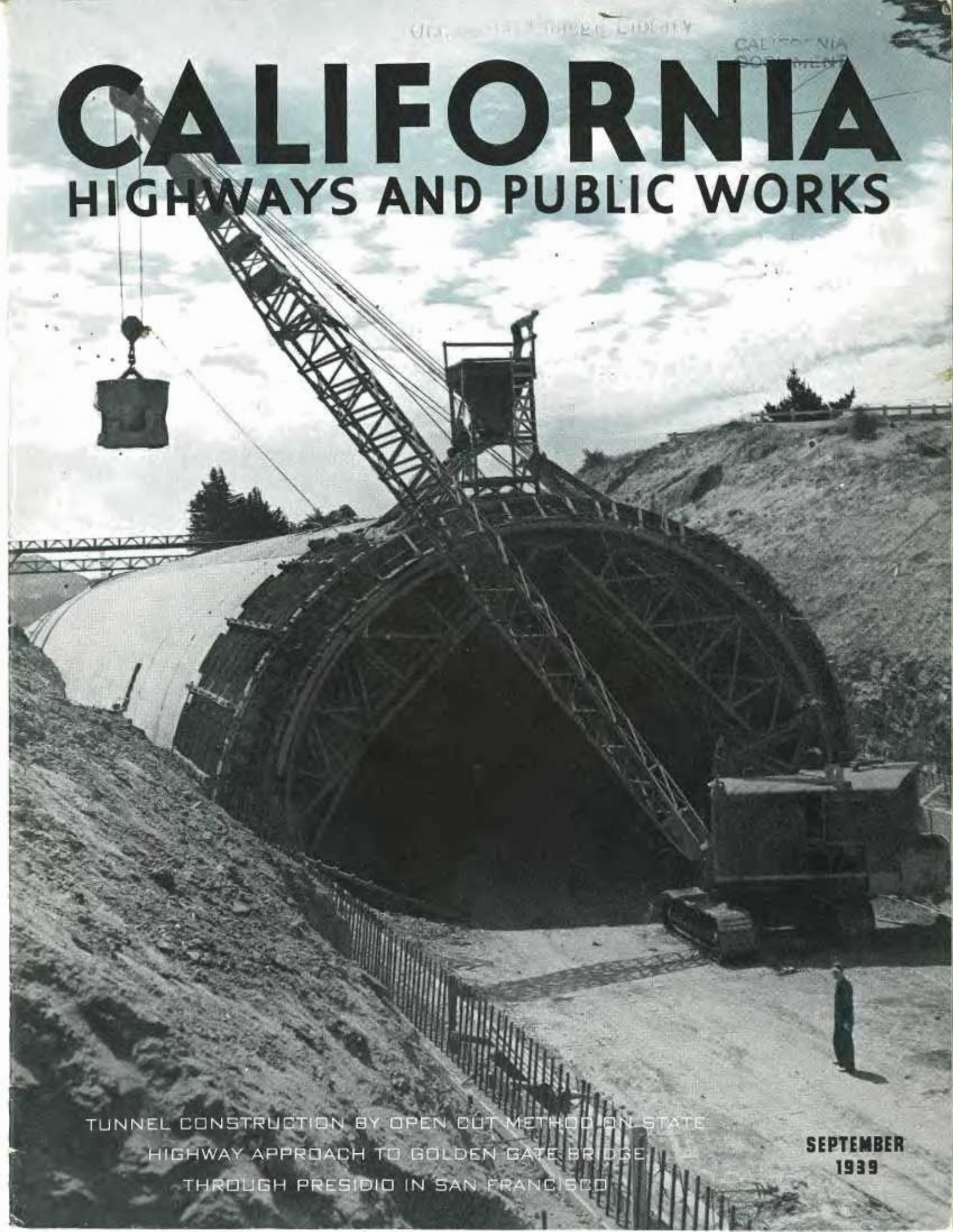


# CALIFORNIA

## HIGHWAYS AND PUBLIC WORKS



TUNNEL CONSTRUCTION BY OPEN CUT METHOD ON STATE  
HIGHWAY APPROACH TO GOLDEN GATE BRIDGE  
THROUGH PRESIDIO IN SAN FRANCISCO

SEPTEMBER  
1939

# CALIFORNIA HIGHWAYS AND PUBLIC WORKS

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

FRANK W. CLARK, Director    C. H. PURCELL, State Highway Engineer    J. W. HOWE, Editor    K. C. ADAMS, Associate Editor

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# 87 Bridges Replaced, Eliminated or Strengthened on Mendocino Coast Area Highways

By E. L. WALSH, Associate Bridge Engineer

**W**HEN, in August, 1933, as provided by Senate Bill No. 563, an additional 6,780 miles of road were added to the State Highway System, a heavy burden of maintenance and reconstruction was placed on the Division of Highways.

One section of highway which has presented a difficult problem is the coast road (State Highway 56) from Jenner to Westport along the northern Mendocino County coast. The roadway surface was in poor condition and practically all of the bridges were badly in need of repair.

A thorough engineering investigation of each of the bridges revealed that the majority of them were not safe for legal loads. In the section from the south Mendocino County line at the Gualala River to Westport, a distance of 81 miles, there were 84 timber bridges with a combined length of 16,812 lineal feet. Only five of them were capable of supporting legal loads.

A large percentage of these bridges were constructed previous to 1910; at least ten of the bridges were constructed before 1900; and one, the Dark Gulch Bridge, was built in 1874. These bridges were designed to support a six-horse team with a loaded wagon, a load far below the required capacity of modern traffic.

Several of the structures were found to be in such poor structural condition that the cost of making adequate repairs would practically amount to the cost of complete renewal. Most of the structures were narrow, ranging in width from 10 feet to 23 feet, the majority being 14 or 15 feet wide. These bridges were not designed for modern heavy-loaded, fast-traveling vehicles, and in most cases the width of roadway and poor alignment of approaches made them hazardous for present day traffic.

The structures, built when the

## Friant Dam Bids

23

As this issue goes to press the opening of bids for construction of Friant Dam, scheduled for September 7th, has been deferred to September 14th. The U. S. Bureau of Reclamation announced that the bids were returned to bidders unopened when at the last hour the Department of the Interior was notified by the Department of Labor that a revision of certain wage rates listed in the specifications was necessary.

Commissioner of Reclamation John C. Page, on a visit to the Central Valley Project from Washington, D. C., announced that the Bureau of Reclamation immediately would issue an addendum to the Friant specifications, listing the revised wage rates and setting an early date for a new bid opening.

The minimum wage changes, communicated by the Department of Labor, involved seven of the 123 labor classifications in the Friant Dam specifications. Under the Davis-Bacon Act, the Department of the Interior is required to include in the specifications the wage rates determined by the Department of Labor. The scale thus established must be the minimum paid by contractors on project construction.

Mr. Page said that despite the postponement the Bureau of Reclamation will make every effort to avoid any delay in an award of contract.

road was lightly traveled, have faithfully and economically served their purpose; but since the change in traffic conditions they have become definite hazards.

Every effort has been made by the Division of Highways to plan the work of improving these roads in a systematic manner consistent with the funds available, by strengthening and replacing the weak bridges, improving the surfacing, realigning, straightening and widening the dangerous sections so as to raise the maximum load capacity of the highway.

Because of the obvious impossibility of reconstructing all of these substandard bridges, it has been necessary to remedy the condition by various other means. In certain instances, it has been possible to repair the structures by strengthening members, placing supplementary supports, rebuilding the floor systems and making other repairs of a temporary nature in order that the load capacity of the bridges could be increased.

The problem of eliminating these substandard bridges in order to remove the restricted load postings as quickly as possible has been given serious thought by the engineers of the Highway Department. In many cases it has been possible to eliminate a dangerous structure by realigning the highway and replacing the bridge by a culvert.

Where it has been necessary to replace a major structure with a new permanent-type structure, such new structure has been placed on the ultimate highway alignment. To accomplish this it has been necessary for the district engineering personnel, in cooperation with the Department of Surveys and Plans, to make extensive surveys of the whole route from Jenner to Westport; to anticipate future requirements and to analyze the various possibilities be-



Old timber truss bridge across Jug Handle Creek on State Highway 56 replaced by reinforced concrete arch span at right.

fore establishing the ultimate location of the whole section of highway—some portions of which may not be built for many years.

As this section of highway traverses a rugged coast and crosses many streams and canyons, the projection of the future alignment to be used as a basis for a well planned program has required considerable study.

The principal industries of the Fort Bragg area, located about 160 miles north of San Francisco, are lumber and fishing. There is a railroad connecting Fort Bragg with Willits on the Redwood Highway, U. S. 101. This, of course, does not serve the lumber mills located south of Fort Bragg and at Westport nor towns like Point Arena, Greenwood, Albion, Casper, Mendocino City and Westport along the coast, or Boonville and the other towns along Route 48 from the Redwood Highway to the coast.

In order to remove the restrictions

imposed as soon as possible, a concentrated effort has been made first to provide an outlet from Fort Bragg and Westport via Navarro River, Boonville and Cloverdale, so that unrestricted ingress and egress will be available and legal loads can be hauled with safety.

#### PROGRESS OF WORK ON ROUTE 48

State Route 48, between Cloverdale on U. S. 101 in Sonoma County and the Navarro River, also contained many old, weak timber bridges on poor alignment which imposed a definite restriction on the hauling of supplies to this area. Prior to 1937, approximately 20 miles of this route had been improved and brought up to acceptable standards.

In April, 1938, a contract was completed which covered the realignment of 1.2 miles of road and included the construction of a bridge across Dry Creek, located 13 miles northwest of Cloverdale. The total

cost of this project was \$33,000.

At the present time, there is under construction 6.25 miles of highway in portions between Navarro River and Maple Creek. Nine old bridges which were substandard and not safe for legal loads are being replaced with culverts. In addition, four of the bridges—over Ornbaun Creek, Con Creek, Robinson Creek and Maple Creek—are being reconstructed on improved alignment. The total cost of this project will be about \$220,000, of which \$45,000 will be for new bridges.

On July 26, 1939, bids were received for the reconstruction of Shearing Creek Bridge and one-half mile of road work. This project is located six miles south of Boonville. It is estimated that this project will cost about \$33,000, of which \$20,000 is for the new bridge which will replace the existing substandard structure.

The road between Cloverdale and Fort Bragg, a distance of 80 miles, has had a constant increase in travel,



The old timber bridge across Elk Creek with sharp left turn approach was replaced by concrete girder bridge on new alignment.



particularly in trucking. The several small towns and lumber camps located along the route have no other means of getting in their supplies.

Four years ago, there were 23 bridge structures on the road from Cloverdale to the junction of the coast road, 17 of which were posted for restricted load and speed. These bridges were in a very dangerous condition. Eleven of these have been replaced with culverts and fills on improved alignment and grade, at a cost of approximately \$200,000. Four structures have been replaced with new bridges on improved alignment and grade at a cost, including the grading, of approximately \$83,000. Funds have been budgeted for the replacement of the Lazy Creek Bridge with a culvert and fill on new alignment. This work is planned for construction during 1940.

#### NEW STRUCTURES ON COAST ROAD

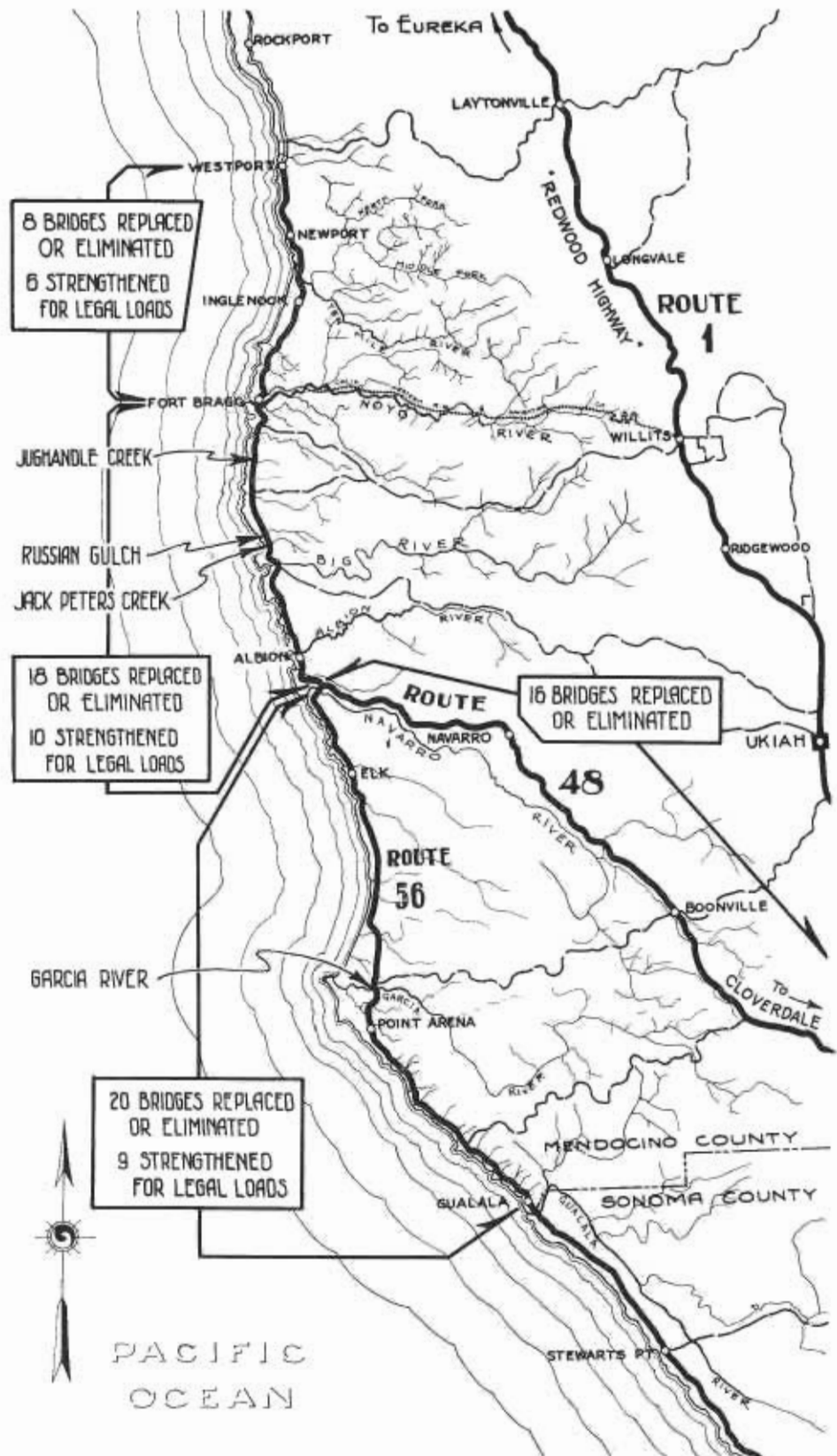
The following are some of the major structures which have been built since the State took over the coast road or which are contemplated for construction in the near future:

The Garcia River Bridge, located on the Coast Route, 45 miles south of Fort Bragg, is a steel truss and steel stringer structure 320 feet long with a 24-foot roadway. This bridge was completed in April, 1938, at a cost of \$45,000 and replaced an old timber structure which was built in 1907.

The Elk Creek Bridge, located on the Coast Route 32 miles south of Fort Bragg, is 122 feet long with 26-foot roadway and consists of reinforced concrete girder spans on concrete piers. It was completed in May, 1938, at a cost of \$16,600 and replaces an old timber structure built by the county many years ago.

The Jack Peters Creek Bridge, located on the Coast Route 10 miles south of Fort Bragg, was completed in August, 1939, at a cost of \$36,000. This structure is a reinforced concrete bridge of the box girder type. It is 233 feet long and has a 26-foot roadway. This structure, costing \$36,000, replaces an old timber truss and trestle bridge which had reached the end of its economic life.

Bids were received on September 13th for a new bridge across Russian Gulch, located nine miles south of



Map showing locations of bridge improvements on Mendocino coast area highways.

Fort Bragg. This structure will be a reinforced concrete arch bridge with a central span of 240 feet. This combined with concrete girder ap-

proach spans will aggregate a total length of 530 feet. The bridge will have a 26-foot roadway and will cost approximately \$115,000. The present



Ancient Garcia River bridge with timber trusses and approaches replaced by 120 foot steel truss span with steel beam approaches

timber truss and timber trestle bridge was built 29 years ago by Mendocino County.

The Jughandle Creek Bridge, located five miles south of Fort Bragg, is a reinforced concrete arch structure having a central span of 210 feet. Including the concrete girder approach spans, it has a total length of 388 feet and a roadway width of 26 feet. This structure was completed in August, 1938, at a cost of \$56,000. It replaced an old timber truss and trestle structure built by Mendocino County in 1888.

Of the 84 bridges on the Mendocino coast between the Gualala River and Westport, 35 have already been replaced with culverts and fills at a cost of approximately \$142,000. Of this amount, \$70,000 was spent north of the mouth of the Navarro River.

Six structures have been replaced with new bridges on improved alignment and grade at a total cost of approximately \$200,000. Of this amount \$100,000 was spent north of the mouth of the Navarro River.

Twenty-five structures have been strengthened for legal loads at a cost of approximately \$200,000, of which \$140,000 was spent between the Navarro River and Westport.

It is planned to strengthen seven weak structures south of the Navarro River during the present biennium. It is estimated that the work will cost \$24,000.

Four structures located south of the Navarro River are now being replaced by culverts and fills at a total cost of \$76,000.

As soon as funds are available, it will be necessary to completely replace the Schooner Gulch Bridge and the Alder Creek Bridge at a cost of \$100,000 and eliminate four weak structures by replacing them with culverts and fills at an estimated cost of \$50,000. Several of the large timber bridges have been strengthened and repaired so that it is expected that they will be able to carry legal loads for several more years. At the end of that time it will be necessary to rebuild them completely.

Many of these bridges such as the Albion River and Ten Mile River bridges are major structures, the replacement of which, including the line change and road approach will involve considerable expenditure. As an example, the replacement of the Albion River Bridge on proper alignment is likely to cost \$300,000.

To date over \$1,000,000 has been spent in this area to increase the load capacity of the roads. After the bridges across Russian Gulch and Shearing Creek have been completed and the Lazy Creek Bridge has been eliminated by realignment, the entire road from Cloverdale to Fort Bragg will be safe for legal loads.

Office Boy (nervously)—"Please, sir, I think you're wanted on the telephone."

Boss—"You think! Aren't you sure?"

Office Boy—"Well, the voice at the other end said: 'Hello, is that you, you old idiot?'"—*Boston Transcript*.

Teacher—What can you tell me of America's foreign relations?

Student They're all broke.



Timber truss bridge, frequently strengthened across Jack Peters Creek replaced by modern concrete box girder span

# Division of Architecture Program Totals \$12,298,288 for Biennium

By W. K. DANIELS, Assistant State Architect in Charge

**L**OOKING toward the work at the present time confronting the Division of Architecture of the Department of Public Works for the current biennium, there is a total of \$12,298,288 available for construction, improvements, and equipment for the various state institutions and departments.

Some of the outstanding projects listed for this biennium include the Acute Psychiatric Hospital Unit to be constructed for the Department of Institutions to be operated in conjunction with the University of California Hospital in San Francisco; the starting of the erection of new state colleges at Santa Barbara and San Francisco; the construction of the Southern California State Prison for first offenders at Chino; and, although of comparatively small cost but nevertheless outstanding, due to the disturbance of old walls and fixtures, the alteration and modernizing of the Governor's office in the State Capitol at Sacramento.

Available State funds for construction, improvements, and equipment for the biennium are listed as follows:

Agnews State Hospital	\$89,650
Acute Psychiatric Hospital, San Francisco	500,000
California Polytechnic School	131,000
California School for Blind	68,000
California School for Deaf	151,300
California National Guard	102,974
Camarillo State Hospital	2,781,460
Chico State College	30,075
Department of Agriculture	60,830
Department of Public Health, Berkeley	10,000
Division of Parks	60,000
Fish and Game Commission	138,600
Folsom State Prison	110,000
Forty-fourth District Agricultural Association, Colusa	19,000



W. K. DANIELS

Fresno State College	180,000
Highway Maintenance Station, Ojai	14,400
Highway District Office Building, Los Angeles	300,000
Humboldt State College	223,390
Industrial Home for Adult Blind	3,500
Mendocino State Hospital	561,625
Napa State Hospital	309,500
Norwalk State Hospital	198,900
Pacific Colony	75,335
Patton State Hospital	216,850
Preston School of Industry	400,050
San Diego State College	303,500
San Francisco State College	415,000
San Jose State College	293,500
San Quentin State Prison	274,900
Santa Barbara State College	567,000
Sonoma State Home	209,440
Southern California State Prison, Chino	1,682,579

Sixth District Agricultural Association, Los Angeles	9,550
State Buildings, Improvements at Sacramento, San Francisco and Los Angeles	397,991
State Narcotic Hospital	150,000
Stockton State Hospital	661,000
Sutter's Fort, Sacramento	30,000
Third District Agricultural Association, Chico	6,500
Ventura School for Girls	12,800
Veterans' Home	470,439
Whittier State School	67,650
Woman's Relief Corps Home	10,000
<b>Total</b>	<b>\$12,298,288</b>

The Division of Architecture has been functioning since 1907—32 years—and is the agency through which all the obligations of the Department of Public Works, in connection with State institutions and departments, are discharged.

#### SUPERVISES SCHOOL CONSTRUCTION

The Division is also vested with authority under the police power of the State and directed to supervise the construction of all new school buildings, the reconstruction, alteration of or addition to all school buildings used for elementary, secondary or junior college school purposes.

The word "architecture" might lead one to assume the Division's time is devoted to designing and planning structures of a classical or monumental character. On the contrary the State's buildings are now designed with maximum simplicity, economy, practicability and efficiency being borne in mind at all times.

The duties and activities of the Division cover a wide field which we daresay is not generally realized.

In addition to designing, planning, and constructing buildings of every nature to meet the diversified require-

(Continued on page 21)



# Pacheco Pass Realignment Job Completed Abolishing 31 Curves

By H. S. PAYSON, Resident Engineer

**T**HE realigned section of State Highway Route 152 on the historic Pacheco Pass in Santa Clara County was opened to travel without any formalities on August 8th. The final cleanup was completed on August 12, with only 229 working days used of the 270 working days allotted for the construction of the 2.6 miles of heavy work eliminating 31 curves on the old road.

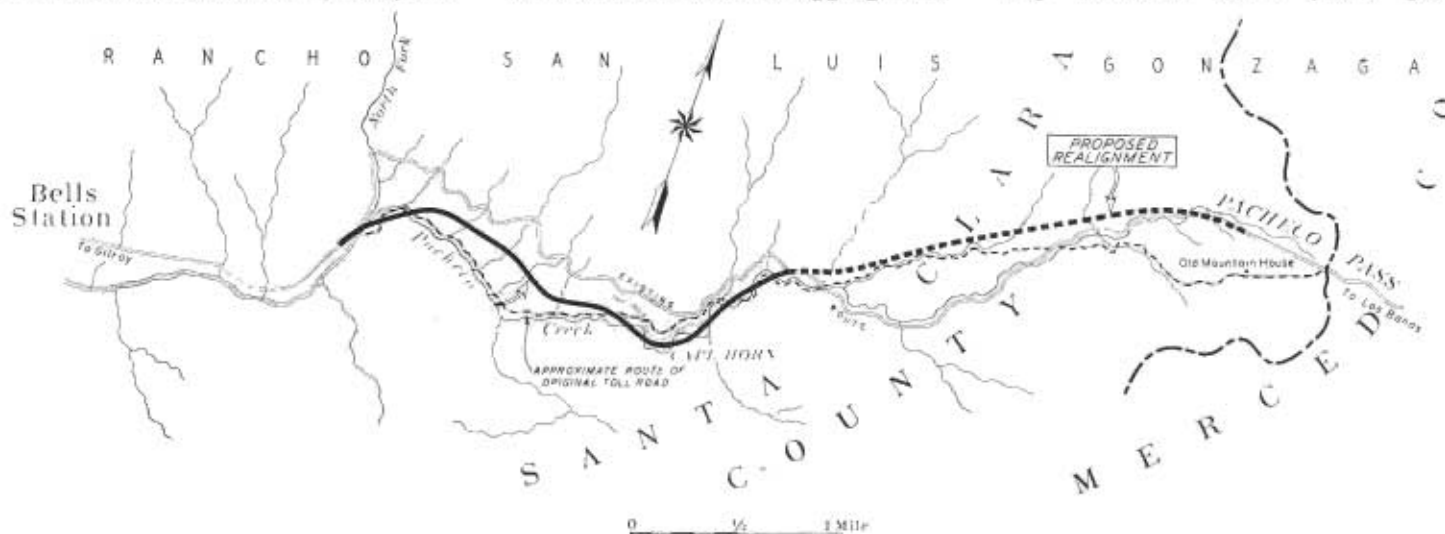
The contract was awarded to Granfield, Farrar & Carlin of San Francisco on November 7, 1938, and

improvement, distance saving and other comparative data, was constructed on entirely new alignment. This had both advantages and disadvantages. The contractor was not hindered in his work by the heavy traffic using the route, but was handicapped to some extent due to inaccessibility of structure locations, particularly on some of the concrete arch culverts.

At one of these locations it would have proven quite expensive and difficult to construct an access road to deliver the concrete aggregate to

consisting of two 20 cubic yard, six 18 cubic yard, and four 14 cubic yard units. In addition there were six bulldozers which were used to spread and compact fills, construct pioneer roads and as boosters for the carryalls during loading.

Six heavy duty scarifiers were also in operation to loosen the excavation for more rapid loading. Five power shovels and fifteen dump trucks completed the dirt moving equipment, and when fully operating moved in excess of one hundred fifty thousand cubic yards per



Heavy black line shows completed sections of Pacheco Pass realignment. Dotted line indicates proposed continuation of improvement when funds are available.

work was started on that date. In establishing the time limit for the work it was expected that inclement weather during the winter would require cessation of work for a two-month period. However, the season was so mild that only four days were sufficiently severe to stop the work, and the completed project was made available for public travel almost two months sooner than anticipated.

This project, which was described in the February, 1939, issue of "California Highways and Public Works" as to location, type of im-

provement, distance saving and other comparative data, was constructed on entirely new alignment. This had both advantages and disadvantages. The contractor was not hindered in his work by the heavy traffic using the route, but was handicapped to some extent due to inaccessibility of structure locations, particularly on some of the concrete arch culverts.

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The completion of this new section eliminates the portion of the route where the heaviest grades and sharp-



est curvature prevailed. The saving of .81 of a mile in the 2.6 miles of the project is not indicative of the time saving. The reduced curvature, increased sight distance, increase in minimum radii and reduced gradient will be conducive to more rapid and pleasant travel on the lateral highway connecting the Bay area arterials and the lower San Joaquin Valley.

As an added feature of safety and convenience, the traveled way has been paved to provide a four-lane roadway in the vicinity of Station 155 where sight distance is limited due to curvature and a high bank on the inside of the curve.

The great benefit gained by this alignment may best be visualized by comparing the standards of the old with the new.

#### Old Highway

Length.....	3.46 miles
Total curvature.....	2,313 degrees
No. of curves.....	39
Minimum radius.....	100 feet
Maximum grade.....	7 per cent

#### New Highway

Length.....	2.63 miles
Total curvature.....	295 degrees
No. of curves.....	8
Minimum radius.....	850 feet
Maximum grade.....	6½ per cent

## Most Auto Mileage on State Highways

Motor vehicles in the United States travel 250 billion miles each year, an average of 8870 miles per vehicle, according to an official report.

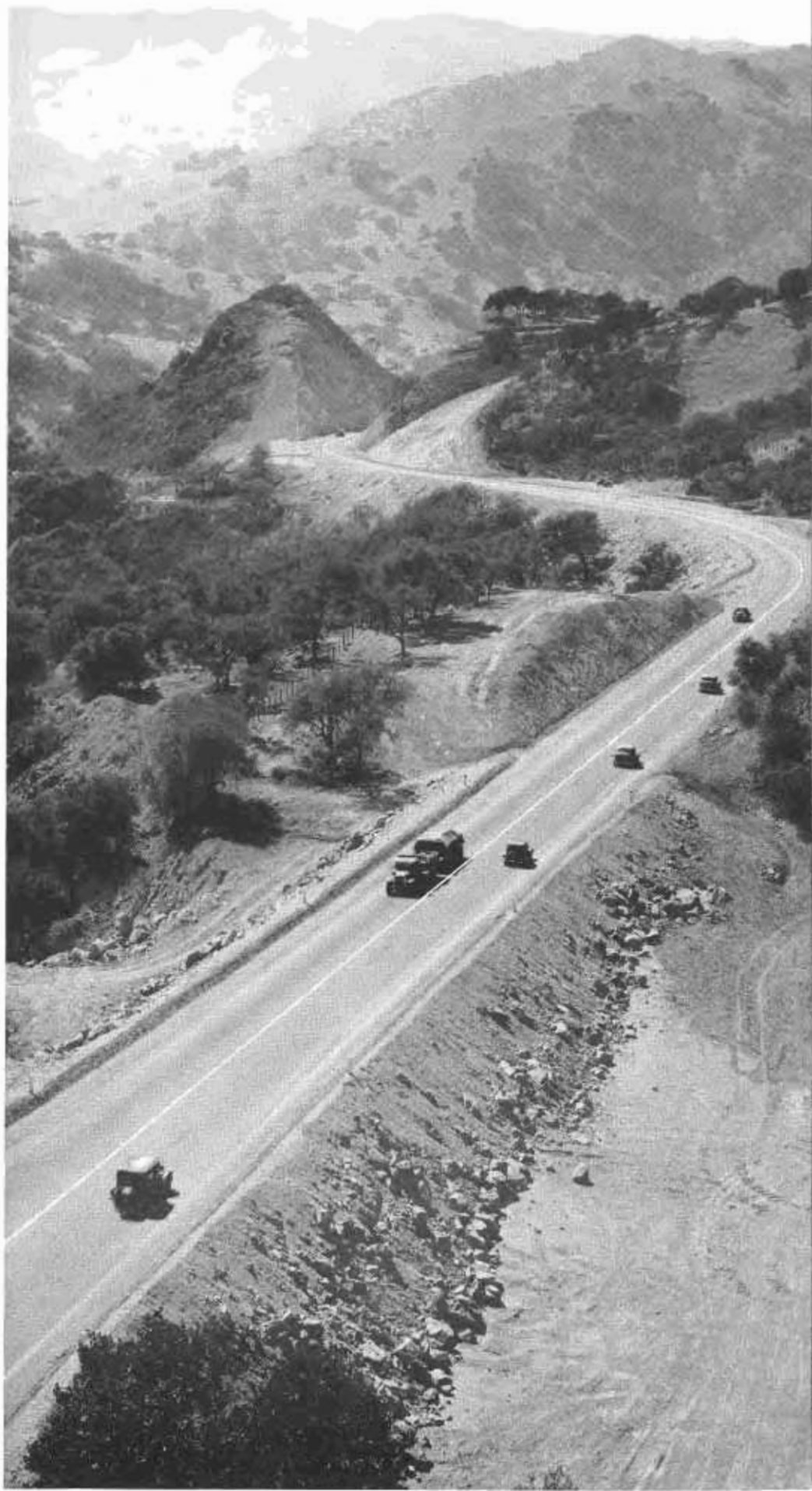
The average vehicle, according to the State Highway Planning Survey, traveled 5000 miles last year on primary rural State highways, 1190 miles on secondary State highways and local rural roads, and 2680 miles on city streets. However, there was wide variation in use of the different classes of highways by urban and rural residents.

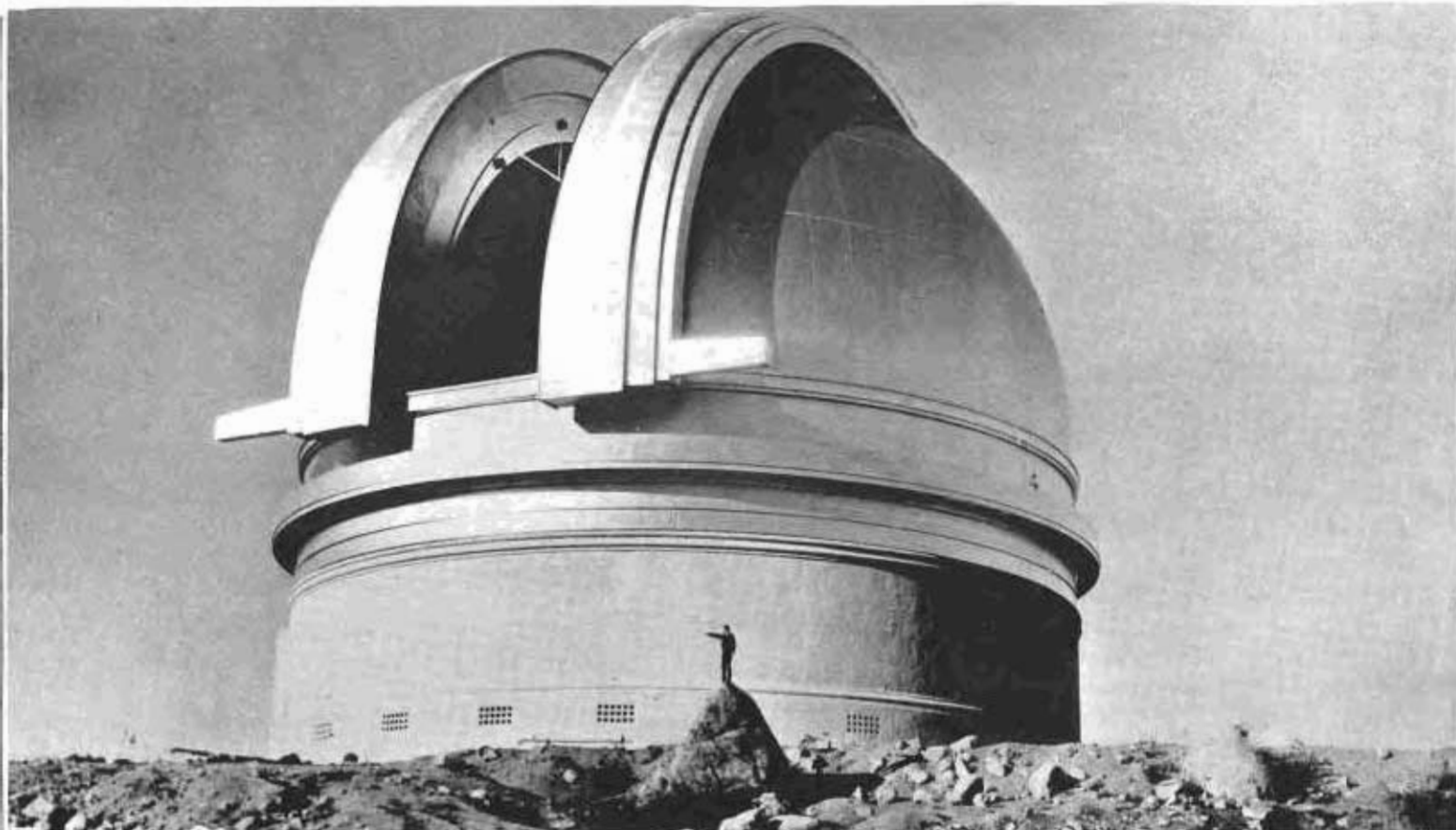
Vehicles owned in small towns were used principally outside of cities while residents of cities did more than 41 per cent of their driving on city streets. All vehicles except those in the largest cities used the State primary rural highways more than all other systems.

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Recently completed realignment of State Highway Sign Route 152 through Pacheco Pass in Santa Clara County.

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Huge rotating dome of Palomar observatory for 200-inch telescope is 135 feet in diameter. The aperture is 30 feet wide.

# Palomar "Highway to the Stars"

By WALTER BEUTHEL, Assistant District Highway Engineer

**I**N SOUTHERN CALIFORNIA is a road which is receiving constantly more attention and publicity, known as "The Highway to the Stars." It is appropriately named and of increasing importance far beyond its immediate locality. It is the road recently constructed up the south slope of Mt. Palomar, in San Diego County, to make possible the locating of an observatory on the mountain to house the largest telescope in the world.

The road may be said to begin at a point about five miles easterly from the little settlement called Rincon on Secondary State Highway 195, about 35 miles east of Oceanside. From an elevation of 2670 feet it rises by grades not exceeding 8 per cent and curves not sharper than 100-foot radius to an elevation of 5568 feet at the observatory plateau near the summit of the mountain, in a dis-

tance of about 12 miles. The roadbed width is 28 feet and the present surface is oil treatment.

In 1927, through the efforts of the late Dr. George Ellery Hale, a \$6,000,000 grant was made by the General Education Board of the Rockefeller Foundation to the California Institute of Technology, for a new observatory to include superior astronomical equipment.

With the funds thus made available it was decided to construct a telescope having a 200-inch diameter mirror, twice the size of the Mt. Wilson instrument, the largest now in use. The advantage of the new telescope will be partly in its greatly increased light concentrating power which will make possible the photographing of more remote objects and show with greater detail and brightness known stars and nebulae.

Technical and mechanical progress

of recent years will also make possible greater stability of the large parts necessary. Temperature control of the huge dome, in which the instrument will operate, will contribute to its effectiveness and improved bearings and supports to its ease of control. There will be additional smaller telescopes to supplement and assist in the observations.

The site on Palomar Mountain was selected as being most favorable because of the prevalence of clear nights throughout the year, minimum of turbulence in the upper air strata and distance from interfering lights of metropolitan areas—all contributing to the quality and quantity of the observatory work.

A condition of this location was that San Diego County provide an adequate road to the observatory site to transport the materials for the several buildings, the large mirror



and large and heavy telescope parts when ready for installation, and thereafter to serve as necessary access to the observatory.

Construction of the road was undertaken in several units by State and county forces and with funds provided by the State, Federal Government and the county.

Old roads or more properly trails existed up the east and south slopes of the mountain but these narrow roads with their steep grades, sharp curves and poor alignment were not feasible even for improvement and were discarded for a new location up the south slope.

Late in 1934, when the design of the 200-inch mirror instrument was being completed, the matter of transportation of the parts was carefully considered by the designers and those



Transporting telescope parts over State Highways to Palomar Mountain.



Heavy loads on mountain grade. Center is part of telescope horseshoe weighing 54 tons. Behind it is a large girder.



Largest parts were moved on 4-axle low bed trailer.

in charge of its construction. The moving parts of the telescope weigh about 425 tons, and it was evident that besides the division into various pieces for design reasons and manufacturing convenience, a further division of certain portions would be necessary in order to get them from factories to the remote observatory site, which is 75 miles from San Diego, the closest port. Rail haul was not feasible because of the size of the parts, and because rail branches ended over 35 miles from the site.

The California Institute of Technology, in charge of the design and erection of the observatory, referred the matter to the Division of Highways, and after consideration of routes and bridge conditions by the State, the telescope design was completed, with the heaviest piece weighing about 54 tons and the largest 22

feet in diameter and 14 feet high.

Roadbed width, gradient and curvature of standards which would make possible the use of vehicles capable of handling these loads were then considered and construction proceeded. The work was sufficiently completed in 1937 to allow safe moving of many loads of fabricated structural steel for the 135-foot diameter dome of the main building, together with other necessary materials.

In October, 1938, the metal parts of the telescope arrived at San Diego by ships from the factories on the eastern coast.

Details of the permits for the hauling were worked out on recommendations of the State authorities as the schedule of the work and the exact data on the vehicles and loads became available.

The route selected included eight bridges on State highways and two on county roads, all newer types and of recent construction. Absence of weak bridges, width of roadbed and most favorable traffic conditions were considered in the choice of route from San Diego to the beginning of the "Highway to the Stars." This 12-mile portion has the steepest grades but no large bridge structures.

As the parts were unloaded from the ship's deck at San Diego an indication of their weight was observed when the rather sizable freighter listed very apparently as each piece was hoisted from the deck by a large railroad crane.

The loads were the heaviest unloaded from a ship at San Diego and also the heaviest moved over highways in this vicinity. A large four-axle, low-bed trailer supported the greatest weights and with two large trucks pulling and another pushing on hills the trip was made to the mountain and then up "The Highway to the Stars" in about two days' time for each load.

The State Bridge Department designated the definite lanes of certain bridges to be used, limited the speed, prohibited other loads on the bridges at the same time and checked the stresses as the loads crossed. The traffic was controlled through the cooperation of State and city police and the moving was accomplished without accident or noticeable damage to road surface or structures.

Road improvement projects

(Continued on page 24)



Section of new highway on Palomar mountain grade.



Map of State Highway 101(X) and County Roads (hatched) over which telescope parts were hauled from shipside at San Diego.

Observatory site



County road to observatory site before rebuilding.



# Grade Crossing Program Presents a Major Traffic-Safety Problem

By J. W. VICKREY, Safety Engineer

**R**OADS, highways and streets are designed, constructed and maintained for one purpose—the movement of people and their commodities.

Over a long period of time people have taxed themselves in various ways to get the money with which to provide for these public thoroughfares so as to make this movement possible. There was a time not so long ago when this movement was fairly simple and no great amount of money was required, as we think of amounts of money today. At that time we were more concerned about a road that would hold up throughout the year without too much dust and mud and inconveniences of that sort.

In later years, with the improvement of vehicles of transportation, the movement has become very complex. We now think in terms of the mass movement of hundreds of thousands of motor vehicles of all sorts, sizes, weights, and descriptions. We think of roads as highways; and a highway signifies to us a divided multiple-lane, smooth, straight boulevard. We talk of highways not in terms of road surface, dust, and mud, but in terms of vehicle miles and in carrying capacities of 1000, 2000 and 3000 cars an hour. This movement now amounts to 250 billion vehicle miles a year throughout the United States; and in California we make up not one-forty-eighth but almost one-tenth of this vast movement.

## MASS MOVEMENT PROBLEM

It is not a difficult task for an average driver to drive an average car over what we think of today as an average mile of road. But multiply that simple movement by 250 billion and you do have a problem. That is the problem with which we are confronted today—to provide for the safe and orderly movement of 250 billion vehicles miles of motor vehicle travel.

The grade crossing problem in Cali-

fornia is a problem within itself; but, of far more importance, it is a portion of this greater problem.

The measure of the efficiency of a highway system, or any single unit or portion of that system, is the orderliness with which it accommodates traffic. That highway does its job the best where traffic moves quickly—with the least confusion, the least congestion, and the smallest number of collisions in terms of miles traveled. The most popular yardstick today for measuring the efficiency of a highway, and the one that can be applied the quickest, is the number of accidents that occur. In fact, it has been contended by some authorities that if a record could be compiled of all accidents, regardless of their degree of seriousness, it would be found that accident occurrence would be in direct ratio to congestion. Whether that be true or not, a better accident reporting system and time will tell. It is a fact that the greatest number of accidents occur in the areas showing heaviest traffic.

## ACCIDENT FREQUENCY SYSTEM

In California we have a system by which we compare the accident situation on one section of highway with another in terms of miles traveled, and at the same time in terms of miles of road. We also compile accident data in such a way as to bring into immediate focus all points of recurring accidents—or as a statistician would say, the points of high accident frequency. By this system we are able to measure the accident frequency at each or all of the 1150 grade crossings on the State Highway System in California, not only one with the other but also with all other points of accident concentration on the State Highway System.

It is interesting to point out here that, judging from the past several years, the average main-line crossing in the State will be the scene of an ac-

cident involving a motor vehicle and a train once in about four years, and that there will be one death at this average crossing in 40 years; and further, that the hazard of a grade crossing with reference to all other points on the highway system is at the ratio of about one to sixteen. In other words, if you are going to be killed in a motor vehicle accident in California, the chances are sixteen to one that it will not occur at a grade crossing.

## \$200,000 AVERAGE COST

There are, in round figures, 12,000 main- and branch-line grade crossings in California, and several thousand more crossings of side tracks, switches, etc., that get only intermittent use. Forget for the moment this latter group and consider only the 12,000 that are in daily use. The average cost of grade separation projects in California has been approximately \$200,000. This figure is, no doubt, somewhat higher than the average cost would be for separating the 12,000 main- and branch-line crossings.

No accurate figures of the cost of separating all of these crossings are available—none has been made. Our engineers, however, use a figure of \$100,000 per crossing for this purpose. The estimated cost of separating the entire group of crossings on this basis, therefore, is one billion two hundred million dollars. If the entire amount of money now available for major construction purposes on the state highway system—approximately fourteen million dollars per year—were devoted to this work alone, it would take about eighty years to do the entire job.

Or, look at it from another viewpoint—assuming that the grade separation job is a safety problem and the money expended therefor is a contribution towards safety. If we are willing to spend over a billion dollars for that job, then we should be just as willing to contribute on the same



Four lane divided highway underpass with 8-foot division strip near Redding on State Route 3 (U. S. 99) in Shasta County.

basis to relieve the traffic accident problem over the entire State. Therefore, on the basis of fatalities, comparing grade crossing accidents with all other traffic accidents, we are talking about a total expenditure in excess of seventeen billion dollars.

In order to work out a reasonable plan of procedure to be followed in improving conditions at grade crossings it is necessary to get the problem in proper focus as related to the entire traffic problem. Highway engineers attempt to measure the necessity for improvement at each of the many crossings and to set up some plan of priority so as to improve the worst crossing first, and so on in proper order, and thus obtain the most value in traffic service for each dollar expended.

#### VALUE OF DELAY TIME

In order to do this from a factual basis they have taken into consideration not only the accident data, which are available, of course, for several years, but also they have measured the delay to traffic in terms of vehicle minutes per day. It is readily

seen that in measuring delay in terms of vehicle minutes consideration has been given to both train and motor vehicle traffic. By placing a value on time of delay it is possible, for comparative purposes, to arrive at an economic value of separating grade crossings.

Of course, there has been much written and more said about the value of human life. Life is a very difficult thing to evaluate, and many things would necessarily have to be taken into consideration in so doing. But the value is the same whether a life is ended at a grade crossing or elsewhere; so in any comparison it is sufficient for our purpose to consider fatality totals without attempting to place a dollar value.

Again, by working up the time of traffic delay, a basis is provided for comparing grade crossings with any and all other types of intersections, and the grade crossing problem is brought more closely into focus with other traffic problems.

Many grade crossings are located in highly congested areas where values are high and right-of-way costs pro-

portionately excessive. At these locations it is usual that street systems are already laid out and abutting property established. A grade separation structure in such places would entail a drastic change in existing conditions and the use of existing streets. If several streets come together near the crossing, as is frequently the case, the problem becomes more complex and more costly.

The proposed Aliso Street Overhead in Los Angeles is an example of this sort of a crossing. The grade separation structure at this point is now being worked out, at an estimated cost of \$1,500,000. Two or three separations like that one would materially raise the average figure of \$100,000 used in a preceding paragraph.

California has already done much with this grade crossing problem. In general, we have been able to follow out an orderly plan based on an economic survey, so that many of the most hazardous crossings have already been eliminated.

In the ten-year period from January 1, 1929, to January 1, 1939, there



have been 69 separation structures constructed. The State has contributed, in round figures, \$5,750,000 toward these projects, and the several railroads have spent a little more than three-quarters of a million dollars. There is now a general trend toward the use of highway funds alone for the construction of separation structures. I quote from an article by Mr. L. H. Collett, Safety Supervisor, Coast Lines, Atchison, Topeka, and Santa Fe Railway:

"For years the American people, in general, and automobilists in particular, have passed to the railroads the responsibility for such accidents. (Mr. Collett is speaking of grade crossing accidents.) But the railroads take the position that when a public crossing is established by law, when the managements of railroads see to it that such crossings are maintained in good conditions and see to it further that proper warnings by whistle and bell are given of the approach of engines and trains—the responsibility of the railroads ceases, and that of the motoring public begins! It is worthy of mention that history does not record an instance where a locomotive has ever jumped off the rails to hit an automobile, then jumped back on the rails and went on its way."

In recent cases before the Railroad Commission that body has leaned toward a policy whereby the major cost of separation is paid from motor

vehicle users' funds. There may be justification for this trend under the existing economic condition of the railroads. The underlying principle, however, is not changed—that rights granted to the railroads do not constitute a complete severance of country or State; and that there is and always will be an obligation on the part of the railroads to provide for cross movement commensurate with the demands of that movement.

During the last four years certain funds have been made available by the Federal Government for grade separation projects. This money was allotted to the several states on the basis of railroad mileage within the State, population of the State, and Federal-aid highway mileage. In addition to eliminating hazards, one of the primary purposes of the appropriation was to furnish employment. California has received about \$11,000,000 from this source. Sixty-nine projects have been completed or are now under construction and only two projects remain to be advertised.

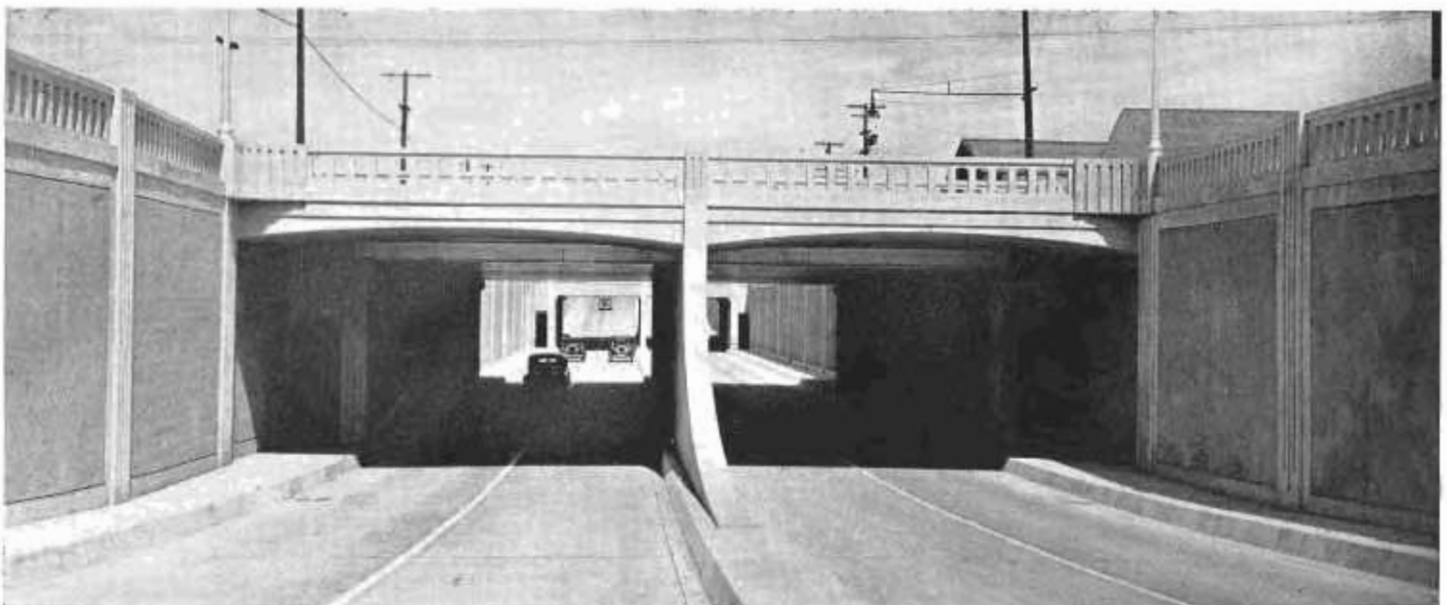
It was specifically required that the funds should be divided among the railroads on the basis of their main-line mileage operated in the State, and that they could not be used for right of way purposes. These requirements were matters of no small moment. The Great Northern Railway operates approximately one hundred miles of road through the most sparsely settled portion of the State. Under the regulations, this

mileage made it necessary to construct one grade separation project on this line, although no crossings in that area could compare in traffic with hundreds of crossings in other locations.

The Union Pacific operates only in Southern California, and the Western Pacific only in Northern California, while the Southern Pacific and the Santa Fe operate over the greater part of the State. Grade separation projects at important crossings are individually expensive; and the problem of distributing a relatively small number of projects over these various railroads and throughout the State, is provided by governmental regulations under which the allotment of these funds was made.

Obviously, it will be many years before even the most important crossings, from a traffic and traffic-safety standpoint, can be eliminated with funds that are now available. Proper consideration for the movement of traffic demands that the work go forward on a balanced and orderly basis. The Division of Highways, therefore, along with the program of separation, is at the same time carrying on a program of grade crossing protection. In carrying out this program, careful consideration is being given to all the known types of protection and a determined effort is being put forth to adapt each type of protection used to its proper place—again being guided by the broad basic principle of obtaining the maximum in service for each dollar expended.

(Continued in a later issue.)



Grade separation at Stockton carries U. S. 50 traffic on 4-lane divided highway under 8 tracks of two railroads.

# Grade Crossing Overhead Project Includes 3-Span Bridge Over Stream

By M. W. GEWERTZ, Resident Engineer

**T**HE recent completion of the Greenville Overhead Project, located on the eastern outskirts of the town of Greenville in Plumas County, marks the elimination of one more dangerous railroad grade crossing and a narrow one-way highway bridge at the same time.

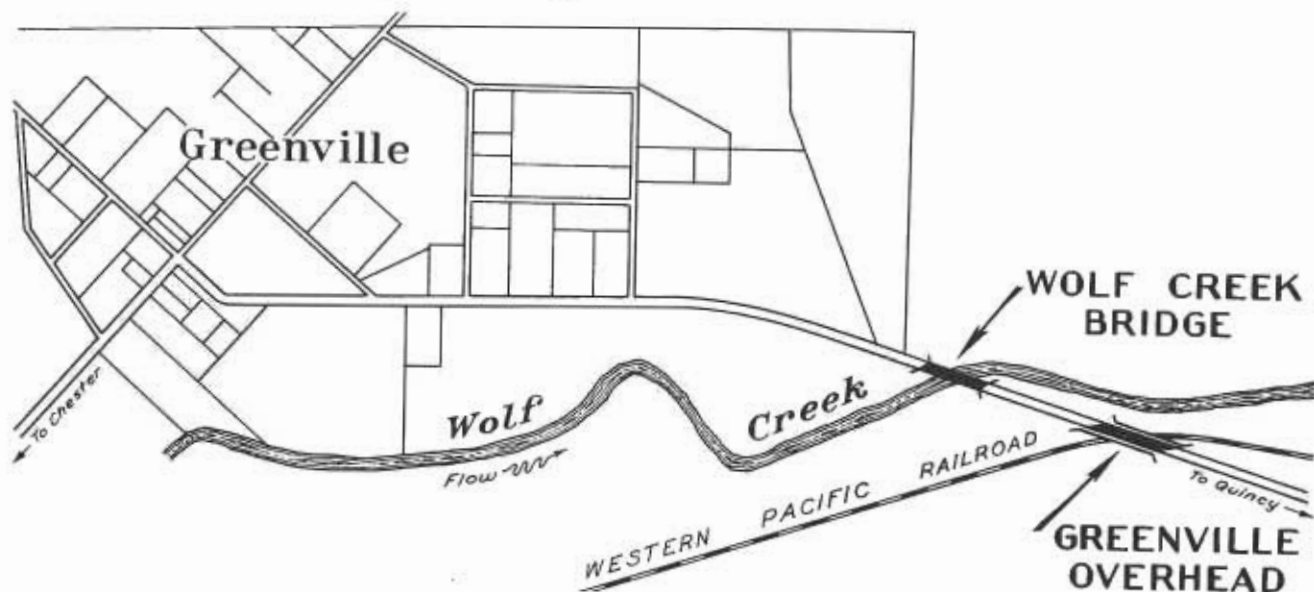
It was originally contemplated that this work be constructed as a Federal Forest Highway Project, and plans were prepared by the U. S. Bureau of Public Roads in 1935. At a later date the project was included among

The cost of the completed project is approximately \$125,000, all of which was supplied from Federal funds. Rights of way were secured with State funds.

The work consisted of the construction of two reinforced concrete and structural steel bridges: one the overhead structure across the tracks of the Western Pacific Railroad, and the other a bridge crossing Wolf Creek, which lies approximately parallel to and about 200 feet north of the railroad. Approach embankments were

feet wide. This provides a shoulder 6 feet wide on the side where the structure sidewalks are located, thus providing a passageway for pedestrians throughout the length of the project. Approximately 1000 lineal feet of laminated guard railing was placed on the shoulder opposite to the sidewalk side where the embankments are high, as an additional safety measure.

A detour approximately 1000 feet in length was constructed with a 24-foot graded roadbed and an 18-foot



those to be constructed by the State with Federal funds, and in the early part of 1938 the plans were revised by the State Highway Department. Funds were made available from the 1938-40 allocation and the construction contract was awarded in August, 1938.

The project is located on State Highway Route 83, a secondary State highway, and has made possible the elimination under one contract of the railroad grade crossing and the old one-way bridge across an adjacent stream as well as providing a material improvement in alignment.

constructed for a length of approximately 2000 feet, providing for both structures. Metal crib retaining walls were constructed to retain the approach fills adjacent to the railroad tracks.

The existing bridge across Wolf Creek, which consisted of a steel pony truss of 60-foot span and 13-foot clear roadway, was removed and the existing railroad crossing was abandoned.

A graded roadbed 31 feet in width was constructed, upon which was placed a base of 6 inches of selected gravel material and a surface of road-mixed material 0.21 inch thick and 22

width of penetration-treated surface. Traffic used the existing railroad crossing during construction, and for a length of approximately 500 feet was routed over the new roadbed while under construction.

The greater part of the material composing the embankments was obtained from a borrow pit site adjacent to the work. Excavation was performed by two carryall units of 12 cubic yards capacity, powered by RD-8 tractors. The wet excavation in the channel and pier footings was removed by dragline and clamshell equipment.

The Wolf Creek channel was changed for a length of approximately 1000 feet, providing a channel with a 30-foot bottom width, 1 to 1 side slopes and a depth of 15 feet. The portion of the channel material suitable for roadway purposes was deposited in approach embankments while the remainder was used to heighten and reinforce the channel banks. Slope protection was provided where the channel was constructed on a curve of 300-foot radius, by placing sacked concrete on the face of the outer slope.

The highway overhead structure across the railroad consists of three 70-foot spans of 36-inch rolled I-beam girders, continuous in design. Expansion is provided for by hinges in each end span near the intermediate piers, and by rocker bearings at one intermediate pier. The intermediate piers each consist of 4 individual reinforced concrete columns on spread footings, while the end bents are supported on steel piles. The deck is a reinforced concrete slab approximately 7½ inches in thickness, supported by 4 lines of girders. A 20-foot clear roadway is provided, with a 3-foot sidewalk on one side.

The Wolf Creek bridge is a 3-span structure quite similar in design to the overhead structure. All the bridge footings are supported on steel H-piles. The intermediate piers were founded below the level of the creek which necessitated the construction of cofferdams and the pouring of concrete seals to exclude water from excavations during the construction of the piers. The bridge piers are a single unit, rather than 4 individual columns as at the overhead. One end span is shortened to 52 feet while all other spans on both structures are 70 feet in length. The deck structure, hinge details, etc., are similar to those at the overhead.

The steel understructure of the deck is painted black while the railing is painted aluminum on both structures, providing a pleasing color contrast.

(Continued on page 21)

At top—Grade crossing on State Highway 83 near Greenville, Plumas County before improvement. Below—structures across railroad and stream connected by highway fill on improved alignment. Reinforced concrete overhead across railroad on two 4-column piers. Bottom—Highway bridge across Wolf Creek.





# New Type Luminaire Developed for Entrance Points of Divided Highways

By F. M. CARTER, Assistant Maintenance Engineer

WITH the development of vapor lights conveying different reactions to the traffic on public ways, the traffic engineer and public officials have given much thought to an intelligent use of the various colored sources in an attempt to promote their uniform usage.

The yellow glow produced by sodium vapor lamps coincided so closely with the color used for many years on the public highways and over a much longer period of years in railroad operation, as a cautionary color, that it was immediately used by traffic engineers to give the same information on vehicular highways.

However, as utilized in actual practice, such illumination is not confined to locations requiring merely cautionary lights, though the sodium vapor light does provide this indication.

California, with the advent of the sodium vapor light, did use it for cautionary lighting at potentially hazardous accident reoccurring intersections of public ways—channelizations, intersections and at underpasses. A new problem is presented in providing a distinctive color for the entrance to divided highways.

The potential hazard at intersections is of a different character than that at the beginning of a divided highway, because in the latter case it is necessary to deflect the traffic at these points of separation into definite lanes of travel and to convey the necessary information that through the section of highway ahead traffic will be separated by a divisional area.

Assuming that these areas are for the most part rural in character, it was considered advantageous to confine this indication to the illumination of the curb at the point of the island and to the area the entering traffic might use. Traffic exiting

from such divisional sections should be readily and adequately advised without being forced to pass through an illuminated area which creates a period of darkness at a point where the potential hazard of head-on collision increases because of the lack of a divisional island.

## TESTS TO DETERMINE TYPE

Through the cooperation of the General Electric Company, various types of luminaires were tested by the Division of Highways. The mercury vapor lamp was selected because its blue-white hue gave a distinctive color for this indication. The color sensitivity effect on the eye produced by mercury vapor reacts similarly with that produced by sodium vapor.

The new 250-watt Mercury vapor inner quartz envelope lamp has practically a point source of light. This makes it possible to shield the source of light from the eyes of traffic at the point of leaving the divisional island section of the highway without sacrificing advance warning indication and efficient distribution. It was found advantageous to use a mounting height that would confine the illumination to the point of the island and the area immediately adjacent to the entrance lanes.

## LIMITATION OF OLD EQUIPMENT

A narrow angle floodlight, when mounted low, produced an effect which approached the desired objective. However, to obtain the best effect with a flood or spot light using the low mounting height, it was found that the glare thrown into the eyes of the exiting traffic was objectionable and very hard to overcome without louvers and shields which spoiled the lighting effect.

A highway type of luminaire with the lamp inclosed within a spun reflector globe combination was chosen

for the next test on night traffic.

These tests showed that the best results were obtained when the reflected source of light was:

(1) visible to the approaching entering traffic at a considerable distance.

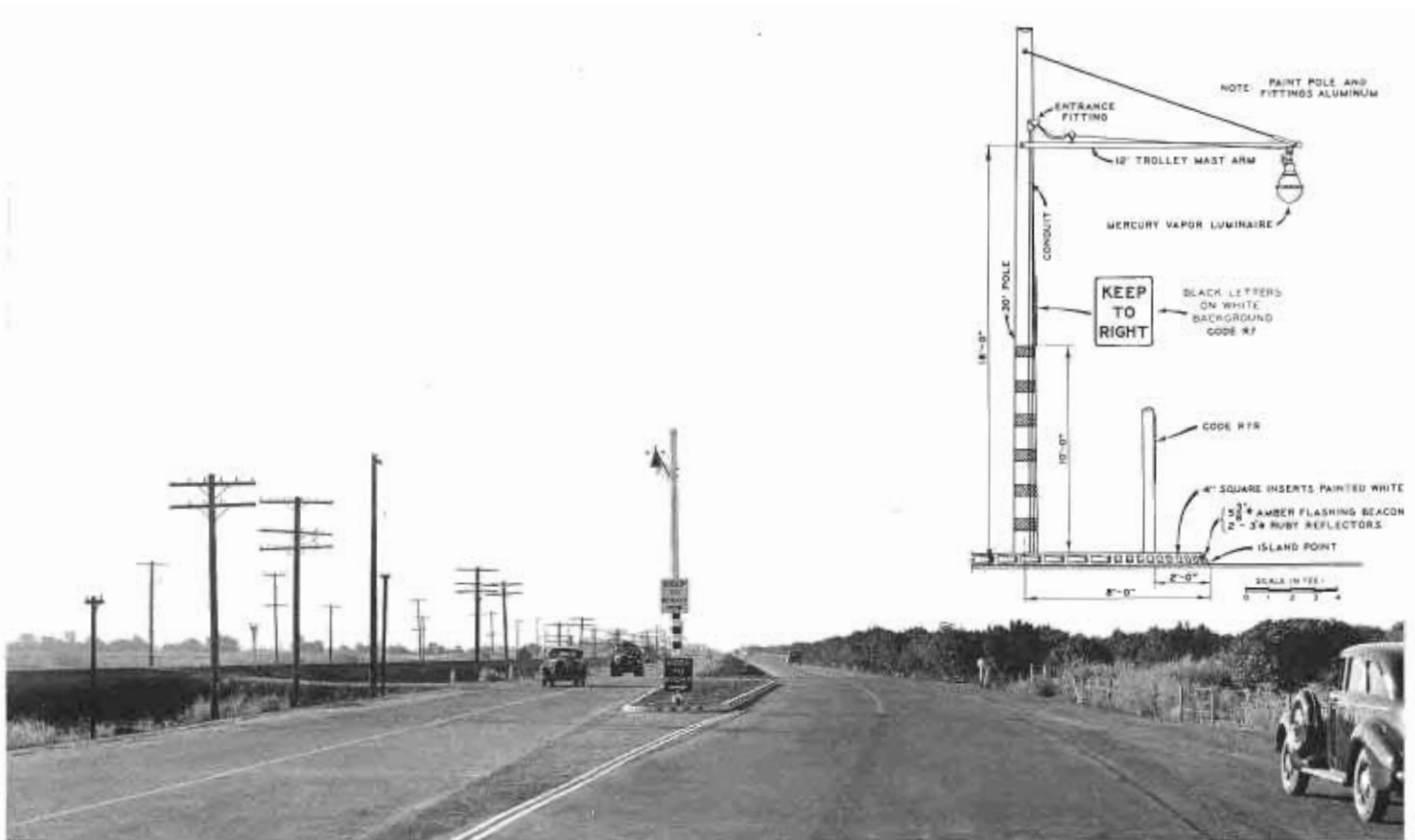
(2) visible from a distance to the exiting traffic but shielded from such traffic (to prevent "flashing the eyes") at the point of exit from divisional island section.

## DESCRIPTION TEST APPARATUS

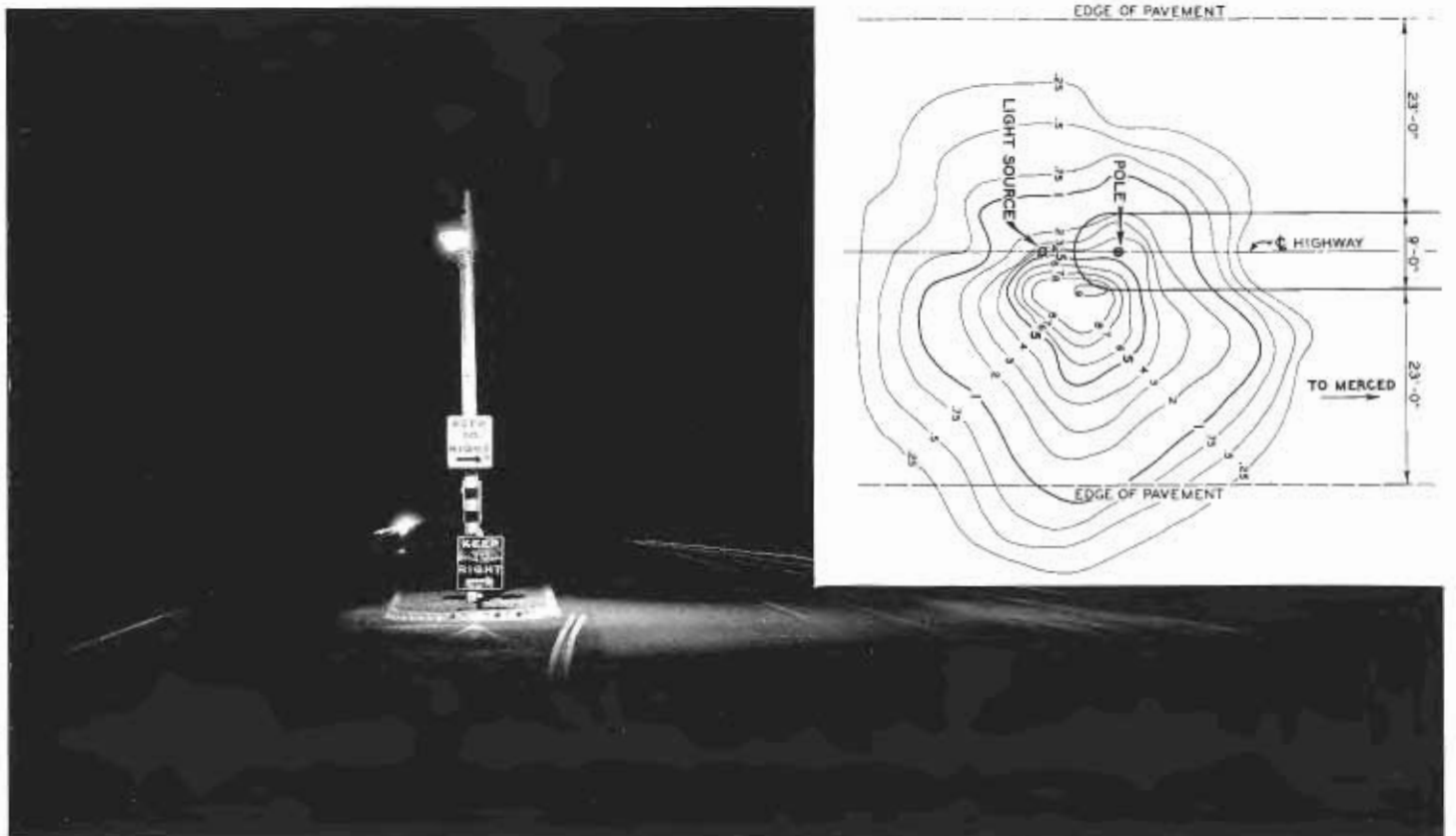
To obtain this effect, a G. E. type 79D luminaire was tested at an 18-foot mounting height (the minimum safe height considered practical) on a 12-foot trolley mast arm so that light distribution could be adjusted vertically and horizontally with respect to the point of island. An adjustable socket allowed the vertical distribution and the intensity of the maximum candle power, to be varied. The results of these tests with an explanation of the objectives above described were submitted to the laboratories and a special shaped shielding deflector was designed to produce the desired effect.

The final installation consists of an inclosed type distorted asymmetric distributing luminaire with adjustable socket mounting—a shielding deflector forming a right angle and fitting the shape of the spun-on globe, to keep the light out of the eyes of the approaching traffic and direct it transversely to the areas for which the illumination was desired. The reflector portion of the luminaire is stepped or fluted to direct the rays away from the opaque inner quartz stem of the lamp to obtain lower lamp operating temperatures and increased life. This advantage may be reduced to some extent by the new deflectors introduced within the luminaire, but

(Continued on page 25)



Daylight view of new divisional island lighting equipment on 30-foot pole with 12-foot arm 18 feet above ground.



Night view shows bright lighting of island point and signs. Inset graph of isolux lines shows illumination of approach lanes.



Improved appearance of U. S. 40 approach to M Street bridge, Sacramento, by tree and shrub plantings. Inset shows former conditions.

# Practical Roadside Development

The following article is the second and concluding instalment on practical highway landscaping by Mr. Bowers.

By H. DANA BOWERS, Landscape Engineer

CALIFORNIA'S varied topographical and climatic conditions make the problem of roadside landscaping rather unique. With the exception of harmonious location and grading, which is always appropriate, the various regions—coastal, valley, mountain and desert—should receive individual methods of landscape treatment.

The humidity of the coastal region allows for a more liberal interpretation of roadside improvement particularly in the use of plant materials. Seasonal rainfall is not always a controlling factor as regards the use of plants, as is exemplified by comparing

the valley and coastal regions. Although the rainfall may be comparable, the existence of atmospheric moisture completely changes growing conditions. Thus in the coastal region there lies the possibility of a comprehensive landscape treatment involving all of the basic landscape requirements as set forth by the Bureau of Public Roads. These are:

I. Landscape Grading (flattening, rounding transition slopes, etc.).

II. Obliteration of old roads, re-soiling borrow pits, etc.

III. Topsoiling, improving of existing soils and soil preparation necessary for seeding or planting.

IV. Planting of trees, shrubs as permitted by local soil, slope and climatic conditions.

V. Seeding or planting of grasses, succulents or other ground covers.

VI. Provision for properly designed rest areas or scenic turnouts.

Projects submitted for landscape credit must include these six basic stages of landscape work or the omission of any of them must be explained.

One of these requirements without at least a majority of the others will not qualify for Federal landscape participation.

Even casual study will reveal the



impracticability of formulating a definite set of rules to cover such a wide range of conditions as are encountered in California.

The coastal region, where such a standard may be conformed with, comprises only a small percentage of the State's area, while the majority of the State—valleys, mountains and desert—presents conditional problems that set a definite limitation on landscape treatment.

In order to carry on a practical and perpetual program of roadside improvement it appears only reasonable that this fact be recognized and a more flexible translation of comprehensive projects be made. Generally speaking, landscaping in the valley region is necessarily confined to tree planting and the flattening of roadside ditches. (Treatment at structures and possibly town entrances are excepted.) Tree planting must be programmed three to five years apart in order to keep within a reasonable and nonfluctuating maintenance set-up. Valley projects then must necessarily be few and far between.

The mountain regions offer opportunities that are perhaps of more esthetic and economic value than does the coastal. Although landscape features here are limited to grading, scenic turnouts, parking areas, topsoiling or general clean-up, *any one or all combined* definitely stand out as an improvement in roadside appearance.

To stipulate that all of these features shall be included in order to formulate a comprehensive plan is not always practical, since in many sections such as the semiarid foothills, clean-up of the right of way or the development of water and parking space might have a great esthetic value and render a useful public service.

In the higher altitudes more heavily covered with natural growth the intelligent use of topsoil on fills and flattened low cuts would bring about a rapid natural effect. Of course there are usually additional opportunities to provide other types of landscape treatment, but the point in mind is this—that even one basic landscape requirement is often highly desirable and worthy of application.

Landscaping in the desert is obviously limited to harmonious grading and top soiling—perhaps top sanding would be more nearly correct. There



Some comparable results of slope rounding are shown above.

is, in certain desert sections, opportunity to conserve or import the "seed coat," where natural desert flowers are known to be present, for a light covering over the slopes.

Cultivation of the area outside the shoulder will change growing conditions to the extent that the results will be surprising. The moisture retained under the pavement will give new life and appearance to desert roadside growth.

Contrary to popular belief, highway landscaping is not entirely a palliative or a follow-up embellishment of construction. Although the process nearly always involves in some way the use of plant material, it should be regarded and practiced less from the standpoint of artificial endeavor, and more from the practical and economical process of a natural restoration treatment to insure roadway permanence which automatically will improve roadside appearance.

There has been but little of this procedure in the past, due, as before mentioned, to inexperience. Mistakes have been made as is the case in any new line of endeavor that launches out on a large program too hurriedly. However, having profited by past experience we should now continue on a more practical basis.

Under way at present in San Luis Obispo County, between Pismo Beach and Arroyo Grande, is a day labor landscape project where the principles set forth in this article are being applied. The location was selected because of the opportunity to create an appreciable change in general roadside appearance by landscape



Scraper and bulldozer rounding and leveling top of cut slope.

grading and by reason of erosion and excessive weed growth, roadside maintenance could be reduced by the planting of self-establishing ground cover. In order to conform with Federal regulations governing landscape projects, groups of trees are also being planted.

Of particular interest is the method and cost of accomplishing slope rounding and transition operations on this project. The following is a description of the method used as written by Resident Engineer L. P. Davis, who has supervised all landscape projects in District V:

"A mechanical method of slope rounding has been developed in District V of the Division of Highways, in connection with certain roadside

development projects following construction which has proven very satisfactory, and is equally applicable to new construction.

"By this method, practically all of the tedious and expensive hand shaping has been eliminated and rounding is accomplished by the use of a scraper attached to a track-layer type tractor.

#### Requirements

"The requirements for satisfactory use of this method are that the top of slopes be of such a nature as to permit tractor operation, and that the soil be amenable to cutting and moving with the scraper.

#### Method

"Rounding is accomplished by backing the scraper over the top of the cut slope, lowering the cutting edge, and making a series of diagonal cuts across the edge of slope, the depth of which may be controlled by the operator.

"At the start of the operation, the cutting edge of the scraper lies in a plane with the slope. As the tractor progresses on a diagonal of approximately forty-five degrees to the edge of the slope, the upper wheel of the scraper reaches the summit, and the relative rate of elevation of the upper and lower sides of the scraper begins to change, resulting in a diagonal transition from the face of the cut to the top of slope.

"The equipment is again backed, slightly overlapping the previous cut and the operation repeated. After

(Continued on page 24)



Scarifier attachment behind scraper aids in working rocky formations.

# Building Highway Tunnel by Open Cut in Presidio

The front cover picture shows one of the many unusual types of construction which the highway engineers build during these modern days. The picture shows a part of the approach road to the Golden Gate Bridge through the Presidio in San Francisco.

Inasmuch as this highway is being built through a United States military reservation, it is necessary to closely follow the restrictions and regulations imposed by the War Department, which provide that part of the route must be tunneled.

This tunnel portion carries the roadway beneath a section of the Presidio used as a parade ground for military maneuvers and a golf course, for which reason an open cut highway was not possible. Due to the sand formation and the small amount of material over the top of the tunnel, it was found more economical and practicable to use the so-called open cut and backfill method.

The highway is cut through as shown in the picture, permitting the tunnel to be built in 28-foot sections, and the pouring of the concrete in large quantities into the forms from above as illustrated in the photograph, with the aid of a crane and bottom-dump bucket.

The tunnel section is then backfilled or covered over with soil to restore the original ground surface and the false work removed from the interior.

The tunnel is 1300 feet in length and will accommodate a four-lane highway. The material taken from the tunnel cut was used to overload a section of fill on marshy ground skirting the edge of Mountain Lake. The material thus stockpiled as overload will later be used to backfill the tunnel and tunnel retaining walls.

The tunnel approaches the practical limit of length without requiring forced ventilation equipment, but ventilation is provided by a 24- by 24-foot shaft about midway of the length of the tunnel.

Speaking of public enemies, we know a plebe who whistles to wake the birds up every morning.

## Thanks for Help

Millbrae, Calif.,  
August 8, 1939.

California State  
Highway Division,  
Sacramento, California.

Gentlemen:

Your Mr. Holt, at the Burlington Station on the Redwood Highway, rendered us invaluable aid after an accident we suffered on the morning of July 8, 1939, near the Burlington Station. His courtesy and efficiency enabled us to proceed after minimum delay, and since he accepted no compensation for the assistance which he found in the line of duty, we wish to take this means of calling attention to his extraordinary helpfulness. If there is any recognition due to highway employees for unusual services, Mr. Holt is surely deserving of his share.

Thank you kindly for expressing to him our appreciation.

Yours truly,

E. E. PHILLIPS.

## Grade Crossing Overhead Project

(Continued from page 15)

Ceremonies attending the formal opening of the project were held in conjunction with the annual "Gold Diggers Celebration" of the town of Greenville, and the colorful costumes of the visitors lent a festive appearance to the occasion. The ribbon cutting ceremony was climaxed by a parade led by a group of gaily dressed school children.

Representatives of the U. S. Bureau of Public Roads, the California Division of Highways, the Western Pacific Railroad, the Plumas County board of supervisors, the town of Greenville, and the contractor were present and addressed the group, expressing their satisfaction and gratification at the completion of this much needed improvement.

The contractor on the project was the George Pollock Co. of Sacramento, California.

# Architecture Program Totals \$12,298,288

(Continued from page 5)

ments for State mental hospitals, prisons, reformatories, homes and schools for the blind, deaf and feeble-minded, armories and national guard encampments, colleges, agricultural exhibits and grandstands, office buildings, etc., the Division cares for all alterations and repairs to existing buildings.

We also design and install all heating, lighting, ventilating, refrigerating, water supply, mechanical and electrical plants as well as changes and extensions of original equipment; we survey grounds, lay out walks, drives and roads; provide water supply, sewer and drainage systems requiring the design and construction of dams, reservoirs, pipe lines, wells, pumping plants, ditches, sewage treatment and disposal plants and drains.

### ALSO PROVIDE FURNISHINGS

Because of the legal interpretation of earlier appropriations we have been obliged to purchase and have delivered furnishings for buildings involving beds, mattresses, blankets, ticking, sheets, pillow slips, dishes, knives, forks, spoons, tables, chairs, ice cream freezers, etc.

It can readily be seen that our activities go far beyond the circumference of the meaning of the word "architecture."

It would appear that our work for the most part can be classified as having benevolent tendencies and accordingly should be entered on the credit side of Gabriel's ledger. On the other hand, however, we wonder how the powers that be will measure our credits against the construction of a lethal gas chamber at the San Quentin Prison which was designed and constructed for the sole purpose of taking human lives.

Bill—"Have you ever seen one of those inventions that tell when a man is lying?"

Jack—"Seen one? I married one."—*Portland Oregonian.*

Mrs. Newdriver (to garage mechanic)—"They tell me I have a short circuit. Can you lengthen it while I wait?"—*Christian Science Monitor.*



# Pinole Grade Separation on U. S. 40 Carries Highway Over Railroad

**T**HE Pinole Overhead, separating the grades of Highway U. S. 40 and the Atchison, Topeka and Santa Fe Railroad, was completed on September 1. This improvement, located on the main transcontinental trunk highway 16 miles east of Oakland, is another unit in the intensive railroad grade separation program started in 1936.

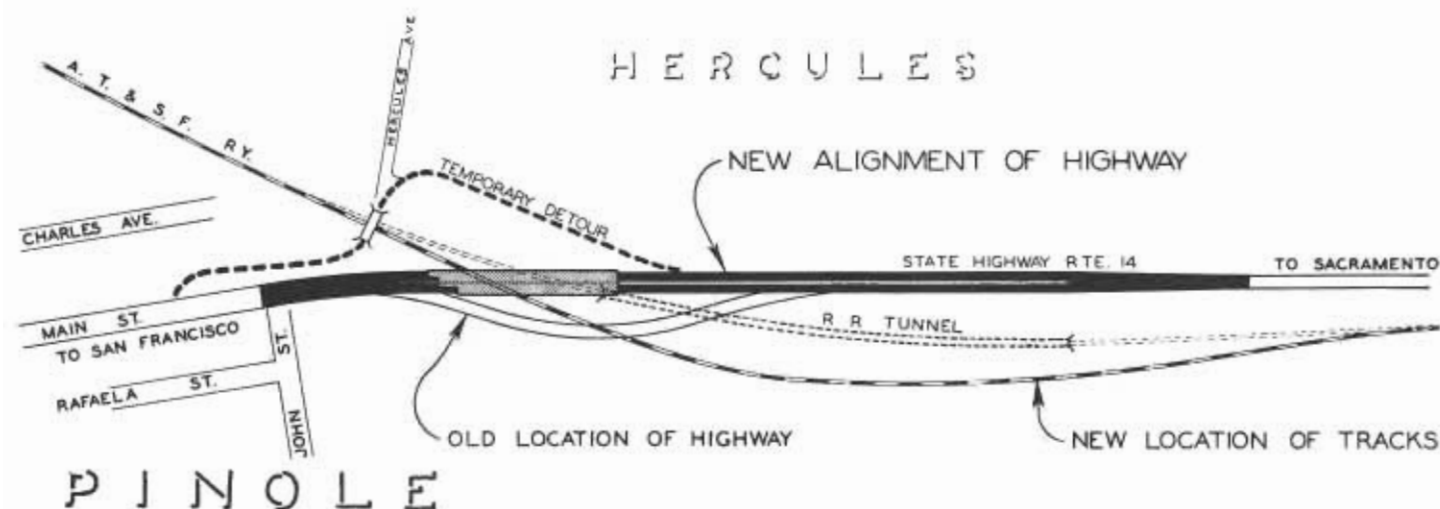
Previous to construction of the new structure, the old highway was located over the Santa Fe Tunnel near its portal. The old highway, consisting of a 30-foot paved surface, was on poor alignment with short radii reverse curves and a portion of

foot 6-inch end spans. The structure is of rigid frame design, which permits the use of lighter sections and aids in obtaining the necessary vertical clearances over the railroad without increasing the approach grades. The conservation of head room is very important at this location, as the south end of this project is located in the town of Pinole where it is necessary to maintain the existing street grade. The new road crosses the railroad track at an elevation six feet lower than that of the old road.

The spans of the bridge are supported by three columns and the span lengths are apportioned in such a

of the acute angle of intersection between the center line of the railroad and the highway, as well as the necessity of maintaining railroad traffic at all times during construction. The project involved the relocation of the Santa Fe tracks in an open cut and the abandonment of the former railroad tunnel. This required the relocation of approximately 3500 feet of track and the removal of 400,000 cubic yards of excavation.

In constructing the overhead structure it was necessary to coordinate the work with that of the Santa Fe in order that construction delays would



it was located in a cut, with sight distance restricted.

The new alignment eliminates 67 degrees of curvature and is a link in the general improvement of the State highway routing from Sacramento to the Bay area, which includes the recently completed line change south of Vacaville, the revised location from Fairfield to Cordelia and the American Canyon cut-off.

The structure over the tracks is built of reinforced concrete. It is 425 feet long and has two 25-foot roadways separated by a four-foot dividing strip which separates traffic from opposite directions. There are eleven 34-foot slab spans and two 25-

manner that the railroad can pass under the structure between the columns at an angle of intersection with the highway of 26 degrees 12 minutes. This arrangement allows the construction of the supports at right angles to the center line of roadway and thus obviates the necessity of designing the structure on a skew.

Collision walls extending seven feet above the ground were constructed between the columns paralleling the track, to protect the structure against the possibility of projecting loads from trains.

The design as well as the construction was made difficult because

be reduced to a minimum. During the time that train traffic was using the old tunnel and track the south half of the structure was completed, the railroad cut was made, the new tracks laid and train traffic was transferred to the new railroad location. The old tracks were then removed and construction of the north half of the structure proceeded without interference.

All work in connection with the construction of the overhead and approaches was handled by the State Division of Highways. The work of making the railroad cut and other work incidental to realigning the

(Continued on page 24)



Views of new grade separation on U. S. 40 near Pinole in Contra Costa County where the highway formerly crossed over the railroad tunnel. At top—New divided highway bridge over railroad. Center—New railroad cut. Bottom—Divided highway approach.

# Practical Roadside Development

(Continued from page 20)

the first slice has been made, the upper scraper wheel is rolling on the above mentioned transition, causing a smooth transverse rotation of the scraper's cutting edge as the equipment progresses, resulting in improved control.

"For further rounding a new series of cuts are made at approximately right angles to the first. This second operation increases the radius of rounding and results in a curve of improved smoothness due to the fact that both wheels of the scraper are this time rolling on the transition. These series of cuts may be continued, limited only by the ability of tractor to operate on the rounded slope. Scraping may be supplemented by the use of a scarifier.

"Should it be desirable to greatly increase the radius of rounding beyond the normal limits of safety for tractor operation, this may be accomplished by increasing the length of "hitch" or distance between tractor drawbar and the cutting edge of scraper.

"In addition to the rounding described above, this method is used at the ends of cuts to develop transitions from existing slopes to normal ground.

## Advantages

"Slope rounding by hand methods, or by bulldozer, results in all trimmed material falling to the gutter where it must be rehandled and disposed of by trucks.

"With the method heretofore described, there is a minimum of slough to be handled due to the fact that practically all material removed in the rounding operation is drawn to the top of cut where it may be drifted into surface irregularities by the same equipment, greatly improving the profile line of cut.

## Costs

"On the Federal aid landscaping project between Pismo Beach and Arroyo Grande, 9725 lineal feet of slopes, ranging from a light sand to compacted gravel, adobe soil and sandstone, were rounded and transitions developed at the ends of cuts by the above method for an expenditure on tractor and equipment of

\$798.72, or a cost of approximately \$0.082 per lineal foot. This rounding was somewhat more extensive and involved a greater yardage than is ordinarily encountered on construction work, since many of the cuts were graded appreciably lower.

"On a number of cuts, due to existing right of way fences, excessive erosion and rocky ledges, it was impractical to operate the tractor and equipment. In these places hand methods of rounding were employed at a total cost of \$450. This included the removal of slough on hand operations, also minor clean-up of slopes on the entire project, and left the slopes in a finished condition preparatory for ground cover planting operations. The cost of this supplemental hand rounding was approximately \$0.046 per lineal foot for the job providing a combined cost as follows:

Mechanical method of slope rounding 9725 l. f. ....	\$798.72
Supplemental hand slope rounding -----	450.00
	<hr/>
	\$1,248.72

"Making a total cost for the complete rounding and grading of approximately \$0.128 per lineal foot."

## Pinole Grade Separation on U. S. 40

(Continued from page 22)

tracks was handled and financed by the Santa Fe Railroad. The railroad company also assumed the obligation of furnishing the necessary additional right of way for both the railroad and the highway. The cost to the railroad for its portion of the project amounted to approximately \$125,000; while the cost to the State was approximately \$110,000.

Work was started on the project on September 12, 1938. Rail traffic was transferred to the new location on April 24, 1939, and the bridge was opened to traffic on August 4, 1939. The work was performed under contract by the Union Paving Company. John E. Burke was Resident Engineer in charge of construction for the State.

# Palomar Highway to the Stars

(Continued from page 10)

recently completed or under way which are used as approach roads are:

(1) 3.3 miles Iron Spring Creek to the observatory site, built by State contract.

(2) About 9 miles from State Route 195 to Iron Springs Creek by county forces.

(3) About 2.8 miles reconstruction on Cu Cu Grade State Route 195 completed by State contract in 1937.

(4) Reconstruction of the Rincon Grade, bridges and oiling of the surface on the Valley Center County Road, Escondido to Rincon, by county forces.

(5) State prison camp work, about eight miles of reconstruction along the San Luis Rey River between La Jolla Indian Reservation and Morettis, still in progress near Lake Henshaw.

(6) A State supervised project constructing a reinforced concrete bridge across the San Luis Rey River at Rincon, now completed.

(7) Two Federal Government reconstruction projects recently completed by the Public Roads Administration within Pala and La Jolla Indian Reservations, 3.2 miles and 2.2 miles long respectively.

All large and heavy loads have now been moved with the exception of the mirror and two large gears being completed at Pasadena.

From now on the "Highway to the Stars" and its feeder roads will be called on to carry an increasing passenger car traffic. The observatory will draw scientists from all over the world, together with many tourists and others having only a casual interest in astronomy. A visitors' gallery is provided from which the huge telescope can be seen without disturbing the work of the astronomers. A museum of astronomical photographs will also be open to the general public.

The trip over the approach roads and the road up the mountain is very attractive. A portion of the "Highway to the Stars" passes through densely timbered country of great beauty and the approach through the Indian reservations, past the San Luis Rey and Pala missions and along the San Luis Rey River has considerable appeal.

Traffic counts at Rincon show a 24-hour total of 172 vehicles in 1934 and 895 vehicles in 1939. The increase will probably continue after the observatory is completed.





Grade separation at Famosa in Kern County on Golden State Highway (U.S. 99) carrying 2 railroad tracks over a 4-lane highway.

## New Type Luminaire Developed for Division Islands

(Continued from page 16)

test results on this point are not yet available.

The lamp is a 250-watt mercury vapor, 10,000 lumens, type H5A, which at present has the same service life as incandescent Mazda lamps, but which, no doubt, will be improved as was the case with the Sodium Vapor, to approximate that of Sodium lamp life. The unit was mounted 18 feet above the pavement on a 12-foot trolley mast arm fixed to a pole set eight feet back from the point of the island. The luminaire hangs four feet out from the point of the divisional island on the center line extended.

### FOOT CANDLE GRAPH

The accompanying graph of the isolux lines for horizontal foot candles shows how the illumination from this specially designed deflector meets the requirements as submitted. The far lane of the exiting traffic receives practically no illumination, and the inner lane receives but three-quarters of a foot candle. A distant indication is received by this traffic with no flash at the point of exit. The point of the island on the exit side receives two-foot candles and this illumination on the curb at the point increases to four-foot candles at the center, with nine-foot

candles on the curb and immediate adjacent pavement at the entrance. The area receiving eight-foot candles is correctly located to provide the indication where needed most.

The direction and spread of light as shown by this graph of final illumination is obtained with no flash or source of light being visible to the entering or exiting traffic. A sign, 30 by 36 inches with black copy on a white background, reading KEEP TO RIGHT, is placed on the light standard at a height of approximately ten feet from the bottom of the sign above the pavement. This height was determined by readings in order to place the sign in the maximum beam from the luminaire. The legibility of this sign produced by the blue-white mercury vapor light was increased nearly 100 per cent over daylight visibility. The sign, while not legible, was visible to approaching drivers from a considerably greater distance.

In order to provide extra safety a flashing yellow beacon was imbedded in the curb at the point of the island with a three-inch reflector on either side. A low mounted reflectorized KEEP TO RIGHT sign also gives an additional factor of safety.

California is the first state to make

use of this distinctive lighting of approach island points and channelization area.

Since the installations are comparatively recent there has been no opportunity to evaluate the effect on accident reduction. However, the favorable reaction from several traffic engineers as well as the motoring public indicates that this new idea of a definite and distinctive area illumination will be a contribution to safety.

## Mexico Dedicates Link of International Highway

Mexico officially opened a modern paved stretch of more than 400 miles of the International Pacific Highway between Guadalajara and Mexico City on Saturday, July 29.

Dedication ceremonies marked surfacing of the entire link and another step in the development of the west coast tourist route now traversable from Southern California via Nogales, Arizona, to the capital of Mexico.

The Federal highway borders the beautiful Lake Chapala, largest in the Republic and passes also extensive Lake Patzeuaro.

## Highway Bids and Awards for the Month of August, 1939

**BUTTE COUNTY**—Between Mile 8.90 and Mile 10.50, and between Mile 11.00 and Mile 14.30, about three and four-tenths miles in length, road mix surfacing to be constructed. District III, Route 87, Sections A and B. Lee J. Immel, Berkeley, \$14,141; Fredericksen & Westbrook, Sacramento, \$16,701; Garcia Const. Co., Irvington, \$14,068; Hemstreet & Bell, Marysville, \$12,882; Harms Bros., Sacramento, \$14,636; Spaletta, Siri & Siri, Santa Rosa, \$13,291; E. B. Bishop, Orland, \$17,000. Contract awarded to Embleton & Schumacher Co., Albany, for \$11,970.18.

**BUTTE COUNTY**—Between Railroad Crossing and Route 21, about 2.4 miles to be surfaced with plant-mixed surfacing. District III, Route 87, Section A. Hemstreet & Bell, Marysville, \$11,402; Fredericksen & Westbrook, Sacramento, \$10,945. Contract awarded to Piazza and Huntley, San Jose, \$8,625.

**CALAVERAS AND ALPINE COUNTIES**—Between Dorrington and Markleeville, about 23.7 miles road-mix surface treatment to be applied. District X, Routes 23 and 24, various sections. Lee J. Immel, Berkeley, \$25,111. Contract awarded to Oranges Bros. Construction Department, Stockton, \$20,664.50.

**COLUSA, BUTTE, SACRAMENTO, YOLO AND PLACER COUNTIES**—At various locations in District III, about 31.4 miles seal coat to be applied. C. F. Fredericksen & Sons, Lower Lake, \$19,600; E. F. Hilliard, Sacramento, \$21,193; J. C. Compton, McMinnville, Ore., \$19,155; Granite Construction Co., Ltd., Watsonville, \$18,693; Lee J. Immel, Berkeley, \$18,535. Contract awarded to E. A. Forde, San Anselmo, \$17,888.45.

**EL DORADO COUNTY**—Between 2 miles east of Phillips and 3 miles west of Meyers, about 2.4 miles imported surfacing material to be placed and road-mix surface treatment applied. District III, Route 11, Section I. J. A. A. Tieslau, Berkeley, \$14,886; Louis Biasotti & Son, Stockton, \$15,433; Fredericksen & Westbrook, Sacramento, \$16,153; Pacific Truck Service, Inc., San Jose, \$16,904. Contract awarded to Lee J. Immel, Berkeley, \$12,647.30.

**FRESNO AND KINGS COUNTY**—Near Lemoore, about 31.3 miles road-mix surface treatment to be applied. District VI, Routes 10 and 125, Sections F, BC-D. A. S. Vinnell Co., Alhambra, \$11,450; Oranges Bros., Construction Dept., Stockton, \$11,551; Stewart & Nuss, Inc., Fresno, \$11,636; L. A. Briscoe, Arroyo Grande, \$12,103; Piazza and Huntley, San Jose, \$13,430. Contract awarded to Basich Bros., Torrance, \$9,925.40.

**FRESNO COUNTY**—Between Kingsburg and Fresno, about 11.8 miles in length to be surfaced with plant-mixed surfacing and nonskid surface treatment applied. District VI, Route 4, Sections A, F, B. Union Paving Co., San Francisco, \$16,564; Granite Const. Co. Ltd., Watsonville, \$16,238. Contract awarded to Leo A. Briscoe, Arroyo Grande, \$15,816.15.

**FRESNO COUNTY**—Across Big Dry Creek near Humphreys and near Tollhouse, two bridges to be widened. District VI, Route 76, Section B. Thomas Construction Co., Ontario, \$8,943; L. C. Seidel, Oakland, \$9,238; Jourdan Concrete Pipe Co., Fresno, \$10,083; Nelson & Wallace, Escalon, \$10,295; C. C. Gildersleeve, Berkeley, \$10,558; R. Hodgson & Sons, Porterville, \$11,078;

A. Soda & Son, Oakland, \$13,095; A. S. Vinnell Co., Alhambra, \$16,375. Contract awarded to Midstate Construction Co., Fresno, \$8,621.50.

**HUMBOLDT COUNTY**—About 3 miles south of Scotia, bridge across Eel River to be repaired. District I, Route 1, Section E. Ernest E. Smith, Eureka, \$13,839; Fred J. Maurer & Son, Eureka, \$15,473; C. C. Gildersleeve, Berkeley, \$14,486. Contract awarded to Reginald G. Clifford, San Francisco, \$12,943.65.

**KERN COUNTY**—Between Arvin and 2.5 miles east of Monolith, about 16.2 miles road-mix surface treatment to be applied. District VI, Routes 58, 140, Sections EFG, D. Basich Bros., Torrance, \$7,380; J. E. Haddock, Ltd., Pasadena, \$7,828. Contract awarded to A. S. Vinnell Co., Alhambra, \$6,897.50.

**KERN AND INYO COUNTIES**—Between Johannesburg and Olancha, about 28.5 miles seal coat to be applied. District IX, Routes 145 and 23, Sections A, B, C, I. Basich Bros., Torrance, \$14,854; J. A. Casson, Hayward, \$15,562; W. R. Shriver, Los Angeles, \$17,684; V. R. Dennis Construction Co., San Diego, \$18,660; J. E. Haddock, Ltd., Pasadena, \$19,884. Contract awarded to A. S. Vinnell Co., Alhambra, \$14,285.20.

**KERN AND KINGS COUNTIES**—Between Blackwells Corner and Route 125, about 22.6 miles road-mix surface treatment to be applied. District VI, Route 138, Sections E, A. Granite Construction Co., Ltd., Watsonville, \$9,484; Basich Bros., Torrance, \$10,155; A. S. Vinnell Co., Alhambra, \$10,162; L. A. Briscoe, Arroyo Grande, \$11,784; John Jurkovich, Fresno, \$12,518; Stewart & Nuss, Inc., Fresno, \$13,072; Oilfields Trucking Co., Bakersfield, \$19,186. Contract awarded to Clyde W. Wood, Los Angeles, \$7,298.49.

**KERN COUNTY**—Portions between Bakersfield and Weldon, about 41.6 miles road-mix surface treatment and seal coat. District VI, Routes 57 and 142, Sections A, B, E, F, G, I. Oilfields Trucking Co., Bakersfield, \$19,488; Maceo Construction Co., Clearwater, \$24,266; Basich Brothers, Torrance, \$17,678; A. S. Vinnell Co., Alhambra, \$22,527; Griffith Co., Los Angeles, \$25,482. Contract awarded to Clyde W. Wood, Los Angeles, \$14,484.35.

**KERN COUNTY**—Between Lerdo and Delano, about 19.1 miles nonskid surface treatment to be applied. District VI, Route 4, Sections D, E, F. Granite Construction Co., Ltd., Watsonville, \$15,742; J. A. Casson, Hayward, \$16,382; Piazza & Huntley, San Jose, \$17,410; Stewart & Nuss, Inc., Fresno, \$18,885. Contract awarded to A. S. Vinnell Co., Alhambra, \$14,895.

**KERN COUNTY**—Between Taft and Western Water Works, about 12 miles road-mix surface treatment to be applied. District VI, Route 140, Section A. Basich Bros., Torrance, \$5,149; L. A. Briscoe, Arroyo Grande, \$5,744; J. E. Haddock, Ltd., Pasadena, \$7,185; Oilfields Trucking Co., Bakersfield, \$8,603. Contract awarded to A. S. Vinnell Co., Alhambra, \$4,968.16.

**KINGS AND FRESNO COUNTIES**—Between Route 10 and 6 miles south of Fresno, about 23.0 miles in length non-skid surface treatment to be applied. District VI, Route 125, Sections E, A, B. Granite Construction Company, Ltd., Watsonville, \$14,920; A. S. Vinnell Co., Alhambra, \$16,445; Lee J. Immel, Berkeley, \$16,538; Stewart & Nuss,

Inc., Fresno, \$16,631. Contract awarded to L. A. Briscoe, Arroyo Grande, \$14,810.

**KINGS COUNTY**—Near Dallas School, about 1.5 miles to be surfaced with plant-mixed surfacing. District VI, Route 135, Sections A, B. Piazza and Huntley, San Jose, \$6,062; L. A. Briscoe, Arroyo Grande, \$6,515. Contract awarded to Union Paving Co., San Francisco, \$5,870.

**LASSEN AND MODOC COUNTIES**—Between Summit of Big Valley Mt. and Adin, about 2.1 miles road-mix surfacing and seal coat to be placed. District II, Route 28, Section AA. A. A. Tieslau, Berkeley, \$7,387.80. Contract awarded to Powers & Patterson, Greenville, \$5,491.50.

**LASSEN COUNTY**—Repairing by removing the existing superstructures and replacing with reinforced concrete six bridges over the Pit River and Overflows, south of Bieber, consisting of 39 thirty-foot spans. District II, Route 28, Section A. J. P. Brennan, Redding, \$62,706; C. W. Caletti & Co., San Rafael, \$63,787; Underground Construction Co., Oakland, \$65,948; D. W. Nicholson, Oakland, \$66,204; E. T. Lesure, Oakland, \$67,285; Clifford A. Dunn, Klamath Falls, Ore., \$68,687; R. H. Travers, Los Angeles, \$72,293; L. D. Tonn, Lodi, \$71,751; J. S. Metzger & Son, Los Angeles, \$74,389; R. G. Clifford, San Francisco, \$78,968. Contract awarded to Poulos & McEwen & M. A. Jenkins, Sacramento, \$62,118.

**LASSEN COUNTY**—Between Termo and northerly boundary, about 1.3 miles to be graded, surfaced with crusher run base and road-mix surfacing and about 7 miles to be surfaced with roadmix surfacing. District II, Route 73, Sections F, G. Harms Bros., Sacramento, \$47,934. Contract awarded to Poulos & McEwen, Sacramento, \$37,924.20.

**LOS ANGELES COUNTY**—Between San Gabriel River Bridge and 23.6 mile northerly, about 14.9 miles road-mix surface treatment to be applied. District VIII, Route 62, Sections A, B. Clyde W. Wood, Los Angeles, \$14,518. Oilfields Trucking Co., Bakersfield, \$14,532; J. E. Haddock, Ltd., Pasadena, \$17,063; R. M. Price, Huntington Park, \$18,445. Contract awarded to Basich Bros., Torrance, \$13,458.

**LOS ANGELES COUNTY**—At Pacific Colony State Hospital, near Spadra, roadways, to be surfaced with plant-mix surfacing on imported subgrade material and Portland cement concrete curbs and sidewalks to be constructed. District VII, Route Pacific Colony. Geo. J. Bock Co., Los Angeles, \$26,459; Edward Green, Los Angeles, \$27,139; J. E. Haddock, Ltd., Pasadena, \$33,846; W. E. Hall Co., Alhambra, \$37,715. Contract awarded to Griffith Co., Los Angeles, \$25,913.50.

**LOS ANGELES COUNTY**—Between La Canada and Mt. Wilson, about 12.8 miles road-mix surface treatment to be applied. District VII, Route 61, Section A. Pas. R. E. Hazard & Sons, San Diego, \$16,332; Warren Southwest, Inc., Los Angeles, \$17,388; J. E. Haddock, Ltd., Pasadena, \$21,253. Contract awarded to R. M. Price, Huntington Park, \$13,201.50.

**MADERA COUNTY**—Between San Joaquin River and Kelshaw Corners, about 18.9 miles in length, about 10.9 miles to be surfaced with imported borrow and road-mix surface treatment applied thereto, and about 8.0 miles road-mix surface treatment to be applied to the existing roadbed. District VI, Route 125, Sections A, B, C. L. A. Briscoe, Arroyo Grande, \$59,217; Union

Paving Co., San Francisco, \$53,571; J. C. Compton, McMinnville, Ore., \$59,951; Basich Bros., Torrance, \$60,836; C. F. Fredericksen & Son, Lower Lake, \$52,844; Louis Biasotti & Son and Claude C. Wood, Stockton, \$58,065; Stewart & Nuss, Fresno, \$47,547; Oilfields Trucking Co., Bakersfield, \$47,366; Lee J. Immel, Berkeley, \$55,489; Griffith Company, Los Angeles, \$54,757. Contract awarded to Ruddy and Corfield, Modesto, \$44,224.65.

**MENDOCINO COUNTY**—At Shearing Creek about 6 miles southeast of Boonville, a reinforced concrete slab bridge to be constructed and about 0.5 mile of roadway to be graded, blanketed with imported borrow and prime coat and seal coat applied. District I, Route 48, Section A. E. E. Smith, Eureka, \$19,691; L. C. Seidel, Oakland, \$21,857; Guerin Bros., San Francisco, \$20,585; A. H. Siemer & John Carcano, San Anselmo, \$20,262; Anderson & France, Visalia, \$17,164; Embleton-Schumacher, Albany, \$17,354. Contract awarded to M. A. Jenkins. Sacramento, \$17,148.95.

**MENDOCINO COUNTY**—At Gatchell, Quiliven, Irish and Laurel Gulches, about 1.2 miles to be graded, blanketed with imported borrow, and prime coat and seal applied thereto. District I, Route 56, Sections A, B, C. John Burman & Sons, Eureka, \$66,453; C. W. Caletti & Co., San Rafael, \$74,487; H. Earl Parker, Marysville, \$63,817; Chas. L. Harney, San Francisco, \$67,319; Claude C. Wood, Lodi, \$89,086; Harold Smith, St. Helena, \$72,399; George Pollock Co., Sacramento, \$68,726; Guerin Bros., San Francisco, \$69,847; Fred J. Maurer & Son, Eureka, \$74,915; Caputo & Keeble, San Jose, \$87,136. Contract awarded to J. L. Connor & Sons, Ukiah, \$55,542.90.

**MONO COUNTY**—Between Mono Lake and Benton, 20.8 miles in length, penetration oil treatment to be applied. Dist. IX, Route 40, Sections C,D,E,F. A. S. Vinnell Co., Alhambra, \$8,730; Oilfields Trucking Co., Bakersfield, \$11,002. Contract awarded to Basich Bros., Torrance, \$7,362.

**MONO COUNTY**—Between Bridgeport and the State line, about 13.4 miles to be graded and penetration oil treatment applied. District IX, Route 96, Section A. Fredericksen & Westbrook, Sacramento, \$23,841; Isbell Construction Co., Reno, \$24,350; J. E. Anderson & George E. France, Visalia, \$25,410; A. S. Vinnell Co., Alhambra, \$33,130. Contract awarded to Basich Brothers, Torrance, \$22,615.

**MONO COUNTY**—Between Yosemite National Park and Lake Ellery, about 2.5 miles to be graded, surfaced with imported surfacing material and road-mix surface treatment applied, and a multiple C. M. P. culvert to be furnished and installed. District IX, Route 40, Section A. Fredericksen & Westbrook, Sacramento, \$90,000; A. S. Vinnell Co., Alhambra, \$94,881. Contract awarded to Isbell Construction Co., Reno, Nev., \$70,746.50.

**MONTEREY AND SAN LUIS OBISPO COUNTIES**—Between San Simeon and Big Sur, about 27 miles road-mix surface treatment and seal coat to be applied. District V, Route 56, Sections A, B, C, D, E. Oilfields Trucking Co., Bakersfield, \$23,955; Lee J. Immel, Berkeley, \$23,982; Clyde W. Wood, Los Angeles, \$24,262; Ruddy and Corfield, Modesto, \$26,050; Basich Bros., Torrance, \$26,240; J. E. Haddock, Ltd., Pasadena, \$34,068. Contract awarded to L. C. Karstedt, Watsonville, \$19,906.35.

**NEVADA. PLACER. EL DORADO**—At various locations in District III, about 46 miles seal coat to be applied. A. Teichert & Son, Inc., Sacramento, \$25,063; J. C. Compton, McMinnville, Ore., \$25,953; Lee J. Immel, Berkeley, \$26,220; C. F. Fredericksen & Sons, Lower Lake, \$27,597; A. A. Tieslau, Berkeley, \$28,264. Contract awarded to

## Builders of Good Will

Los Angeles, Calif.

Mr. C. H. Purcell,  
State Highway Engineer,  
Sacramento, California.

Dear Sir:

Under date of July 20 we received the following letter from the Western Novelty Company, by Charles H. Cohn:

"I want to take this time to express my appreciation for the courtesy shown me by one of your road marking crew of the men on Highway 101 in Malibu. Especially, Mr. C. C. Nelson. With crews of this kind on the State Highways, it will go a long way to build up good will with the traveling public.

"The writer had motor trouble just north of Malibu and this crew, while on lunch hour, took it upon themselves to be helpful. Friendly gestures of this kind will go a long way to build up a mutual feeling of respect, both for the workmen and the motorist."

Yours very truly,

S. V. CORTELYOU,  
District Engineer.

Granite Construction Co., Ltd., Watsonville, \$24,636.85.

**ORANGE, LOS ANGELES COUNTIES**—At various locations, about twelve miles in length, road-mix surface treatment to be applied. Dist. VII, Routes 43, 175 and 176. Sections A,B and C. R. M. Price, Huntington Park, \$11,610; R. E. Hazard & Sons, San Diego, \$12,577; A. S. Vinnell Co., Alhambra, \$13,121; C. R. Butterfield-Kennedy Co., San Pedro, \$14,167; Dimmit & Taylor, Los Angeles, \$14,605. Contract awarded to J. E. Haddock, Ltd., Pasadena, \$10,444.

**ORANGE COUNTY**—Near Galivan, about four-tenths mile in length to be graded and surfaced with plant-mixed surfacing. Dist. VII, Route 2, Section A,B. V. R. Dennis Const. Co., San Diego, \$12,456; A. S. Vinnell Co., Alhambra, \$13,106; Basich Bros., Torrance, \$13,477; J. E. Haddock, Ltd., Pasadena, \$13,765; Martin & Schmidt Contractors, Long Beach, \$14,000; R. L. Oakley, Pasadena, \$15,650; C. R. Butterfield-Kennedy Co., San Pedro, \$16,984. Contract awarded to B. G. Carroll, San Diego, \$12,233.50.

**PLACER COUNTY**—Between Colfax Overhead and 0.6 mile north, about 0.6 mile to be graded and surfaced with plant-mixed surfacing. District III, Route 37, Section Cfx. C. Parish Bros., Los Angeles, \$32,260; Piazza & Huntley, San Jose, \$31,970; Poulos & McEwen, Sacramento, \$33,055; Fredericksen & Westbrook, Sacramento, \$34,098; Louis Biasotti & Son, Stockton, \$34,465. Contract awarded to A. Teichert & Son, Inc., Sacramento, \$30,851.75.

**PLUMAS COUNTY**—Between 14.4 miles east of Howells and Beckworth, about 12 miles seal coat to be applied. District II, Route 21, Sections B, C, D, E, F. Close Building Supply, Hayward, \$9,127; C. F. Fredericksen & Sons, Lower Lake, \$9,640. Contract awarded to Hayward Building Material Co., Hayward, \$8,877.50.

**PLUMAS COUNTY**—Between 2 miles west of Route 83 and Chester, about 5.1 miles to be surfaced with roadmix surfacing and seal coat. District II, Route 29, Section A. A. A. Tieslau, Berkeley, \$11,407; Heafey-Moore Co., Fredericksen & Watson Construction Co., Oakland, \$11,415; C. F. Fredericksen & Sons, Lower Lake, \$11,822; Powers & Patterson, Greenville, \$11,994; Lee J. Immel, Berkeley, \$12,056; E. B. Bishop, Orland, \$13,579. Contract awarded to Garcia Construction Co., Irvington, \$11,356.50.

**RIVERSIDE AND SAN BERNARDINO COUNTIES**—At various locations in District VIII, about 81.7 miles road-mix surface treatment and seal coat to be applied. R. E. Hazard & Sons, San Diego, \$64,922; Basich Bros., Torrance, \$69,753; J. E. Haddock, Ltd., Pasadena, \$67,133. Contract awarded to Geo. Herz & Co., San Bernardino, \$64,753.60.

**SAN BENITO COUNTY**—Between Loneoak Road and Bear Valley, between Pinnacles and Route 119, and between Pajaro River and 0.5 mile southerly, about 28 miles to be treated with liquid asphalt. District V, Routes 119 and 120, Sections B, C, F, A. L. A. Briscoe, Arroyo Grande, \$6,609; Granite Construction Co., Ltd., Watsonville, \$7,224. Contract awarded to Oilfields Trucking Co., Bakersfield, \$4,495.

**SAN BERNARDINO COUNTY**—Across Santa Ana River one mile south of Colton, a reinforced concrete bridge with steel stringers to be constructed. District VIII, Route 43, Section F. George Herz & Co., San Bernardino, \$64,157; J. S. Metzger & Son, Los Angeles, \$65,210; V. R. Dennis, Construction Co., San Diego, \$66,373; Gibbons & Reed Co., Burbank, \$69,711; Byerts & Dunn, Los Angeles, \$69,782; Carlo Bongiovanni, Los Angeles, \$71,016; Vinson & Pringle, Phoenix, Ariz., \$73,259; Matich Bros., Elsinore, \$78,785. Contract awarded to J. E. Haddock, Ltd., Pasadena, \$63,471.15.

**SAN BERNARDINO COUNTY**—Between Big Bear Dam and Meadow Lane, about 7.2 miles in length, road-mix surfacing and seal coat to be applied. Dist. VIII, Route 43, Sections C and G. Clyde Wood, Los Angeles, \$24,829; R. M. Price, Huntington Park, \$27,799; Ruddy & Corfield, Modesto, \$30,885; A. S. Vinnell Co., Alhambra, \$31,304; J. E. Haddock, Ltd., Pasadena, \$41,148; E. L. Yeager, Riverside, \$44,844; Geo. Herz & Co., San Bernardino, \$47,442. Contract awarded to R. E. Hazard & Sons, San Diego, \$23,554.50.

**SAN LUIS OBISPO COUNTY**—Between Cambria and 3 miles south of Paso Robles, about 21 miles penetration oil treatment and seal coat to be applied. District V, Route 33, Sections D, E. A. S. Vinnell, Alhambra, \$7,992; L. A. Briscoe, Arroyo Grande, \$9,218. Contract awarded to Oilfields Trucking Co., Bakersfield, \$6,487.50.

**SANTA BARBARA**—Between Gaviota Pass and Santa Ynez River, about 2.8 miles, road-mix surface treatment and seal coat to be applied to existing shoulders. Dist. V, Route 2, Section D. Basich Bros., Torrance, \$7,112. Contract awarded to J. E. Haddock, Ltd., Pasadena, \$6,052.50.

**SANTA CLARA COUNTY**—Between one mile and four miles east of Alum Rock Road, apply road-mix surface treatment. District IV, Route 115, Section A. Lee J. Immel, Berkeley, \$5,416. Contract awarded to Pacific Truck Service, Inc., San Jose, \$4,850.60.



**SANTA CLARA COUNTY**—Construct a gravel base and road-mix surface between 3½ miles East of Bell Station and Merced County line approximately 2.8 miles. Dist. IV, Route 32, Section C. Embleton-Schumacher Co., Albany, \$17,365; Pacific Truck Service, Inc., San Jose, \$18,178. Contract awarded to Lee J. Immel, Berkeley, \$16,969.

**SHASTA COUNTY**—Between Shingletown and 2.9 miles easterly, about 2.9 miles to be surfaced with imported borrow and road-mix surfacing and seal coat applied. District II, Route 20, Section E. Poulos & McEwen, Sacramento, \$29,710; Leo J. Immel, Berkeley, \$22,806; A. A. Tieslau, Berkeley, \$26,447; Piazza & Huntley, San Jose, \$26,600; Young & Son Co., Ltd., Berkeley, \$29,303; Guerin Bros., San Francisco, \$35,662. Contract awarded to Claude C. Wood, Lodi, \$22,760.

**TEHAMA COUNTY**—Between Proberta and Red Bluff, about 6.2 miles to be graded and paved with asphalt concrete and bridges to be constructed. District II, Route 7, Section B. Fredericksen & Westbrook, Sacramento, \$227,080; Heafey-Moore Co. & Fredrickson & Watson Construction Co., Oakland, \$231,191; N. M. Ball Sons, Berkeley, \$233,523; Granfield, Farrar & Carlin, San Francisco, \$237,342; Poulos & McEwen, Sacramento, \$240,421; A. Teichert & Son, Inc., Sacramento, \$243,718; Union Paving Co., San Francisco, \$247,857; Louis Biasotti & Son, Claude C. Wood and L. D. Tonn, Lodi, \$248,465; Marshall Hanrahan, Redwood City, \$248,671. Contract awarded to Piazza & Huntley & J. P. Brennan, San Jose, \$210,865.15.

**TULARE AND FRESNO COUNTIES**—Between Staffords Corner and South Fork of Kings River, about 47.3 miles road-mix surface treatment to be applied. District VI, Routes 129 and 41, various sections. Oilfields Trucking Co., Bakersfield, \$32,927; Macco Construction Co., Clearwater, \$27,102; Basich Brothers, Torrance, \$22,956; J. E. Haddock, Ltd., Pasadena, \$41,464; Clyde W. Wood, Los Angeles, \$18,891; A. S. Vinnell Co., Alhambra, \$22,452. Contract awarded to Granite Construction Co., Ltd., Watsonville, \$18,747.04.

**TULARE COUNTY**—Between Yokohl and Lemon Cove, about 5.3 miles nonskid surface treatment to be applied. District VI, Route 10, Section D. Granite Construction Co., Ltd., Watsonville, \$4,138; A. S. Vinnell Co., Alhambra, \$4,349; Piazza & Huntley, San Jose, \$4,554; L. A. Briscoe, Arroyo Grande, \$4,570. Contract awarded to Stewart & Nuss, Inc., Fresno, \$4,034.80.

**TULARE-KINGS COUNTIES**—Between Tulare and 3 miles north of Goshen, between Hanford and Route 4, about 26.2 miles in length to be surfaced with crusher run base, plant-mixed surfacing and nonskid surface treatment. Dist. VI, Routes 4, 10, Sections FEA. Granite Construction Company, Ltd., Watsonville, \$31,949; L. A. Briscoe, Arroyo Grande, \$32,237. Contract awarded to Union Paving Co., San Francisco, \$30,823.90.

**TULARE COUNTY**—Across Sand Creek Channel, about 15 miles north of Visalia, a reinforced concrete slab bridge to be constructed. Dist. VI-Route 131, Section A. Victor L. and Wm. B. Jacobson, Los Angeles, \$5,400; C. C. Gildersleeve, Berkeley, \$5,482; James E. Anderson, Visalia, \$5,647; Thomas Construction Co., Burbank, \$5,847; L. D. Tonn, Lodi, \$5,890; R. Hodgson & Sons, Porterville, \$6,357; L. C. Seidel, Oakland, \$6,435; L. H. Hansen & Sons, Fresno, \$6,584; Midstate Const. Co., Fresno, \$7,183; A. S. Vinnell Co., Alhambra, \$8,132. Contract awarded to F. Fredenburg, South San Francisco, \$5,375.25.

**VENTURA COUNTY**—Between Ventura and Rancho El Rincon, about twelve and three-tenths miles in length, road-mix surface treatment to be applied. Dist. VII,

Route 2, Section D,E and F. Oilfields Trucking Co., Bakersfield, \$7,196; C. R. Butterfield-Kennedy Co., San Pedro, \$10,496; George J. Bock Co., Los Angeles, \$11,141; A. S. Vinnell Co., Alhambra, \$11,150; Oswald Bros., Los Angeles, \$11,562. Contract awarded to J. E. Haddock, Ltd., Pasadena, \$6,637.

**VENTURA COUNTY**—About ¼ mile southeast of Piru, a reinforced concrete slab and girder bridge to be constructed, consisting of seventeen 50-foot spans and two 15-foot cantilever spans. District VII, Route 79, Section C. Macco Construction Co., Clearwater, \$80,507; Carlo Bongiovanni, Los Angeles, \$84,132; Griffith Co., Los Angeles, \$84,289; Martin & Schmidt, Long Beach, \$85,643; J. E. Haddock, Ltd., Pasadena, \$86,234; Byerts & Dunn, Los Angeles, \$86,619; Trewhitt Shields & Fisher, Fresno, \$88,275; Paul J. Tyler, Oroville, \$88,956; Vinson & Pringle, Phoenix, Ariz., \$93,284; Gibbons & Reed, Burbank, \$99,281; C. O. Sparks & Mundo Engineering Co., Los Angeles, \$102,165; Engineers, Ltd., San Francisco, \$102,905; A. S. Vinnell Co., Los Angeles, \$106,361. Contract awarded to J. S. Metzger & Son, Los Angeles, \$78,519.

**VENTURA COUNTY**—Between Buckhorn School and one mile southeast of Piru, about 1.8 miles to be graded and surfaced with plant-mixed surfacing. District VII, Route 79, Section C. Griffith Co., Los Angeles, \$70,150; Rhoades Bros., Los Angeles, \$71,134; A. S. Vinnell Co., Alhambra, \$80,766; Macco Construction Co., Clearwater, \$81,485; C. O. Sparks & Mundo Engineering Co., Los Angeles, \$97,348. Contract awarded to J. E. Haddock, Ltd., Pasadena, \$65,031.

**YOLO COUNTY**—Between Davis and Willow Slough and between Cache Creek and 2.2 miles north, about 6 miles retread surfacing and seal coat to be applied. District III, Route 7, Section A. B. Granite Construction Co., Watsonville, \$25,074; Lee J. Immel, Berkeley, \$26,377. Contract awarded to E. A. Forde, San Anselmo, \$22,796.

**YOLO AND SACRAMENTO COUNTIES**—In Yolo County between Kiesel and Sacramento Weir and between Bryte and Broderick, and Sacramento County between Lincoln Way and Auburn Boulevard, about 10.6 miles existing pavement to be resurfaced with plant-mixed surfacing and armor coat. District III, Routes 50, 98, Sections F. A. Independence Construction Co., Ltd., Oakland, \$33,130; Fredericksen & Westbrook, Sacramento, \$42,137; A. Teichert & Son, Inc., Sacramento, \$29,560; Piazza & Huntley, San Jose, \$34,387; E. F. Hilliard, Sacramento, \$42,307. Contract awarded to J. R. Reeves, Sacramento, \$27,617.50.

**YOLO COUNTY**—On Yolo Causeway, about 2.7 miles metal guard rail, timber wheel guard and fire barrels to be painted. District III, Route 6, Section B. Al. W. Simmonds, Sacramento, \$3,400; Robert McCarthy, San Francisco, \$3,087. Contract awarded to Edwin Anderson, San Francisco, \$2,298.

**YUBA COUNTY**—Between ¼ mile west of Bruce's Corner and Dry Creek about 1.5 miles in length, to be graded and a bituminous seal coat applied. District III, Route 15, Section A. Fredericksen & Westbrook, Sacramento, \$28,207; Harms Bros., Sacramento, \$29,362; Young & Son Co., Ltd., Berkeley, \$29,649; Parish Bros., Los Angeles, \$29,808; Valley Const. Co., San Jose, \$30,808; A. Teichert & Son, Inc., Sacramento, \$31,545; Guerin Bros., San Francisco, \$36,387; Louis Balsotti & Son, Stockton, \$37,777; Claude C. Wood, Lodi, \$45,902. Contract awarded to Hemstreet & Bell, Marysville, \$24,532.10.

"Offisher—hic, tell a policeman to call me a cop."

## Sullivan Observes 25th Anniversary as Road Engineer

**D**ISTRICT ENGINEER E. Q. SULLIVAN of District VIII, Division of Highways, with headquarters in San Bernardino, recently celebrated the twenty-fifth anniversary of his employment in the State highway service.

Following his graduation from the University of California in 1913, Mr. Sullivan was appointed Assistant Resident Engineer in District II on August 3, 1914. He worked progressively as superintendent and resident engineer on day labor and contract construction of roads and bridges until his appointment as Assistant District Engineer in 1922. On October 1, 1923, because of his experience and thorough acquaintance with every phase of highway activity, he was appointed District Engineer in San Bernardino when District VIII office was established, and has served in that capacity since.

A notable achievement in Mr. Sullivan's career was the location and construction under his supervision of a paved highway replacing the famous old plank road across the sand dunes of Imperial County, completed in 1926.

In 1923 Mr. Sullivan began a study of the desert road conditions and the "walking" sand hills on the border land route between El Centro and Yuma that seemed to defy efforts to build a permanent road to go through them. One group of experienced engineers declared that if the grade was low the blow sand would frequently bury the highway just as it did the old plank road. Another group insisted that if the grade was high the wind would blow the sand from under it.

Mr. Sullivan's studies of the movements of the dunes resulted in a plan to locate the pavement upon a grade line above the height of the surrounding dunes and prevent wind erosion of the embankment by oiling all shoulders and slopes to form an oiled cake.

Lawyer—"Are you positive this is the man who stole your car?"

Plaintiff—"I was before the witnesses began testifying. Now I'm not sure I ever had a car."—*The Live Oak*.

# State of California

CULBERT L. OLSON, Governor

## Department of Public Works

Headquarters: Public Works Building, Twelfth and N Streets, Sacramento

**FRANK W. CLARK, Director of Public Works**

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FRED J. GRUMM, Engineer of Surveys and Plans  
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R. H. STALNAKER, Equipment Engineer  
J. W. VICKREY, Safety Engineer  
E. R. HIGGINS, Comptroller

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F. W. HASELWOOD, District II, Redding  
CHARLES H. WHITMORE, District III, Marysville  
JNO. H. SKEGGS, District IV, San Francisco  
L. H. GIBSON, District V, San Luis Obispo  
E. T. SCOTT, District VI, Fresno  
S. V. CORTELYOU, District VII, Los Angeles  
E. Q. SULLIVAN, District VIII, San Bernardino  
S. W. LOWDEN (Acting), District IX, Bishop  
R. E. PIERCE, District X, Stockton  
E. E. WALLACE, District XI, San Diego

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GLENN B. WOODRUFF, Principal Bridge Engineer  
RALPH A. TUDOR, Senior Bridge Engineer  
in Charge of Maintenance and Operation

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ROBERT E. REED, Attorney



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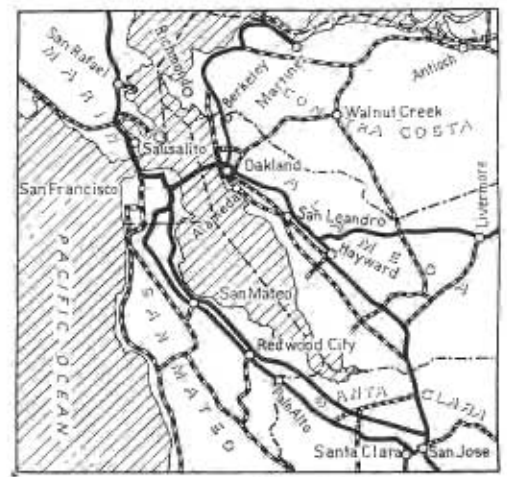
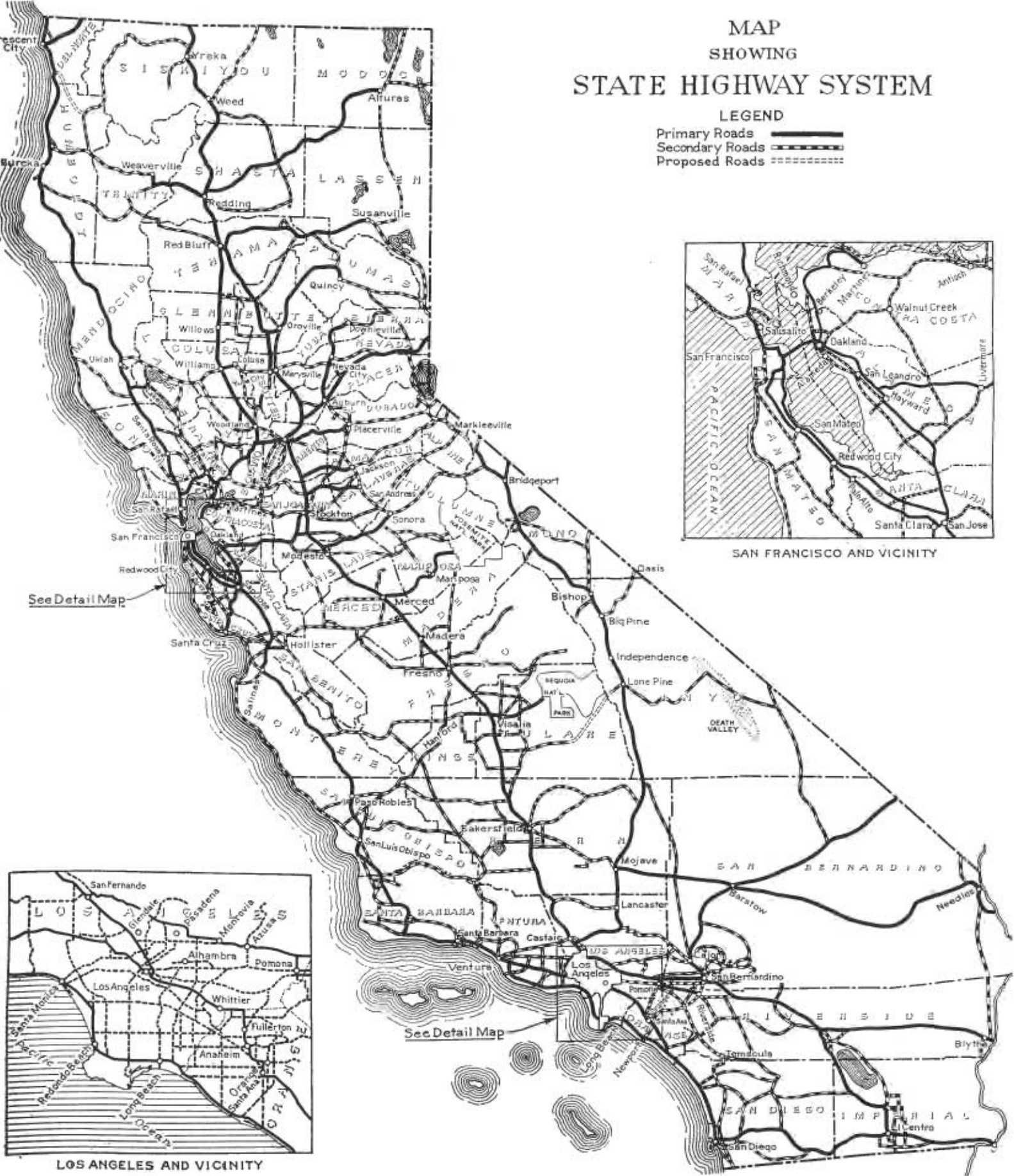
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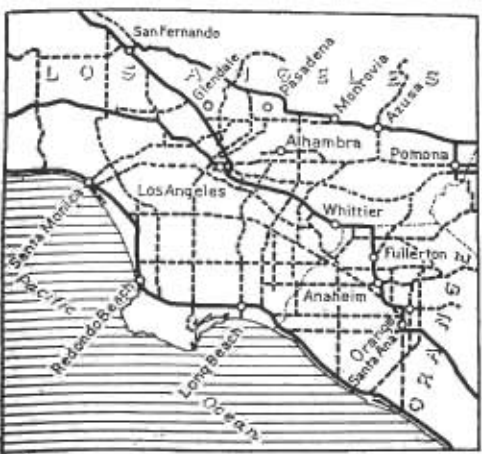
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MAP  
 SHOWING  
**STATE HIGHWAY SYSTEM**

**LEGEND**  
 Primary Roads —————  
 Secondary Roads - - - - -  
 Proposed Roads .....  
 (Note: The legend uses thick solid lines for primary roads, dashed lines for secondary roads, and dotted lines for proposed roads.)



SAN FRANCISCO AND VICINITY



LOS ANGELES AND VICINITY