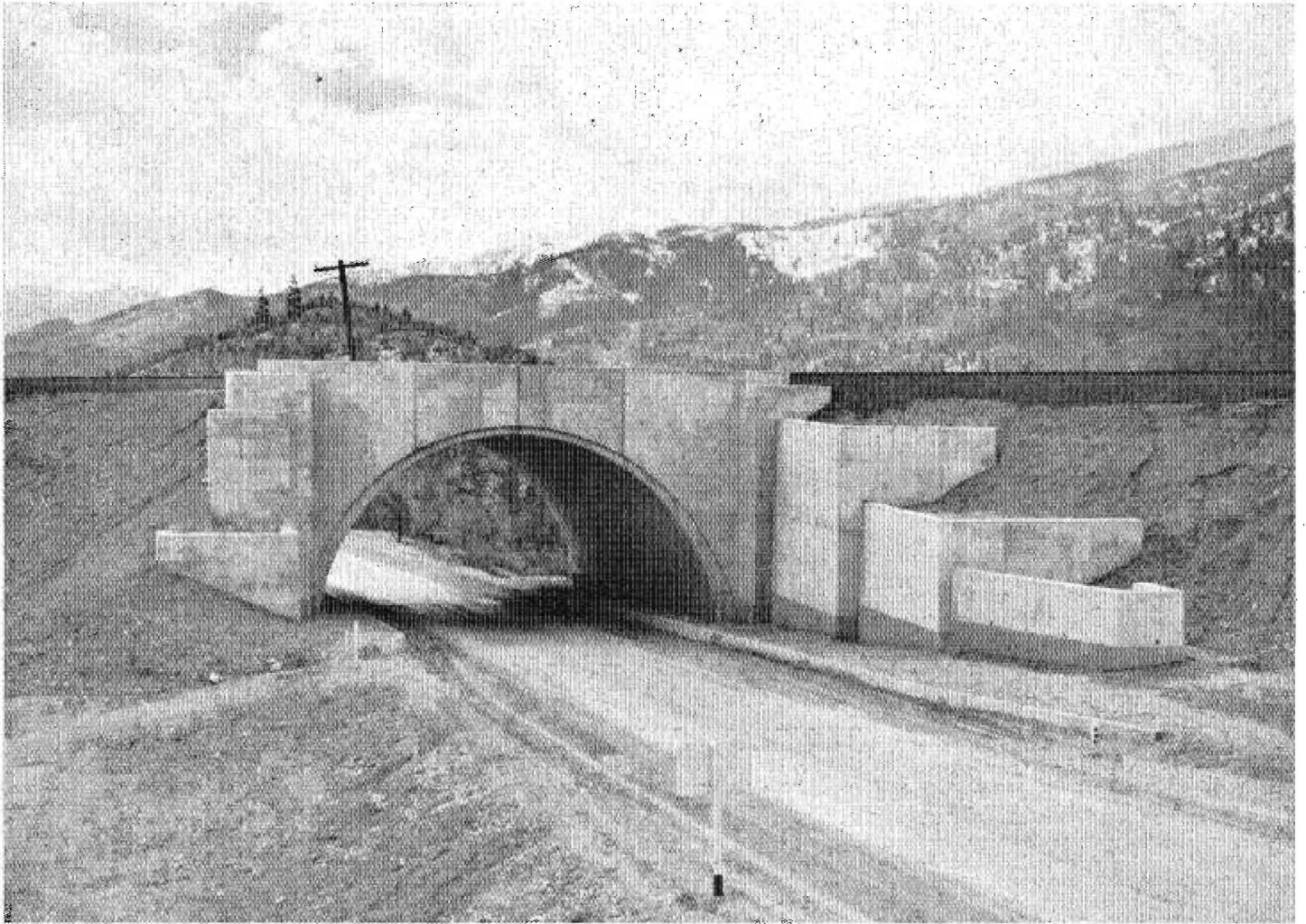
<sup>11</sup> Chapter 669, 1941 Statutes.

<sup>12</sup> As amended Chapter 669, 1941 Statutes.

<sup>13</sup> Chapter 1380, 1947 Statutes.

# New Bailey Hill Railroad Underpass

This is the recently completed Bailey Hill Underpass on U. S. 99, three miles south of the Oregon line, in Siskiyou County. It carries the state highway under the tracks of the Southern Pacific Railroad and replaces an underpass only 20 feet wide, which was built in 1916. This new structure is of the filled-spandrel type, the arch barrel being 87 feet long built on a skew of 30 degrees to the center line of the railroad. The arch has a clear span of 44 feet and a rise of nearly 25 feet. The new underpass provides 32 feet of roadway with full legal clearance.



## Convict Labor

*Continued from page 55 . . .*

which now provides for recreation and education in the prison road camps.

During the period from 1915 to 1944, prisoners from both San Quentin and Folsom Prisons were employed in the state highway road camps at various times. Subsequent to July 1, 1944, the California Institution for Men at Chino furnished men for the Southern California camps, while San Quentin Prison continued to furnish men for the Northern California camps. The last

Folsom camp was closed in August, 1943.

### Prison Camp Personnel

Statute provisions<sup>14</sup> limit the employment of prisoners in highway road camps, to work assignments requiring unskilled labor, which at the present time varies from 65 to 75 percent of the total camp personnel, depending on the size of the camp and type of work involved.

Free personnel are assigned to supervisory positions and to all jobs

<sup>14</sup> Chapter 106, 1941 Statutes.

requiring skilled labor, such as: shovel operators, oilers, truck drivers and equipment operators.

### Cost of Construction Same as by Contract

Experience through the years under the California road camp pay system indicates that the cost of construction of highways by prison labor is approximately the same as it would be by efficiently handled day labor or by contract.

The employment of prisoners from state institutions in the construction

*. . . Continued on page 57*



## Purcell Report

Continued from page 3 . . .

to determine which crossing is most urgently needed.

### Parallel Bridge First

I recommend that the Parallel Bridge should be first financed and constructed. This recommendation is based in particular on known volume of traffic now requiring service at the location of the existing bridge, resulting in congestion on the existing bridge and danger to life and property, the anticipated traffic for said location as conservatively estimated by the Division of San Francisco Bay Toll Crossings and by recognized traffic engineers employed by the division as consulting experts, and on the other reasons set forth in said report. It is in the public interest that such construction should be commenced as soon as possible.

If the authority concurs in this recommendation, it is respectfully requested that the Department of Public Works be authorized to proceed immediately with the necessary work for the completion of final plans, specifications and estimates of cost, the necessary financial investigations and negotiations, including the preparation of a bond indenture for presentation to the authority, the federal legislation necessary for the acquisition of rights of way over federal property or for financing, and to do all other things necessarily required for the construction of the Parallel Bridge and approaches thereto, at the earliest possible moment. Also, that the department be authorized to suspend work on a southern toll highway crossing until a possible method of financing such a crossing can be recommended by the department to the authority.

Respectfully submitted,

C. H. PURCELL  
Director of Public Works

## Convict Labor

Continued from page 56 . . .

of highways, as provided in the Statutes of 1923, and as subsequently amended, is intended primarily to serve a humanitarian purpose and, secondly, an economic purpose. It permits prisoners to return to the State, through

and Public Works

## Endorsements for Parallel Bridge Cited by Warren

Governor Warren in voting with the other members of the Toll Bridge Authority in favor of a parallel bridge across San Francisco Bay said:

"I am fortified in this conclusion by the findings of various public bodies and civic organizations that have studied the problem and reported thereon. Among them are:

1. The Bay Area Council consisting of representatives of the nine bay counties.
2. The Chamber of Commerce of San Francisco.
3. The Real Estate Board of San Francisco.
4. The North Central Improvement Association of San Francisco.
5. The Building Owners and Managers Association of San Francisco.
6. The Chamber of Commerce of San Mateo.
7. The Chamber of Commerce of Eden Township of south Alameda County.
8. The Oakland Chamber of Commerce.
9. The Richmond Chamber of Commerce.
10. The Vallejo Chamber of Commerce.
11. The Alameda Chamber of Commerce.
12. The Board of Port Commissioners, Oakland.
13. The Uptown Development Association, Oakland.
14. The Downtown Merchants Association, Oakland.
15. The Downtown Property Owners Association, Oakland.
16. Building and Construction Trades Council of Alameda County.
17. Building and Construction Trades Council of Contra Costa County.
18. County Board of Supervisors of Alameda County.
19. County Board of Supervisors of Solano County.
20. City of Berkeley, Alameda County.
21. Berkeley Chamber of Commerce.
22. City of Oakland, Alameda County.
23. City of Alameda, Alameda County.
24. City of Richmond, Contra Costa County.
25. City of Vallejo, Solano County.
26. Emeryville Industries Association, Alameda County.

their labor, a portion of the expense of their retention in custody. The men assigned to road camps are self-supporting, being paid a wage for the work performed on highway construction.

*The second article in this series, covering road camp organization—Division of Highways and Department of Corrections—will appear in the next issue of "California Highways and Public Works."*  
—EDITOR.

## WELCOME PRAISE

WESTERN HIGHWAY INSTITUTE  
417 Market Street, San Francisco 5

Mr. G. T. McCoy  
State Highway Engineer  
Sacramento, California

Dear Mr. McCoy: Please permit me upon behalf of our member firms who maintain regular interstate truck operations over U. S. 40 to express their appreciation and high regard for the effective work of the Department's maintenance crews on Donner Summit during the recent unprecedented winter.

We are well aware that your employees often labored long hours under extremely trying conditions to keep this vital east-west route open. That truck operations over the Sierra were possible at all upon occasion during January and February is a tribute to the men behind the plows, with full credit, also, to the skill of the company drivers who somehow got the trucks and trailers through the snow and ice. To all concerned, our compliments and admiration for a tough job well done!

We are attaching copies of this letter with the request that you pass on same to Tom Dennis and to your U. S. 40 district engineers and their splendid crews.

This is respectfully submitted upon behalf of the following Western Highway Institute members and their driver employees: Bekins Van Lines, Salt Lake City; Bigge Drayage Company, Oakland; Consolidated Freightways, Portland; Garrett Freight Lines, Pocatello; Lang Transportation Corp., Los Angeles; Oregon-Nevada-California Fast Freight, San Francisco; Inland Freight Lines, Salt Lake City; Interstate Motor Lines, Salt Lake City; Pacific Intermountain Express, Oakland; Wells Cargo, Inc., Reno; Western Truck Lines, Los Angeles.

The Truck Owners Association of California, San Francisco, also joins in this salute to your men.

Yours sincerely,

WESTERN HIGHWAY  
INSTITUTE

JOHN L. SPRINGER  
President

## Annual Meeting

Continued from page 54...

### Speed Up Acquisition

It was pointed out that this is an unavoidable condition brought about at this time because of our accelerated construction program. As a result, to consistently maintain our firm policy that every possible effort be made to complete right of way acquisition by negotiation before requesting a resolution for condemnation, it will be necessary to step up acquisition to an unprecedented rate.

In this connection Mr. Balfour spoke on an agenda item entitled "The Right of Way Program for the One Hundredth Fiscal Year and Future Years." He presented before the session a complete analysis of the budgeted items and expenditures to date, the importance of speeding up acquisition within judicious bounds, and the need of maintaining a constant pace for the years to come if the Right of Way Department is to complete its share of the work required to keep step with the State's requirements in highway construction.

### Access Opening Problem

Access opening determination was another item covered in the agenda. A policy was established wherein a joint review by the Planning Section for the safety and engineering feasibility and by the Right of Way Department from an economic standpoint, would determine allowed opening locations.

Mr. C. R. Montgomery, acting chief, Division of Contracts and Right of Way, and Mr. Pianuzzi reviewed the development and mechanics of processing utility agreements, procedural agreements and notices. Minor revisions found necessary by our experience since the inception of this procedure were suggested and agreed upon.

Other agenda items covered which have not been commented on included the equalization of performance reports, steps being taken to prepare a Right of Way Manual, and the progress of work being performed for the Public Works Board acquisition program.

A revised form for final reports was presented which reduces the text to only those items that have proven their

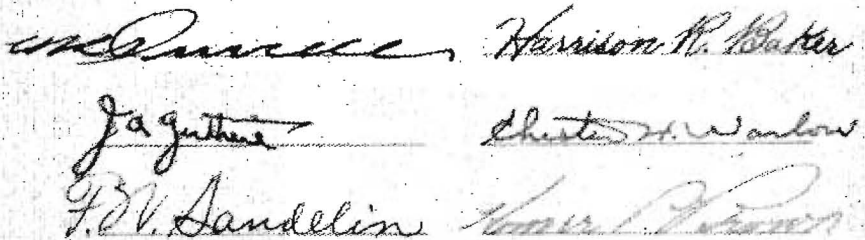
## Testimonial to C. Arnholt Smith

**Whereas,** the resignation of C. Arnholt Smith, as a member of the California Highway Commission has been received with deep regret, and

**Whereas,** by reason of his long experience in public and private life, the good counsel given by Mr. Smith during his term of office was of great value to the Commission,

**Therefore, be it resolved** by the California Highway Commission that it express its profound appreciation for the services rendered by him which often interfered with the demands made on his time in the many enterprises with which he was connected.

### California Highway Commission



**A**PPRECIATION for the services rendered by C. Arnholt Smith of San Diego during six years as a member of the California Highway Commission was expressed in the form of a resolu-

tion adopted by his fellow members and which was framed and sent to Mr. Smith. Press of private business interests compelled Mr. Smith to resign as a highway commissioner.

value for statistical reference. Consequently the proposed form is diminished to about one-tenth of the former requirements. This was enthusiastically supported by all district right of way agents.

On the second day of the session the afternoon was turned over to the district right of way agents for a round

table discussion. Under the chairmanship of Mr. Ray E. O'Bier all district problems of general interest were discussed.

This session was further proof that the annual meetings provide the only real opportunity to district right of way agents to visualize their problems in relation to the state-wide picture.

## Malibu Project

Continued from page 33 . . .

that elevation on down to roadway grade was suitable for pavement base material. It was dozed directly into the contractor's crushing plant after being loosened with dynamite and a heavy roofer. Because of the proximity of residences, great care had to be used in blasting. Only small charges were shot off at any one time, and careful precautionary measures were always taken. This selected material showed an exceptionally good compaction. Relative compactions between 95 percent and 107 percent were obtained. In order to insure its stability, the portion of the base material under the travel lanes was given a treatment of 2 percent of cement by the road mix method.

The only other large cut on this project was in the hillside north of the highway just easterly of Malibu Creek Bridge. There were 3,400 cubic yards in this cut, and the maximum height of the cut was 100 feet. The easterly 600 feet of this cut, to a height of 50 feet, was almost pure sand. To prevent erosion, an experimental sowing of barley seed and a light spraying of SC2 liquid asphalt was applied. The extent of this experimental slope stabilization is indicated on the photograph accompanying this article.

The oil coating applied after seeding operations had been completed, seals the moisture in, and draws and conserves the heat from the sun's rays so that seeds germinate quickly. Sprouting occurred in less than a week's time, and we are now assured of a good growth so that this sandy slope will become stabilized. The cost of this treatment being less than \$600, was comparatively small considering the large expanse covered. This cost was only a small fraction of what the cost would have been to stabilize this slope by any of the other commonly used methods. As time goes on, the behavior of this slope will be watched with great interest.

## Title Searching

Continued from page 54 . . .

A typical job, such as the one mentioned above, will occupy four days of the title searcher's time in making the

and Public Works

## In Memoriam

### BERLE JOY DAVENPORT

Berle Joy Davenport passed away at his home in Mountain View on February 15, 1949. His death came without warning to shock his family and friends.

He was born in Waukee, Iowa, on February 5, 1900, and obtained his early education in Oak Park, Illinois.

From 1916 to 1940 he held various positions in the construction industries, augmenting his education continuously during the period. While working as a draftsman for a patent lawyer he was able to complete his formal education.

In 1940 he became interested in highway engineering and took a position as senior aid in the District VI office in Fresno. In 1943 Berle was transferred to the District IV office in San Francisco. His ability was soon apparent and he was assigned to construction projects as a resident engineer. At the time of his passing he was classified as an assistant highway engineer.

We shall remember Berle for his quiet pleasantness, his interest in community affairs, and his intense enthusiasm in his engineering profession. He was ever eager to fit himself for further opportunities of service and in his departure we lose a wealth of experience and knowledge.

He married Dorothy L. Knudsen in 1921, and is survived by his widow and daughter, Mrs. William Hambrick. In their bereavement his friends and colleagues extend their fullest measure of sympathy.

search and abstracting the records. When the camera is used, however, he will spend two days making the search. The photographer will begin his work on the second day and finish the same day. No allowance for traveling time has been made and the example above will be modified by the distance to the county seat.

The district believes the added expense of photographing the records is amply justified by the accuracy and detail obtained. No expensive equipment is required. The district right of way camera was used on the job cited. The accompanying equipment was made in the District Shop.

## Interesting Job

Continued from page 19 . . .

work except for 88,000 cubic yards, which are to be wasted on the beach opposite the point.

One of the features of the project occurs at Stone Lagoon Summit, where it is entirely impractical, as well as prohibitive in cost, to provide a two-lane passing sight distance. Instead, a four-lane section has been designed as a safety measure to extend over the summit for reducing the possibility of accidents.

Encountered in the design for the project were the usual run-of-the-mill problems indigenous to the unstable Coast Range country: Trenching and stripping unsuitable material from fill foundation areas, and backfilling with pervious or other suitable material, construction with creek gravel under-water portions of fills that toe out into Freshwater Lagoon, placing sand blanket to serve as an outlet to squeezed-out ground water across low-lying marshy terrain north of Lookout Point, and constructing embankment thereon under a controlled rate of placement, to prevent sudden failure of the fill.

### Advantage of New Route

A comparison of the features of the existing and proposed routes further indicates the advantages of the new route:

	Existing road	Proposed road
Total length .....	4.33 miles	3.81 miles
Maximum radius of curve.....	2,000 feet	12,000 feet
Number of curves		
500 feet radius and over .....	8	11
Under 500 feet radius .....	62	0
Under 200 feet radius .....	43	0
Total degrees of turning.....	3,980	315
Maximum grade .....	7%	6.5%
Length of grade		
Under 3 percent.....	12,150 feet	18,250 feet
Between 3 percent and 5 percent .....	5,200 feet	0 feet
5 percent and over.....	5,500 feet	1,800 feet
Total rise and fall.....	843 feet	292 feet

It is planned to construct the project in two contracts. The first contract will carry the project through the completed grading stage; the second contract, to be undertaken next year, is to be for the surfacing of the project. It is expected that the entire project will be completed during the fall of 1950.



# Drill Rig

Borings for Soil Surveys  
And Foundation Explorations

By A. W. ROOT, Senior Physical Testing Engineer

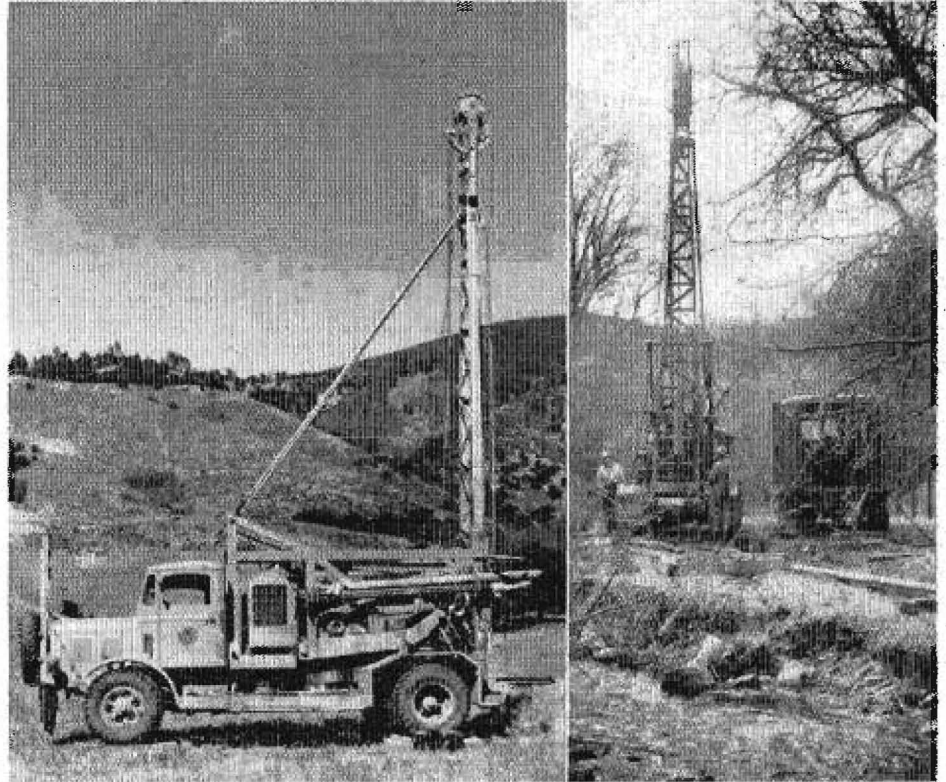
IN THE exploration of subsurface conditions, for obtaining soil samples from materials sites, and in sampling for constructing the soil profile on proposed construction, borings of some type are usually required. Let us consider borings for obtaining samples of soils in place (and the term soil as used here will include gravel, quarry material and other native materials used in construction). Sampling of materials from plants, trucks or stockpiles, while requiring considerable care and skill, generally presents no problems and requires no special equipment, and will not be discussed. Such borings as probe and wash borings have such limited application that they will not be considered.

## Purpose of Borings

The type of equipment required and the kind of sample to be obtained will depend on the purpose of the borings and the information desired. In general, there are two distinct classes of borings: (1) For obtaining samples of the soil in as nearly as possible the same condition as it exists in place, i.e., the so-called undisturbed samples; (2) borings for securing samples of soil with the structure partially or completely destroyed, or disturbed samples.

## Undisturbed Samples

Tests of undisturbed samples are necessary for making analyses of slope and foundation stability. It is true that with any sampling equipment yet devised truly undisturbed samples cannot be obtained as some change in the structure of the natural soil is unavoidable, due to possible deformation caused by the mechanical process of cutting the cores, and also to changes in internal stresses in the core caused by its removal from the bed and the resultant change in pressure and temperature; nevertheless, it is believed that in the great majority of cases samples obtained with the California type 2-inch diameter sampler are sub-



Left—Views of combination drillrig during exploration of foundation for proposed heavy embankment. As a result of an adequate preliminary investigation the unstable nature of the foundation was revealed and embankment failure prevented by foundation stabilization with vertical sand drains and controlled rate of loading. Right—Drill rig making foundation borings for proposed 120-foot high embankment

stantially representative of the condition of the soil in place.

The extent to which the soil is remolded in the sampling process depends both on the type of sampling equipment and its method of use. There are several designs of sampler, which when properly used will secure samples of cohesive soil closely approximating their condition in place. No practicable satisfactory simple method has been devised for obtaining undisturbed samples of cohesionless soil, but fortunately most of our foundation problems are concerned with soils which possess sufficient cohesion to be sampled readily.

## California Sampler

The Materials and Research Department has used the 2-inch diameter

piston type California sampler successfully for many years, and although the core is somewhat smaller in diameter and the area-ratio somewhat greater than is theoretically desirable, the California sampler incorporates so many features which it is believed are superior to other types of samplers that it is used in most foundation borings by this department. Because of the heavy and costly equipment required for this type of sampling, and the skill and experience necessary for proper sampling and testing, this work is handled by headquarters laboratory.

Various other types of samplers are available, of which the thin wall or Shelby-tube type is widely used, either the open-tube or piston type. Undisturbed samples may also be taken by

cutting blocks of soil from the walls of shafts, pits or tunnels. Care must be used in cutting, transporting and preparing such samples to avoid disturbance or loss of moisture.

#### **Coring of Rock**

Coring of rock or other material too hard to be sampled with the driven or rammed sampler must be done with rotary core barrels having either a diamond bit or some type of hard-faced cutting bit. Circulation of mud in the bore hole removes the cuttings and prevents caving of the hole. Core recovery depends on the skill of the drill operator as well as on the use of proper type of core drilling equipment. At present the Division of Highways does not own any rotary drilling equipment for such core drilling, and the core drills are rented when needed; however, it is hoped that a rotary rig will be acquired in the near future.

#### **Testing Undisturbed Cores**

Sufficient identification and classification tests are made so that the beds can be stratified, and representative samples selected for the strength and consolidation tests. The identification tests include moisture and bulk density determination, mechanical analysis, Atterberg tests, specific gravity, loss on

ignition, and petrographic classification.

Representative samples of each of the various beds are then tested for strength and consolidation. The shearing strength is determined by direct shear tests and unconfined compression tests, the cohesion and angle of internal friction being thereby determined.

Compressibility of the soil is determined by consolidation tests, and from the time-consolidation curves and voids ratio-pressure curves calculations can be made of the rate and magnitude of probable settlement due to consolidation under proposed loadings.

#### **Use of Boring and Test Data**

Having made the necessary borings and completed the tests of the undisturbed cores, the most difficult phase of the work is the next step: The analyses of the boring and test data, and the design of the treatment or structure. As neither the methods of obtaining undisturbed samples nor the test procedures have been completely standardized, the results obtained may be misleading or erroneous unless careful judgment is exercised. The greatest possibility of error, however, is in the interpretation of the test data. Although the study of soils mechanics has made encouraging progress during the

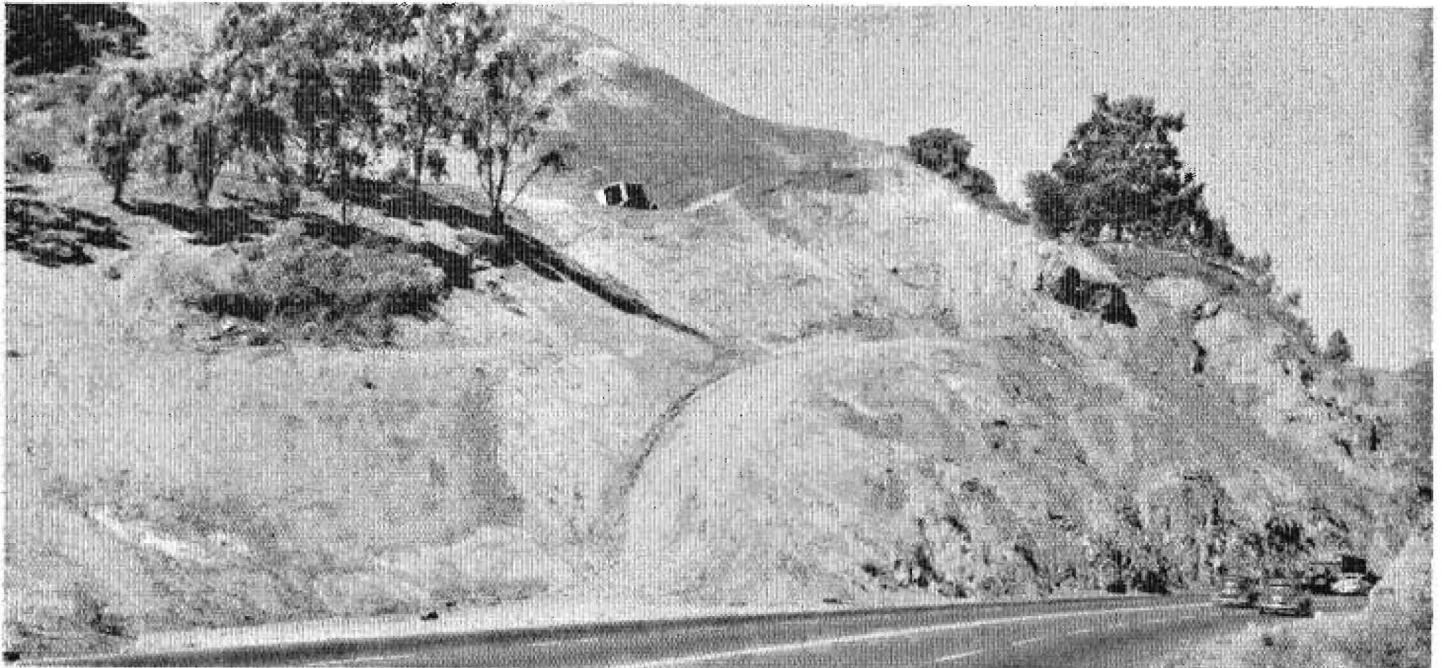
last two or three decades, many of the calculations are necessarily predicated on assumptions of conditions which may not prevail in nature, such as perfect homogeneity, etc., and in the analyses and interpretation of the test data the limitations must be recognized; previous experience with similar conditions is always helpful in analyzing the test data on a given project.

The subject of borings, their interpretation and application, is so complex that in a brief discussion only cursory mention can be made of some of the applications of obtaining undisturbed samples and a few of the design treatments which have been used.

#### **Important Application**

One of the most important applications of this type of boring is in the exploration of fill foundations. Fill failures are of three general types: 1. Slipouts due to displacement or plastic flow of unstable soil underlying the embankment; 2. Failure due to slippage along a weak plane in the foundation soil, usually an inclined stratum lubricated by ground water; 3. Shear failure within the embankment caused by stresses due to the weight of the fill exceeding the shearing resistance of the soil; such failures may occur when an embankment is not properly com-

*View of a large cut after unloading of slide and construction of flatter slopes with benches. Horizontal drains are being installed to complete the stabilization treatment*





*Large fill slipout was later corrected by combination of stripping, rock drains, toe support fill and horizontal drains*

pacted or when the fill slope is too steep for the height of fill, and the weakness may be aggravated by saturation or seepage.

All of these types of embankment failures may be prevented by proper design and construction, drainage being the most important consideration in the design of stable fills. Thorough exploration of the foundation soil is essential, and adequate borings should be made to determine the depth, character and location of any unstable material, and to determine seepage and ground water conditions. The number, depth and type of borings will depend on conditions at the specific site in question.

#### **Stabilization Methods**

Where embankment is to be constructed over unstable areas some of the methods for stabilization are:

(1) Stripping of all plastic or unstable soil from the fill area before placing embankment is practicable only where the wet or unstable material is relatively shallow; in stripping it is important that all the weak material which might affect the stability of the embankment be removed, and that adequate provision be made to intercept and remove any seepage or ground water.

(2) Where borings reveal a zone of wet, unstable material at such depth that the cost of stripping would be excessive the fill foundation can often be stabilized by a system of trenches backfilled with pervious material. To be effective the trenches must be excavated to firm material below any seepage zones, and sufficient filter material placed in the bottom and on the slopes of the trenches to assure thorough drainage; large fill areas may require a system of trenches laid out on a grid or herringbone pattern, the location and spacing of the trenches depending on the terrain and the soil formation.

#### **Saturated Soil Beds**

(3) If the foundation soil consists of saturated beds of soil having such low shear strength that the weight of the fill would cause plastic flow, the embankment may fail by settling into and displacing the soft material, causing push up or heaving outside the fill slope. If the depth of the saturated soft material is too great to be stripped economically the installation of vertical sand drains will often permit construction of stable embankments over such beds of weak soils. By reducing hydrodynamic excess pressure and accelerating the consolidation of the saturated soils the shearing strength is

increased and the settlement subsequent to construction is greatly reduced. From tests of undisturbed cores of the foundation soil the consolidation characteristics of the soil can be determined and the required spacing of the vertical sand drains estimated.

(4) Drainage of ground water by means of horizontal drains installed with hydrauger equipment has been used successfully in stabilizing foundations under embankments. However, many formations cannot be drilled economically by this method, nor is it effective in draining beds of saturated clay or other relatively impervious soil.

#### **Strut Fills**

(5) Toe support or strut fills, by providing weight to resist the upward movement of the soil outside the body of the embankment, tends to prevent fill failures resulting from plastic flow and displacement of the foundation soil. The toe support fills are most effective where the embankment is on level ground or where the strut fill can be constructed between the normal fill slope and an adjacent canyon wall or hill, so as to act as a buttress. The toe support fill must be carefully designed to assure that the added weight increases the resistance against sliding



and does not merely result in a greater load which adds to the driving force.

(6) Often some combination of two or more of these five types of treatment will be found most efficient and economical. No one type of treatment is applicable to all unstable areas, and careful study must be made of the geology, boring and test data for each site before the most effective and economical design can be determined.

#### **Design of Slopes**

Design of slopes in proposed cut areas often requires exploratory work which may include geologic studies and geophysical testing as well as borings. Such investigation is essential where the excavation will be in old landslides or other unstable formations. Proper design of cut slopes, together with drainage treatment where required, will often prevent costly slides during construction or subsequently. The design may consist of slope flattening, benching, unloading of active slides, drainage by horizontal drains, or surface drainage. Often some combination of these methods will be necessary if stable slopes are to be attained.

Undisturbed samples refer to sampling methods by which the disturbance or remolding of the soil is kept at the minimum. The cost of such borings is necessarily high and where it is not essential to obtain the larger diameter undisturbed cores economy in the cost of exploration can be effected by use of the No. 2 or 1¼-inch outside diameter California sampler, which is one of the most useful tools available for district use.

#### **Useful Information**

Much useful information can be obtained with this sampler, but its limitations must be recognized, because of the small diameter of cores the soil is remolded to some extent, and tests other than identification tests, are likely to be unreliable. The most serious deficiency of the No. 2 sampler is the inability to penetrate hard formations, which makes it difficult to determine whether the bottom of any soft beds has been reached. The use of the Barco gas hammer or power driven drop hammer will minimize the tendency of the operator to assume firm or bedded material when hard driving is encountered. For shallow holes in inaccessible

locations the driving can be done most economically with the hand hammer; however, for deep holes in different formations the use of the Barco gas hammer is recommended.

#### **Boring Work**

On boring work requiring the testing of undisturbed cores, or on important foundation studies where complete information cannot be obtained with the 1¼-inch sampler, power borings should be made with the 2-inch diameter California sampler, but many projects can be explored satisfactorily with the No. 2 hand sampler if the operator is persistent and drives a sufficient number of holes. If firm material is assumed when one or two hand borings reach refusal, underlying beds of unstable material might not be discovered. Often the boulders or hard inclusions which caused refusal in the first borings will be missed by adjacent holes. Experienced drilling crews can usually judge whether the borings have penetrated to firm or bedded material, or if refusal is reached on a float rock fragment.

Ground water observations, which are important in stability explorations, can be made with the 1¼-inch borings. Where future ground water levels are to be recorded perforated casing should be installed in the bore holes. The tinned speaker tubes formerly supplied for casing the hand boring holes are no longer obtainable; however, aluminum tubing in five-foot lengths with slip joints have been procured, which are superior to the old speaker tubes.

#### **Use of Hand Boring Data**

The depth of unstable material can often be ascertained and ground water conditions determined by means of hand borings, and the No. 2 sampler has been used successfully in exploring foundation for proposed fills on numerous projects, and the corrective treatment designed from the information thus obtained.

#### **Borings for Securing Disturbed Samples**

In the exploration of borrow sites and roadway cuts, samples are necessary for quality tests, and for determination of the uniformity of material in the deposit. Sampling may be done by various methods depending on type of material, depth to be sampled, acces-

sibility of site, and equipment available. Where the soil is sandy and loosely consolidated, and relatively shallow test holes are required, the samples can readily be obtained with some type of post hole auger. However, for depths greater than about 15 feet, and for cemented or highly consolidated materials the manually operated auger is unsuitable.

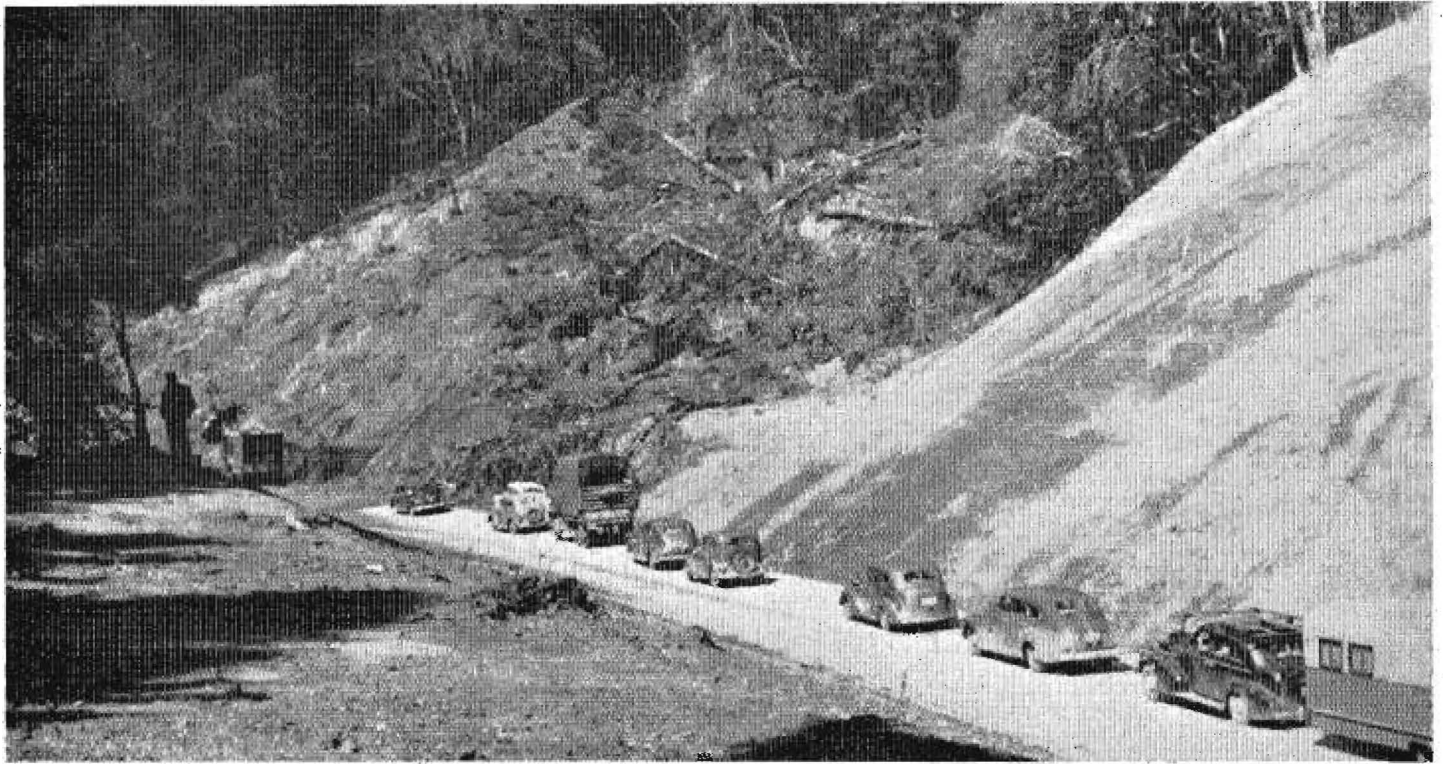
Shallow deposits of fragmental material or coarse gravel are best explored by open test pits. For depths up to six or eight feet, in material which has sufficient fines to prevent caving, test pits can be excavated by pick and shovel methods. If power equipment is available a bulldozer or a truck-mounted dragline or clamshell can be used to advantage. Unfortunately no boring equipment has been devised which will easily and cheaply bore through cohesionless, coarse material such as clean gravel and boulders.

#### **Power Boring Equipment**

Many of the sites to be sampled will be of such depth or the soil so compact that they cannot be sampled economically with manually operated augers, and power boring equipment should be used. At present most of the districts have no power boring rigs and either the headquarters laboratory is requested to make the borings or equipment must be rented by the district from private contractors. Rental of boring equipment is not entirely satisfactory: advertising for bids involves considerable delay, and often the equipment supplied by the low bidder is of poor design or improperly maintained. Headquarters Laboratory has only two power drilling rigs, and with the present volume of work these rigs are often not available when needed.

#### **Mobile Boring Equipment**

Recognizing the urgent need for suitable power boring equipment the Materials and Research Department began, more than a year ago, a study of the manufactured rigs on the market to determine if suitable mobile boring equipment was available. It was concluded that none of the boring rigs then being sold met all the requirements of capacity, mobility and reasonable cost; accordingly, at the request and with the collaboration of this department, Headquarters Shop started



Road temporarily closed by slide occurring during construction. Subsequently flatter cut slopes with benches were constructed. Installation of horizontal drains is planned to complete the stabilization treatment

to design and construct a boring rig. Completion of the equipment was delayed by difficulty in procuring needed parts and materials, and also by pressure of other shop work. As a result the first model was not ready for operation until late in the year, and the first field trials revealed deficiencies in design which necessitated extensive rebuilding, so that the boring rig was not finally completed in workable form until the latter part of the year.

This boring rig is mounted on a 4 x 4 Dodge Power Wagon, using a power take-off for driving the hoists and drilling mechanism. Side opening bucket-type augers are driven by a rotary table and Kelly bar; a hydraulic pump operates a ram which provides pressure for the feed or crowd, and which may be used also for pulling if the bucket gets stuck; the derrick is also raised and lowered by means of a hydraulic cylinder. Two hoists are provided, so that in pulling the bucket out of the hole the Kelly bar is left attached to the slow speed hoist, and the faster hoist used for pulling the drill rod extensions to which the bucket is attached. This drill rig has operated satisfactorily on four projects,

drilling holes up to 65 feet in depth in various soils; however, it is not suitable for drilling hard rock or large boulder formations.

It was originally intended that one drill rig of this type would be supplied to each of the eleven highway districts, but as the rig finally constructed is somewhat more elaborate and more costly than first planned, it is now believed that only a few of the larger districts will require the type of boring rig described. It may be that a lighter, less powerful, and cheaper rig will be satisfactory for a large portion of the sampling work in certain areas.

#### Testing Disturbed Samples

There are standard test procedures for tests of disturbed samples of soil proposed for use as embankment, sub-base, base, or aggregates, and the tests to be made will depend on the use proposed. Successful exploration of the materials site will depend on the selection and number of samples submitted for test. It is important that the number and location of borings be sufficient to prove the range in quality of the material and the distribution of the different types of material. If the material varies

with depth separate samples should be taken of each type of soil rather than a composite sample of the full depth of the boring or test pit. Changes in the character of the soil can usually be detected by visual inspection, noting the color, plasticity and gradation.

Designation of materials site for 50,000 or 100,000 cubic yards of material on the basis of one test hole and one or two samples has, as you know, caused much trouble in the past. It is realized that in many cases proper investigation of materials sources was not made because of shortage of funds, inadequate personnel and lack of suitable equipment. Similarly, many preventable slides and slipouts have occurred which should have been investigated during the preliminary soil survey and appropriate treatment designed.

Complete and thorough soil surveys, including particularly foundation studies and comprehensive materials explorations, will surely pay large dividends in economies effected by the most economical use of available materials, and by prevention of slides and slipouts through proper design and corrective treatment.

**EARL WARREN**  
*Governor of California*

**CHARLES H. PURCELL**  
*Director of Public Works*

**FRANK B. DURKEE**  
*Acting Deputy Director*

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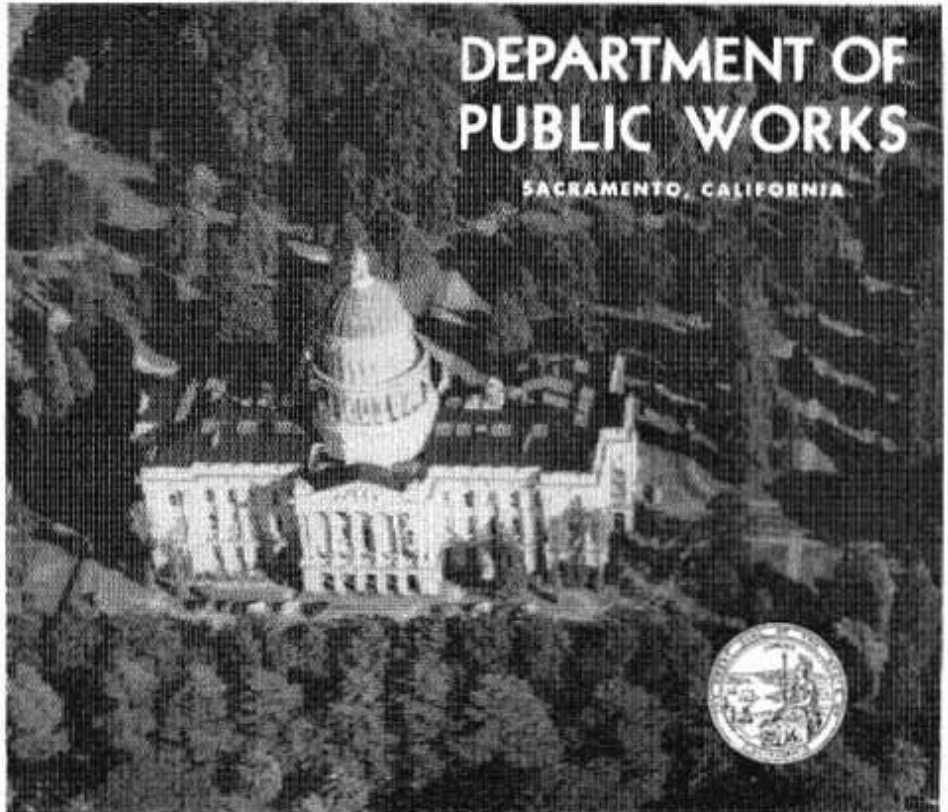
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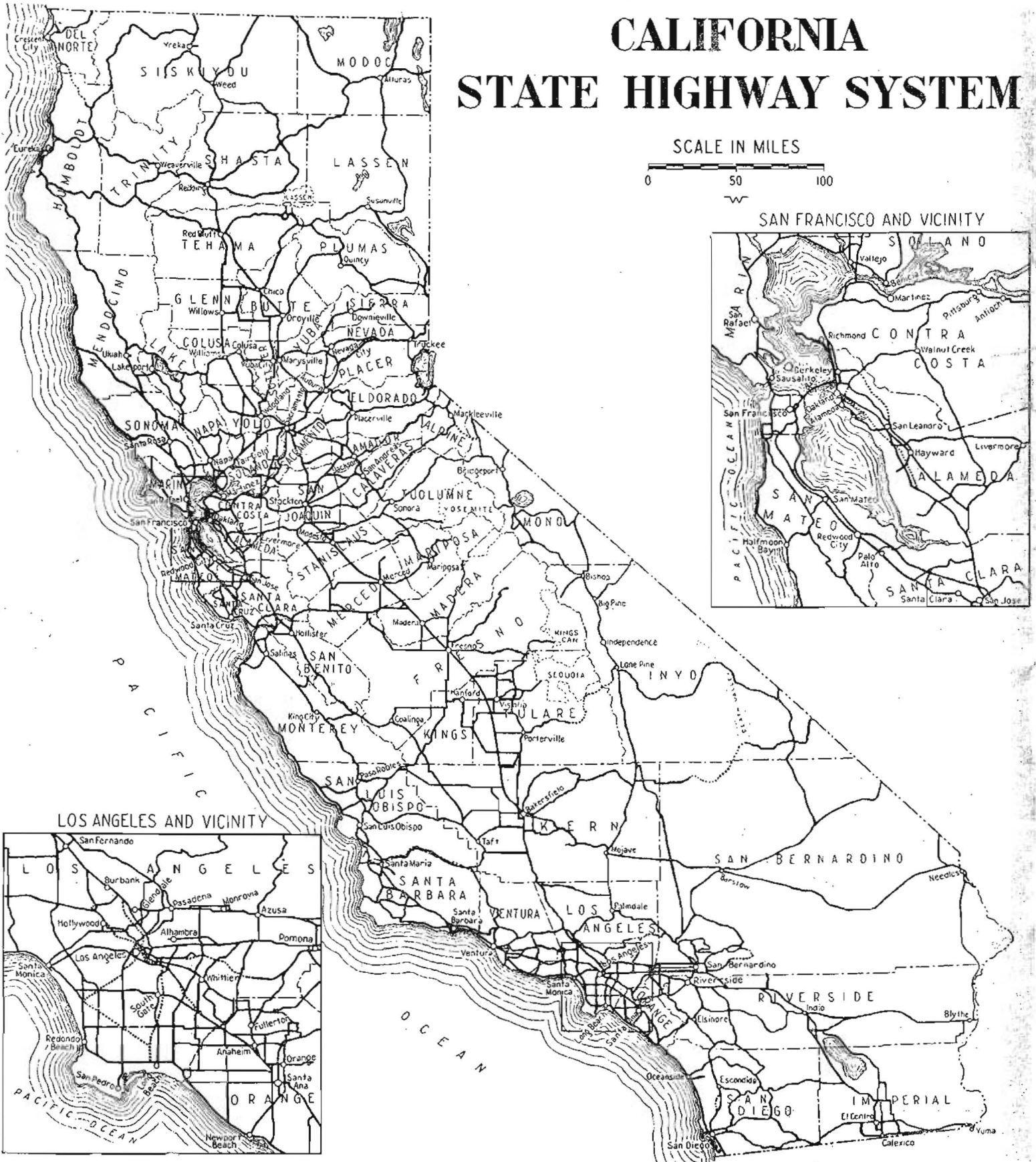
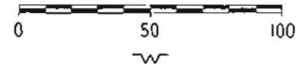
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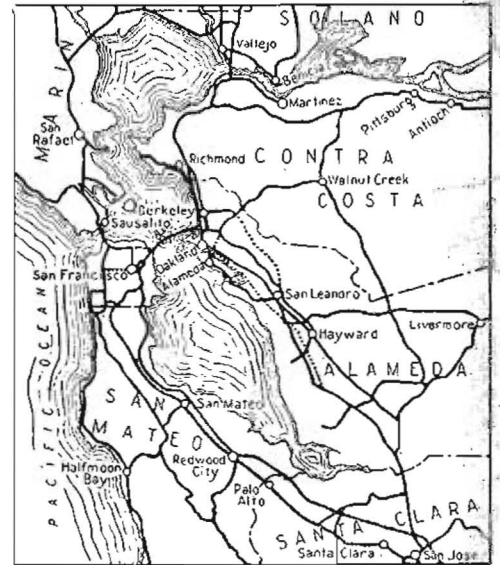


# CALIFORNIA STATE HIGHWAY SYSTEM

SCALE IN MILES



SAN FRANCISCO AND VICINITY



LOS ANGELES AND VICINITY

