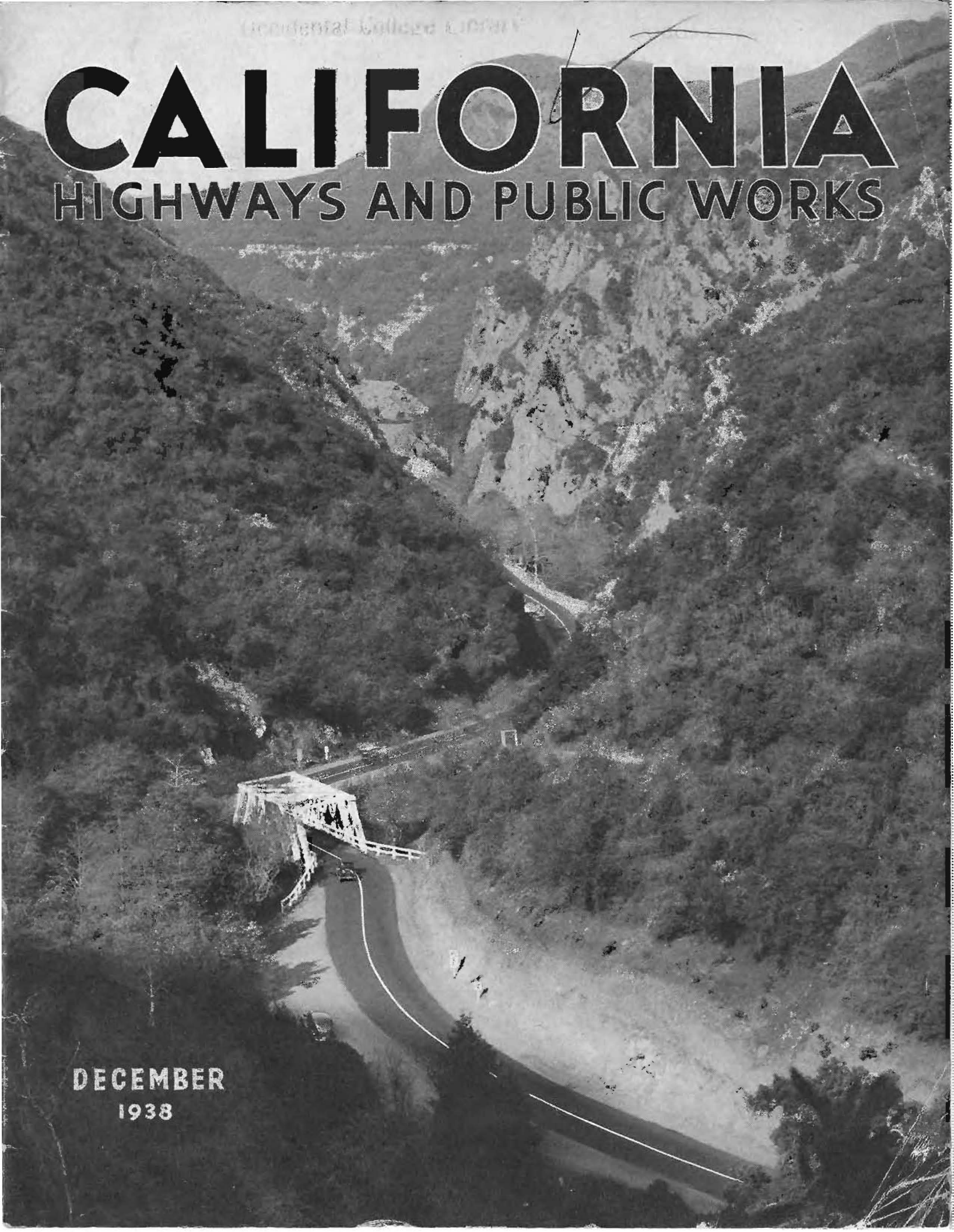


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CALIFORNIA

HIGHWAYS AND PUBLIC WORKS

DECEMBER
1938



CALIFORNIA HIGHWAYS AND PUBLIC WORKS

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

EARL LEE KELLY, Director C. H. PURCELL, State Highway Engineer JOHN W. HOWE, Editor K. C. ADAMS, Associate Editor

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Increase in Vehicular Transportation and Population in District VII Creates Complex Highway Situation

By S. V. CORTELYOU, District Engineer

THE very large and rapidly growing metropolitan area of which Los Angeles is the center, is included in District VII of the State Division of Highways, and presents one of the most difficult and perplexing highway problems to be found anywhere in the United States.

The district is comprised of Ventura, Los Angeles and Orange counties, and includes:

- 42 % of the population of the state;
- 44.5% of the registered motor vehicles of the state;
- 40.2% of the assessed valuation of the state;
- 44.3% of the value of crop production;
- 37 % of the total value of manufactured products of the state.

District VII includes 62 incorporated cities. Within this area the industries and activities of the population are many and varied. Los Angeles, Orange and Ventura counties rank Nos. 1, 3 and 12 respectively among the counties of the entire nation in value of agricultural products, according to the 1930 federal census.

The agricultural industry in the district, although large and important, approximating a value of \$171,000,000 per year, has been surpassed by the rapidly and constantly growing manufacturing industry, the total value of which per year is now five times the value of all agricultural products of this area.

The Port of Los Angeles has for many years been undergoing improvements, and is handling an increasingly large tonnage of freight. This tonnage has increased to such an extent that during the year 1937, according to figures furnished by the Maritime Commission, it stood first among ports of the entire United States for intercoastal shipping, actually surpassing the Port of New York by a narrow margin in this respect.

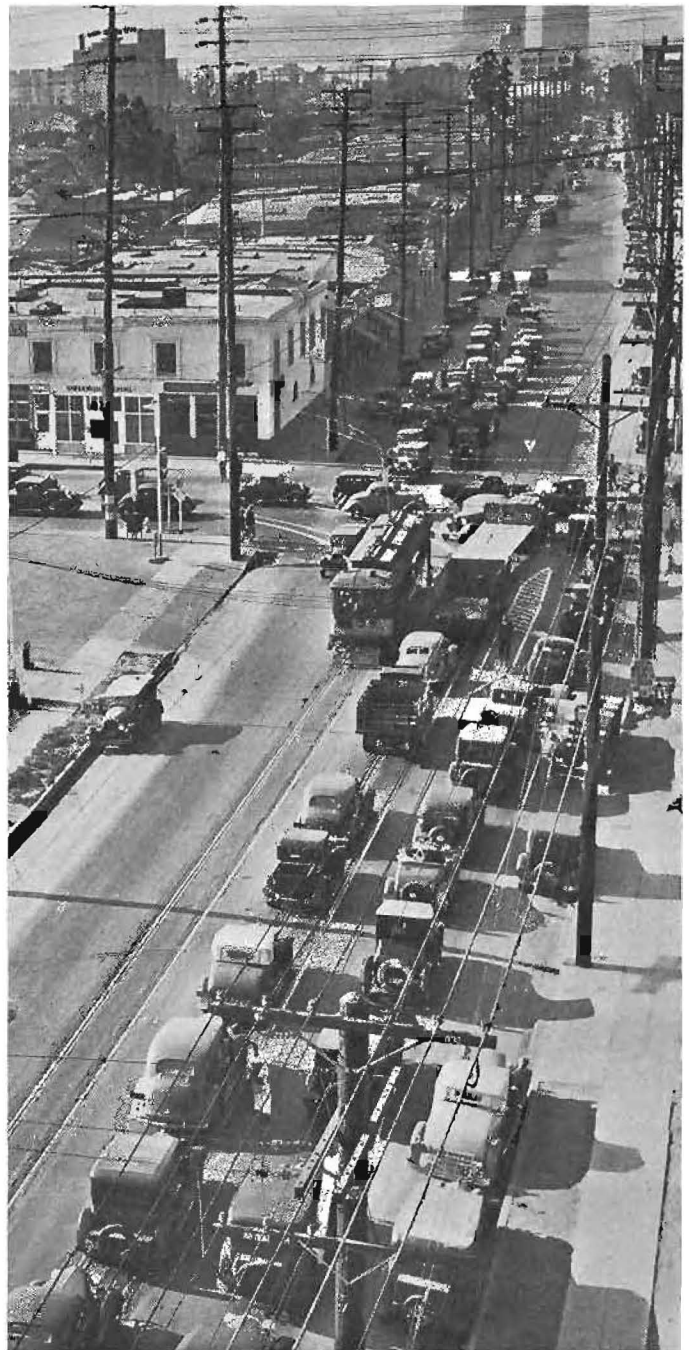
A total of 4,249,322 long tons of freight, exclusive of petroleum products (which are handled by pipeline) were handled in and out of this port last year. Of this enormous tonnage, approximately 70 per cent was handled by truck, imposing an extremely heavy burden on highway transportation facilities.

A large proportion of the agricultural products and oil produced in the surrounding country is shipped through this port, and correspondingly large quantities of incoming freight are distributed in Los Angeles and tributary country.

There is a tremendous interchange of freight, not only between the various parts of Ventura, Los Angeles and Orange counties and the Port of Los Angeles, but with the Imperial Valley, the agricultural region east of Los Angeles, and the southern portion of the great San Joaquin Valley.

So great is the interchange of freight between the San Joaquin Valley and the Port of Los Angeles, that the Ridge Route, which is the main connecting highway, now carries the greatest tonnage of freight of any highway in the western portion of the United States.

Congestion of Traffic Big Problem



Intersection of Olympic Boulevard and Santa Fe Avenue in the city of Los Angeles. This is a typical midday traffic scene at this point. Olympic Boulevard is State Highway No. 173 extending through the city.



Top—Scene on Coast Route, State Highway 60, north of Santa Monica, which carries a daily average traffic of 10,000 to 15,000 vehicles and more on holidays. Center—Timber truss bridge across Rio Hondo River on State Highway 172, near Montebello oil fields, Los Angeles County. Bottom—Sharp turn at bridge on State Highway 138 between Maricopa and Ojai.



An increasingly large portion of the freight transportation in this area and surrounding areas is being handled by motor truck, and the State Highway system which forms a primary network of connecting highways carries the large burden of providing adequate transportation facilities between the various points. On account of the unusually heavy percentage of truck traffic, the greater portion of the highways must be designed with high type surfacing and correspondingly strong bridges to carry the load imposed upon them.

The mere fact that District VII contains 42 per cent of the population of the entire State does not begin to give a true picture of the traffic problem that faces the State Highway Department in this territory. During the decade from 1920 to 1930, which is the latest period for which authentic data are available (U. S. Census, 1930), the population of the entire State increased by 65.7 per cent, while the population of the area comprising District VII increased by 132.1 per cent, or more than double the percentage increase of the State as a whole.

Although authentic data relative to present population are not available, it has been estimated by competent authorities that the coastal plain of 1235 square miles immediately surrounding Los Angeles will, by 1950, have a population approximating 6,500,000, with a corresponding increase in motor vehicle registrations.

Real estate values are rising rapidly and may be expected to continue to rise with the rapid increase in population. This is very important from a highway standpoint, because of its effect on the cost of acquiring rights of way for highway improvements. The foregoing facts form a necessary background in considering present and future highway improvements for this area.

District VII has a total mileage of 1411.6, of which 299.5 miles are pri-



Top—Narrow winding road and one way bridge on State Highway over San Marcos Pass in Ventura County. Center—Short sight distance and many sharp curves on State Highway through hills near Ventura-Santa Barbara County line. Bottom—Narrow, steel, through-truss bridge over Piru Creek between Santa Paula and Ventura which carries much heavy traffic.

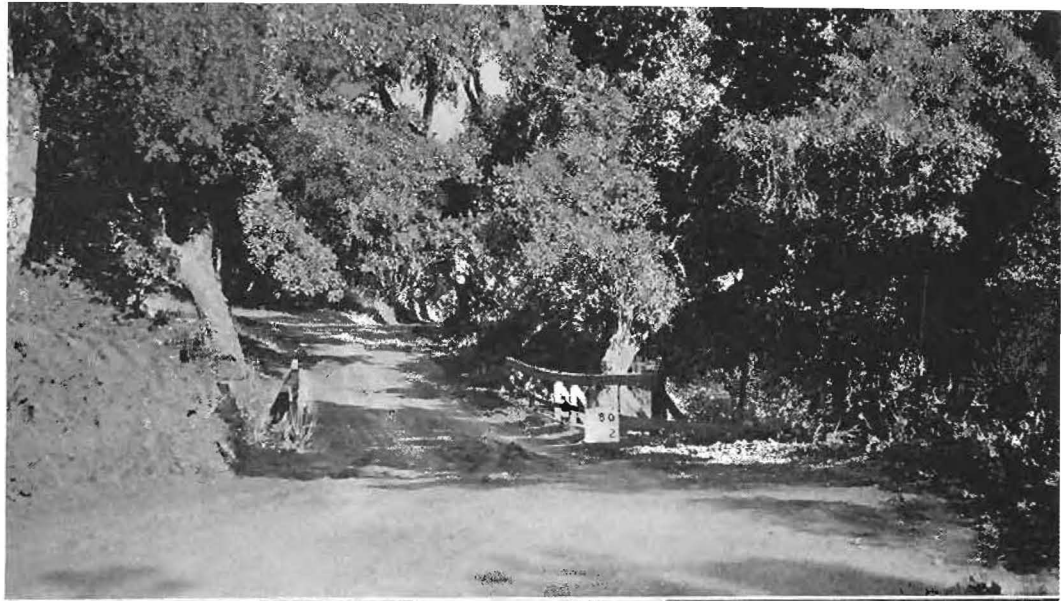
many highways in unincorporated areas; 164.76 miles are primary highways within incorporated cities; 694.1 miles are secondary highways within rural districts; and 259.45 miles are secondary highways within incorporated cities.

The primary highways are the portion of the original State Highway System which connected the county seats of all counties of the State in one network. The so-called secondary highways are other additional roads, part of which were built by the State and part by the counties, and which were subsequently taken into the State system.

Together the primary highways and the secondary highways form the principal network by which traffic moves in various directions within the district. The fact that some are classed as "Secondary Highways" does not necessarily mean that they carry less traffic than the primary roads, as many "Secondary Highways" are listed among the most heavily traveled highways in the State system.

This system supplements a network of city streets and county highways for handling local traffic. The volume of traffic for the combined three counties, including that handled by city streets, county highways and State highways, is 46.6 per cent of all traffic in the State. Thirty-one per cent of all the traffic in the three counties is carried by the State Highway System.

Practically the entire network of streets and roads within the metropolitan area is now overcrowded with traffic, and when one attempts to conceive of a State Highway System adequate to carry the traffic demands imposed upon it, one must realize that immediately after a State highway is widened or otherwise improved, traffic formerly handled on adjacent roads and streets is attracted to the new improvement, thus overtaxing it from the start and rendering it inadequate



for the increased traffic which it is required to carry.

Not only is each new improved portion of the highway required to carry a greatly increased traffic, but owners of abutting property, realizing the commercial value of the improvement, immediately build up businesses which in turn require zoning for lower speeds, thus tending to cut down the traffic capacity of the highway.

An inventory of the present District VII system indicates the following mileages and percentages of the various types of surfacing of the rural highways now in use:

- 60 miles or 6% oiled and of inferior standards;
- 171 miles or 17% of intermediate type gravel and oiled;
- 124 miles or 12% of plant-mixed or macadam of intermediate standards;
- 9 miles or 1% of bridges;
- 642 miles or 64% of Portland cement concrete or asphaltic concrete of high type surfacing.

The fact that 64 per cent of the rural highways now have a high type of surfacing does not mean that they are in every way adequate for present day traffic requirements. Many of them were built years ago on inferior standards of alignment and grade. Many are too narrow to carry the traffic, and there are a great many highways and railroads intersecting at grade which endanger, delay and congest traffic.

In addition to the mileage shown above of rural highways, there are 424 miles of State highways within incorporated cities. In nearly all cases these highways are too narrow to accommodate present day traffic, and with the maze of intersecting streets and railroads and restricted speed limit zones, there exists in District VII one of the most difficult traffic problems to be found anywhere.

Of the 1411.6 miles of highways within District VII, 667.5 miles are multiple-lane highways as indicated by the following tabulation:

Rural					Total Miles
No. of Lanes					
3	4	6	Div. 4		
201	97	31	20		321½
Municipal					Total Miles
No. of Lanes					
3	4	6	Div. 4	Div. 6	
51	236	48	4	7	346

[Four]

\$800,000,000 Estimate for District VII

The Automobile Club of Southern California, together with other civic organizations in Los Angeles and vicinity, have recently estimated that a complete new system of motorways which would in effect be freeways extending in various directions from the business district of Los Angeles would cost in the neighborhood of \$800,000,000.

This estimate of \$800,000,000 is mentioned in order to show that the estimate of \$100,000,000 to bring existing highways in District VII to adequate standards as detailed in this article by District Engineer Cortelyou is in fact most conservative.

This estimate of \$100,000,000 should be regarded as a minimum amount because there would still be required a very large annual expenditure to maintain and to enlarge such a system in order to keep pace with the ever-increasing traffic demands.

The total number of miles of highways within District VII does not give a true indication of the maintenance requirements since it includes a large portion of multiple-lane highways which if reduced to an equivalent length of two-lane highway would amount to a total of 2031 miles of two-lane roads.

The estimate of required expenditure, that follows, does not take into consideration the fact that as soon as any portion of this highway system should be improved, traffic now using other streets and highways would immediately use the new improvement, thus again making it inadequate for the volume of traffic it would be required to carry. Neither does it provide wide rights of way for future construction on our present system, which would be very desirable at this time to protect our present highway investment before land values increase to such an extent as to make their cost very much greater.

The estimate provides for two freeways which in general follow present State Highway routes, but does not provide for an adequate system of freeways radiating from the business center of Los Angeles in all directions, without which no transportation system in a metropolitan area similar to this could be considered complete. At the present time at least six such freeways are badly needed, and their cost would far exceed that of all other highway expenditures in the district combined.

Considering the present State Highway System in District VII, the following expenditures would be required to bring it up to adequate standards for handling the amount of traffic it is now called on to carry and to provide safety for traffic:

168 miles widen 2 lane to 3 lane pavement.....	\$8,338,000
112 miles widen 3 lane to 4 lane pavement.....	5,526,000
214 miles reconstruct 2 lane pavement	9,207,000
7 miles reconstruct 3 lane pavement	188,000
63 miles reconstruct 4 lane pavement	8,670,000
67 miles construct new 2 lane pavement	4,389,000
8 miles construct new 3 lane pavement	319,000
31 miles construct new 4 lane pavement	4,370,000
37 railroad grade separation structures	8,976,000
36 highway grade separation structures	8,610,000
Bridges—New and reconstructing	2,850,000
Sea shore protection.....	1,050,000
60 miles of freeway construction, including R/W and grade separation structures	36,000,000
Miscellaneous minor improvements	1,560,000
	\$100,053,000

A freeway may be described as a highway through a built-up area from which all vehicular access to abutting property is cut off and on which there are no intersections at grade of either highways or railroads, thus permitting the free and uninterrupted flow of traffic in either direction. Facilities for cars entering or leaving a freeway are only provided at convenient intervals and always without left turns across moving traffic.

To serve their purpose freeways must be divided multiple-lane roads of sufficient width to provide safety for traffic and to carry the traffic burden imposed upon them without



Photo courtesy Automobile Club of Southern California

Evening rush hour traffic scene at intersection of Fletcher Drive and San Fernando Road in Los Angeles. Both are State Highways with an average daily traffic count of 15,000 to 25,000 vehicles

undue congestion. In all cases where the construction of a freeway is justified, traffic must necessarily be exceedingly large, requiring very wide rights of way for the highway proper with additional widths on each side to provide for service roads to accommodate abutting property.

In cases where right of way is acquired for freeways, it is necessary to proceed on a minimum width of 90 feet, providing no service roads are required for handling local traffic adjoining the freeway. However, in cases where service roads are required, it will be necessary to secure

a minimum width of 170 feet and a maximum width of 200 feet, to which must be added the additional required width for accelerating and decelerating lanes at side street intersections, and, where grade separations will be made, for the acquisition of the necessary right of way along both sides of the abutting streets for some distance back from the freeway proper.

The width of right of way depends on whether full clover-leaf or compressed clover-leaf intersections are desired for connecting the freeway in these locations with the abutting service streets and the connecting

roadways to the intersecting highways.

The highly developed character of the territory which such proposed freeways traverse, makes the cost of acquiring rights of way very great. Development of the entire area is proceeding very rapidly with an increasing number of subdivisions springing up in the direct path of proposed freeways, thus constantly increasing the cost of acquiring right of way. Although securing right of way for a freeway would be costly even at the present time, it will undoubtedly be much greater as time goes on.

Detour Parallels Construction Job

ONE of the considerations on a reconstruction project is to take care of traffic adequately from the time the existing road is torn up until the work is completed and the new road thrown open to travel. This problem has been nicely handled on the grading and paving contract, 2.3 miles in length, being finished between Roseville and Rocklin in Placer County.

As soon as the necessary grade widening was completed, a road-mix

detour was constructed of the native materials approximately $1\frac{1}{2}$ inches thick and 20 feet wide, the old pavement being used, meanwhile, to carry the traffic. Upon completion of the detour, it was thrown open to traffic. The existing pavement was then removed, the area graded, and the placing of the portland cement concrete pavement was quickly started.

This detour, cheaply constructed and with no asphaltic seal, has held up remarkably well since given over to traffic on September 22d, and at the time of writing, according to Resident Engineer Remington, there has not been a single accident, even

though it closely parallels construction for the greater part of the project.

Since the last official summer traffic count shows this highway as carrying from 4285 to 6300 cars daily, the record, both from a traffic and engineering standpoint, speaks well for those having the project in charge.

Lawyer: "Then you admit that you struck the plaintiff with malice aforethought?"

Defendant, indignantly: "You can't mix me up like that. I've told you twice I hit him with a brick, and on purpose. There wasn't no mallets nor nothin' of the kind about it—just a plain brick like any gentleman would use."



Section of new four-lane divided highway through Cuesta Pass. Center parting strip is unfinished and traffic striping yet to be done.

LA CUESTA REALIGNMENT OPENED, 59 STEEP CURVES ELIMINATED

By LESTER H. GIBSON, District Engineer

LA CUESTA, the steep and tortuous grade that since the days of the Franciscan friars has been the bogey of travelers on El Camino Real, no longer will impede the flow of motor vehicle traffic over The King's Highway.

Modern engineering skill at last has conquered Cuesta Pass on U. S. 101, midway between San Francisco and Los Angeles, eliminating the three score and more steep and hazardous curves on the Coast Highway where it winds through the Santa Lucia Mountains just north of San Luis Obispo.

The new divided four-lane highway through Cuesta Pass, constructed by the State Division of Highways at a

cost of \$1,050,000 to replace the old and dangerous road that originally was the Trail of the Padres, was officially dedicated to public service by Governor Frank F. Merriam on Saturday morning, November 5.

Pageantry, speechmaking and banqueting highlighted a two-day celebration hailing the opening of the new highway.

Standing on the spot where General Fremont camped with his troops on his march south to complete his conquest of California, Governor Merriam, wielding an ancient, hand-forged knife from the Mission San Luis Obispo, severed a rawhide riata stretched across the newly completed highway.

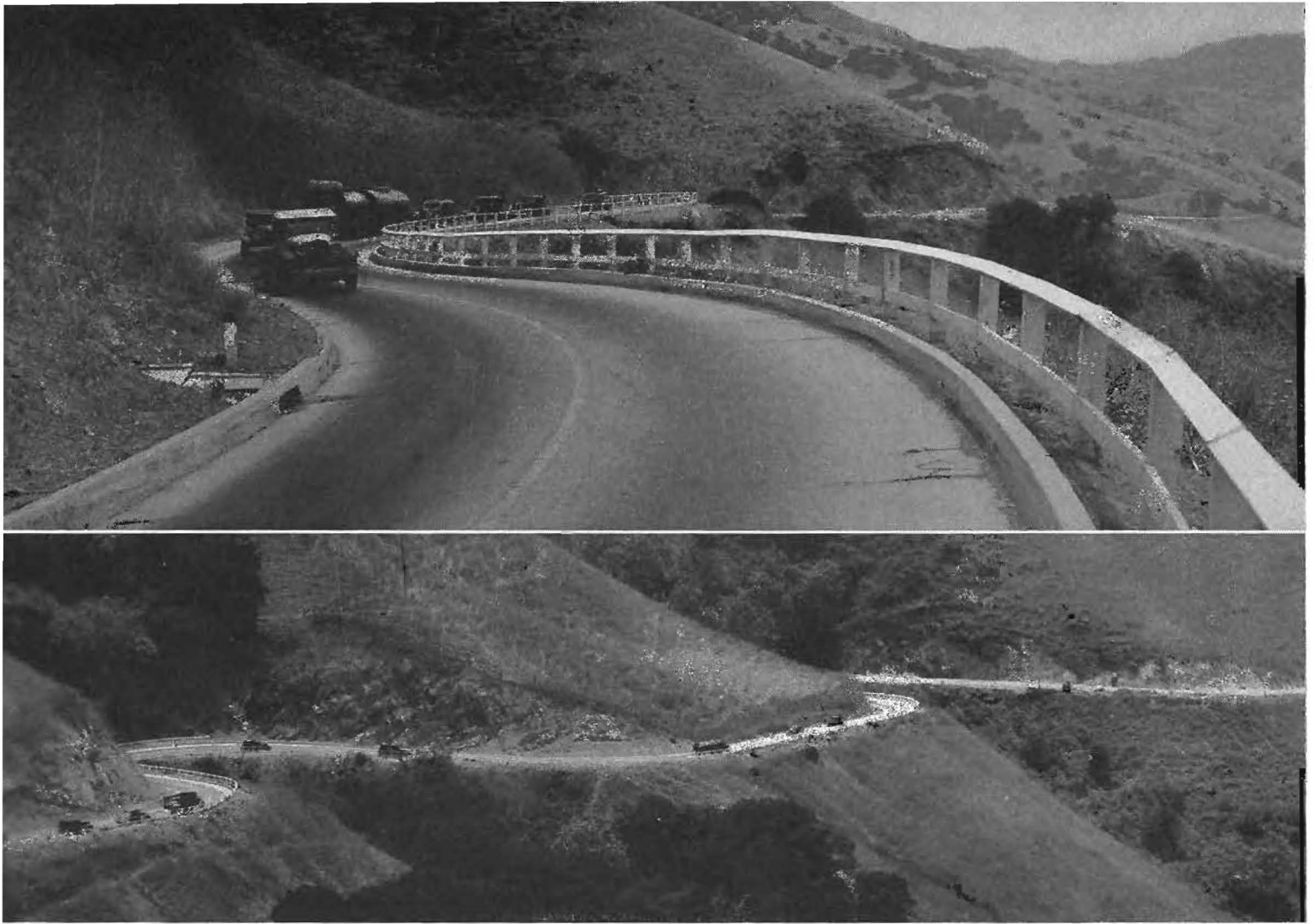
"This road opening is different from any I have attended," the Governor said, "in that I am using this old knife from your famous mission to cut the rawhide rope barrier. It makes this an especially romantic occasion and from it we should draw a lesson of progress and realize that Californians enjoy more blessings than any other people in the world. We should be grateful for these blessings and let this occasion be an inspiration for greater attention to maintaining and increasing them.

"I am happy to be present and to open this highway for the safe and happy travel of the thousands who will travel over it."

(Continued on page 8)



Top view shows wide roadbed and easy grade of new Cuesta Pass Highway providing 4 plant-mix surfaced traffic lanes separated by 4-foot dividing strip as yet unfinished and unstriped. At bottom, construction scene on huge fill that required moving 122,000 cubic yards of dirt.



At top one of the many steep, sharp curves on the old, narrow, La Cuesta road with traffic held up behind slow vehicles. Bottom scene gives general view of old winding grade.

The dedicatory ceremonies were opened by Claude Arnold, chairman of the San Luis Obispo County Board of Supervisors, president of the Mission Trails Association and chairman of the celebration committee. He introduced Senator Chris N. Jespersen of Atascadero, who presented speakers including H. R. Judah, chairman of the California Highway Commission, and Harry A. Hopkins, Assistant Director of the State Department of Public Works, who spoke for Director of Public Works Earl Lee Kelly.

FIRST USED BY PADRES

The ingenuity of man devising and improving modes of travel has required continual improvement of facilities for the use of ever changing modes of travel. Since founding of the Mission of San Luis Obispo de Tolosa by Padre Junipero Serra in 1772, Cuesta Pass has seen many a changing picture: first, Franciscan Fathers, Spanish courtiers, soldiers,

mail carriers and brigands traveling by primeval trail; then, traveling by such road as nature offered, immigrant wagons; and in 1855 two-horse stages, later supplanted by six and eight-horse stages. Many were the passengers of these early stages who had reason to remember the arduous ascent of Cuesta Pass as they were required to work their way, in addition to paying a good price, by pushing the stage up hills and holding it from upsetting on sideling places.

Issuance of \$20,000 worth of bonds in 1876 for constructing Cuesta Road over the Santa Lucia Mountains made possible the replacement of the winding road carved out by wagon wheels and pounding hoofs along the creek bottoms and up over the pass. Completion of this road, modern for that time, was acclaimed by all, as permitting one to travel with comparative ease over the once arduous pass. This road, though steep and narrow, is still traversable on the southern ascent where it winds along

the precipitous westerly slope of San Luis Obispo Canyon.

ADVENT OF AUTOS

The advent of automotive transportation again changed the picture and shortly after formation of the first California Highway Commission in 1912, the problem of providing a road across this barrier adequate for the latest mode of transportation was presented. While the existing road was considered one of the best mountain roads in the southern part of the State, it was hardly suitable for adoption as a link in the main coast highway between San Francisco and Los Angeles.

Surveys were made and a contract let late in the Fall of 1914 for grading and surfacing a 24-foot roadbed with gravel along the easterly slope of San Luis Canyon. Thus, on completion of this contract in 1915, there came into being the highway over which traffic, until recently, wound its way over La Cuesta. The follow-

ing year an oil surface was provided which was maintained until 1922 when a 20-foot width of 6-inch concrete pavement, with a curb on either side, was constructed.

Again man had failed to perceive the developments his ingenuity would effect in the modes of transportation. With an ever growing increase in vehicles, particularly in the number of ponderous long trucks with trailers or semitrailers that moved slowly over the winding grades on both sides of Cuesta Pass, a once modern highway became obsolete, impeding the flow of traffic. Passing on the old two-lane road was hazardous and usually impossible in this day of speed, making the fast automobile traffic adopt the slow creeping pace of the large heavily laden trucks.

It was a frequent sight to observe a line of 20 or more automobiles creeping along behind a large truck throughout their crossing of Cuesta.

TRAFFIC CONGESTION

Once again the Santa Lucia Mountains became a barrier to transportation by reason of this serious traffic congestion which was rapidly becoming more acute. With appropriation of funds by the California Highway Commission at its meeting on January 3, 1936, for the reconstruction of 3.28 miles of highway over La Cuesta between San Luis Obispo Creek and Cuesta Siding, surveys and exhaustive studies were immediately undertaken.

Designing a highway with a construction cost that could be economically justified, that would ascend the southerly slope in a restricted distance without an excessive grade on flat sweeping curves, that would be stable along a steep canyon slope known to be generally unstable and would adequately and safely serve the mixed traffic of today and tomorrow, presented a real engineering problem.

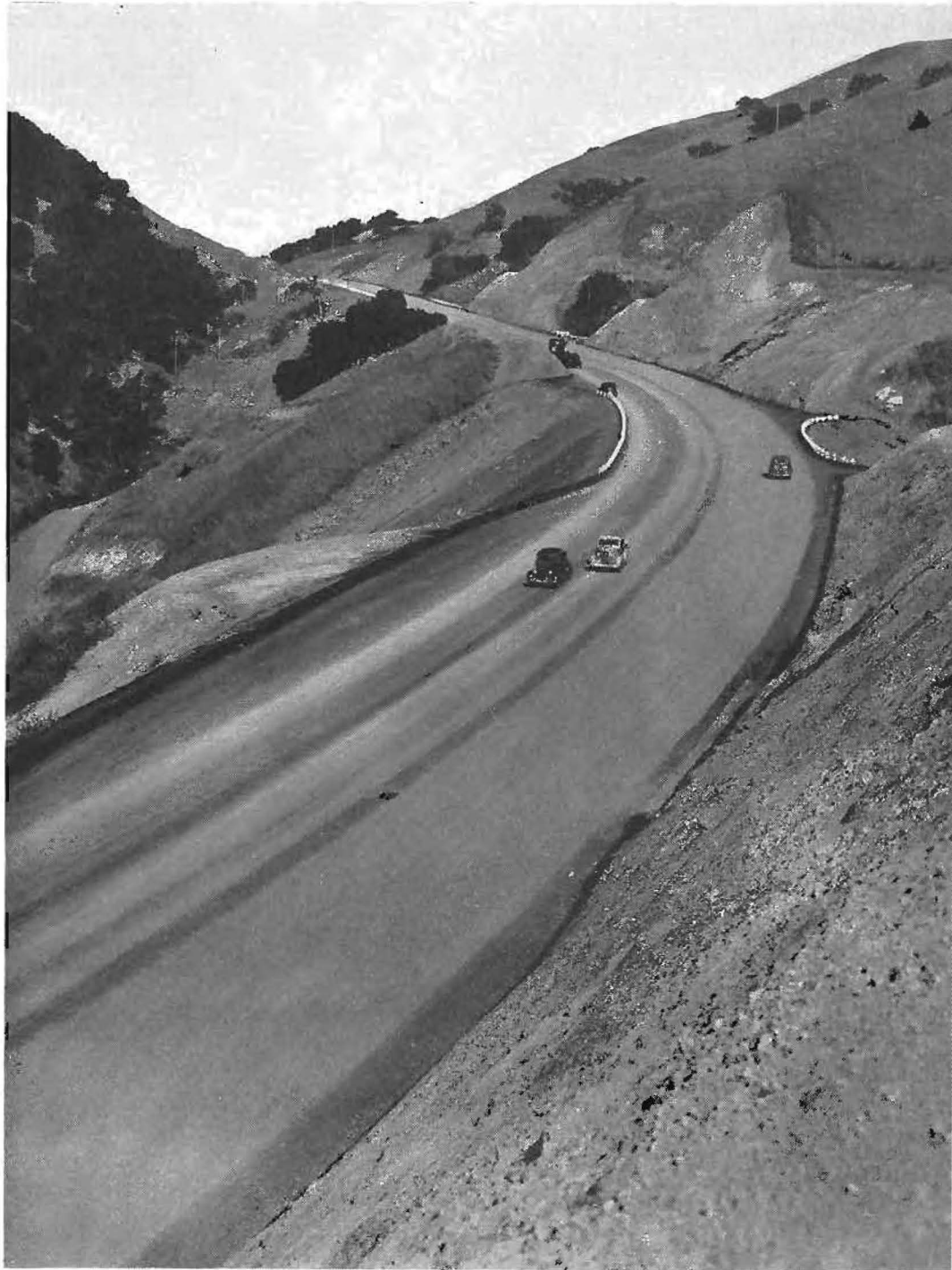
The unusually large number of heavily laden trucks creeping over Cuesta in coastal transportation predominated traffic. This type of traffic created a serious traffic congestion and dictated that reconstruction provide four traffic lanes with a neutral strip to separate opposing traffic for safety alone. Constructing a roadbed of sufficient width to provide these traffic lanes over steep terrain requires cuts and fills of unusual mag-

nitude. Results of preliminary surveys and exhaustive studies dictated a location following along the same side of the canyon as the existing road south of the summit and the opposite side of the canyon from the existing road north of the summit, with an overhead crossing of the Southern Pacific Railroad.

With the location and size of the cuts and fills determined, it became

necessary to definitely ascertain the geological structure, what materials would be encountered in excavation, if they were stable or would be subject to slides, and if the soils found under the embankments would afford foundations for fills of such magnitude.

Under supervision of the Division of Highways Materials and Research Department extensive soundings were



Parking spaces are provided at appropriate places on the La Cuesta realignment. Striping and finishing of center dividing strip remain to be done.

made and samples taken, generally with soil tubes of their own design which obtained a continuous core. At a few locations where investigations to depths greater than possible with a soil tube were necessary, borings were made with a well drilling rig. From the information thus obtained plans were formulated to preclude slides and correct unstable embankment foundations. Where unstable cut slope material was evidenced benches were designed in the slope to lessen the load, or the slope flattened from the customary 1:1 to as much as 1½:1, the usual angle of repose for soils. During construction some of the cut slopes were flattened to as much as 2:1.

DRAINAGE PROBLEM

Correcting the unstable fill foundations was yet another problem. The seepage found in each ravine served to saturate and lubricate the heavy mantle of soil covering the ravines making them very unstable. To dehydrate these areas and provide permanent drainage, a system of trenches was designed consisting generally of a main 10-foot width transverse trench with laterals. These trenches were to be backfilled with 2 to 8 feet of rock which was to extend up the trench slopes. In addition, in the main trenches 8-inch perforated metal pipe was to be laid.

In what is known as Schoolhouse Canyon, where one of the largest fills of the project was required, a drainage trench system could not be used due to the comparatively level canyon floor and the fact that plastic clays highly saturated by an underground flow extended to a depth of 75 feet. After particular study and experiment, it was decided to sink about 300 sand wells or piles completely penetrating the unstable mass and connected with a system of drains at the natural ground level; the theory being that as the load is applied by placing the embankment a readily accessible outlet is provided for the water contained in the unstable mass, permitting a comparatively rapid lowering of the moisture content with early stability.

A year was consumed by the surveys, soil investigations, and studies to assure that all factors had been given due consideration.

The handling of traffic through construction of this magnitude was a major problem in itself. Traffic

Salient Facts Concerning Cuesta Grade

First road was nothing more than a trail following along creek bottoms and up over the summit. This was later known as the "Padre's Trail." Existed until obliterated by present construction.

Mission San Luis Obispo de Tolosa established by Father Junipero Serra in 1772.

First stage over Cuesta in 1855—two-horse and later six- and eight-horse stages. The first day's journey by stage was to San Miguel.

Present county road south of summit along westerly precipitous slope constructed by bond issue of 1876 amounted to \$20,000 for the purpose of making a road over Santa Lucia Mountains, to be known as Cuesta Road.

California Highway Commission let contract for grading old road along easterly slope late in fall of 1914. Completed in 1915. Total cost \$58,771. Surface oiled in 1916 and maintained as such until 1922.

California Highway Commission let contract in 1922 for daylighting blind curves and constructing 21½-foot reinforced concrete pavement with curbs along each side. Completed December 26, 1922, at a total cost of \$169,166.

Funds for present construction voted by commission at meeting January 3, 1936, in the amount of \$665,000 and at meeting of March 5, 1937, \$280,000 additional was voted, making a total of \$945,000.

Work started June 15, 1937. Total excavation involved, 1,365,000 cubic yards. Maximum fill on project contains 122,000 cubic yards; though only 350 feet long it has a maximum height of 170 feet.

There are two cuts of particular note, one containing 190,000 cubic yards and the other 210,000 cubic yards.

Roadway consists of two 21-foot lanes surfaced with plant-mixed surfacing on crusher run base divided by a raised 4-foot parting strip. The width of roadbed is 52 feet.

Reinforced concrete overhead crossing of the Southern Pacific Railroad, constructed under supervision of Bridge Department of Division of Highways. Approximately \$100,000 expended on this portion of the project.

Total cost of project including preliminary engineering, moving utilities, construction of overhead and road will approximate, \$1,050,000.

Comparison of old and new roads:

	Old	New
Length	4 miles	3.283 miles
Roadbed width	24 feet	52 feet
Number of curves.....	71	12
Minimum radius	60 feet	800 feet
Average grade	6.222%	7%
Minimum vertical sight distance.....	275 feet	440 feet
Unimpeded safe driving time.....	10 min.	5 min.
Driving time required.....	10 to 45 min.	5 min.

must go through safely and without interruption. No detours were available around the work nor was it economically feasible to construct them. Only a small portion of the existing road could be used as detours until construction was completed. Where construction destroyed the existing road, provisions were made for its use by traffic until at least half the width of the new roadway had been completed to grade and available to traffic.

HUGE EXCAVATION JOB

Construction operations were started June 15, 1937, with clearing and grubbing following closely by excavation of the fill treatment trenches which had to be completed post-haste to permit starting construction of the fills. Construction of the fill treatment was a fair sized project in itself,

amounting to approximately \$87,000. It was necessary for the contractor to excavate a system of construction roads to afford access for equipment and hauling rock backfilling material. This was quite an item due to the steep terrain and involved moving many free yards of earth.

In terms of money, excavation of the large cuts and construction of the adjacent embankments involved approximately 50 per cent of the total final contract payment. It is interesting at this time to compare the 89,000 cubic yards of excavation involved in constructing the existing road built in 1915 with the 1,365,000 cubic yards moved under this contract.

The maximum fill on the project contains 122,000 cubic yards, and, although only 350 feet long, it has

(Continued on page 17)



Realignment of U. S. 101 through San Rafael near Grand Avenue has four traffic lanes with painted dividing strip—Service road at right.

San Rafael Bottleneck Broken

By W. A. RICE, Resident Engineer

ONE of the worst "bottleneck" impediments to traffic on the entire California Highway System was removed on Sunday afternoon, November 13, when Governor Frank F. Merriam officially opened the \$400,000 realigned San Rafael-Ignacio Highway.

Officials of the State, Marin County, the Redwood Empire Association and civic bodies of Marin participated in a celebration held at the top of Puerto Suello Hill. Symbolical of the occasion, a huge papier mache bottle blocking the highway was torn in half when the Governor joined a group of students of San Rafael schools tugging on a long rope attached to the neck of the blockading bottle. This ceremony was part of a pageant depicting the various steps in road building from the days of the Padres who established Mission San Rafael to the present.

The realignment of U. S. 101 through San Rafael was made necessary by the steady increase of traffic between San Francisco and the Redwood Empire following completion of the Golden Gate Bridge.

Studies of this growing traffic showed that the most constricted section of U. S. 101 between the Golden Gate Bridge and Santa Rosa was from Ignacio through San Rafael. On the old two-lane pavement, traffic on the seven-mile stretch between these two points reached an intensity of 1700 cars for a one-hour period with a sustained flow of 1250 or more per hour over an eight hour period. Sunday traffic in the summer months of June and July approximated 18,000 vehicles per day and week-day traffic often exceeded the carrying capacity of the highway.

Maximum congestion occurred in San Rafael where numerous inter-

secting streets, stop signals and grade crossings prevented a free flow of traffic. It was decided to fully improve a new half mile section from the north city limits of San Rafael to Grand Avenue from which point one of the future routes contemplated can be continued.

HEAVY TRAFFIC CONGESTION

The entire San Rafael-Ignacio project, 7.5 miles long, a vital link in the Redwood Highway, was inaugurated primarily as an aid in handling peak vacation traffic. The old two-lane road from the junction of the Black Point Road, to San Rafael, proved to be totally inadequate to allow the unimpeded flow of traffic, especially during the week-ends when summer traffic was practically all homeward bound.

There were times when south-bound traffic was congested from

San Rafael to Petaluma, and it took from three to four hours to cover those 20 miles. This was caused mainly by restricted flow of traffic through the town of San Rafael, where speed limits and numerous intersections caused much traffic interruption with the consequent backing up of traffic over long distances of the road.

The southern portion of the project was constructed in San Rafael and consisted of a 50-foot plant-mixed surfacing placed on a graded 90-foot roadbed. A service road was built and an underpass constructed to handle local traffic so that the previous constriction to the flow of traffic due to the numerous intersections might be avoided.

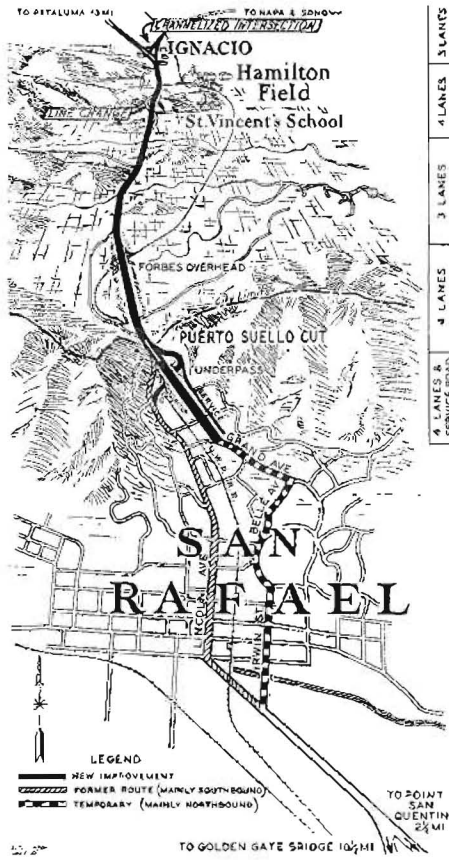
PROVIDE FOR FUTURE

From the northerly city limits of San Rafael to the Black Point Road the existing two-lane roadbed was widened to a graded 64-foot roadbed and surfacing placed thereon. Where sight distance was ample, and traffic could pass safely three lanes were provided. Where sight distance was restricted and where the greatest congestion occurred four lanes of pavement were provided.

The entire project was graded so that a fourth lane could be placed at all points. Several small bridges were widened and the overhead crossing over the Northwestern Pacific tracks at Forbes Station was widened to accommodate four lanes plus a division strip. This anticipated a further growth of traffic and provides that when it becomes necessary to widen the sections where three lanes are considered ample at the present time, it may be done with a minimum expenditure and without a loss of the present investment.

Where the existing surface was of Portland cement concrete, the widening to three lanes was accomplished by adding a 13-foot section of 5-sack concrete along the side of the existing 20-foot pavement. In placing this concrete surfacing every care was taken to make it a smooth even-riding surface. However, since the new pavement abutted directly against the old surface, in most instances considerable difficulty was experienced.

Where entirely new pavement was placed, as over St. Vincent's Cut,



Sketch map of realignment through San Rafael to Ignacio.

float finishing with the Johnson mechanized float gave a very good riding surface. Curing with impervious membrane eliminated ponding or other methods which would have necessitated keeping the road closed to all traffic for a longer period of time, thereby adding to the inconvenience of the public during the summer season. Where the existing surfacing consisted of oiled macadam the widening was done with plant-mixed surfacing.

A major line change was made over St. Vincent's Hill. Here several curves were replaced by two curves, the summit lowered by approximately 8 feet and four 11-foot lanes of concrete surfacing placed. An additional safety factor was incorporated by separating the opposing lines of traffic with a 6-foot dividing strip of plant mix.

From the junction of the Black Point Road to south of Ignacio the surfacing is sufficiently wide to allow for a painted 6-foot dividing strip. Over the Miller Cut, widening to 50 feet was done by placing a 13-foot strip on the east and a 17-foot strip on the west. This allows for a dividing strip to be painted on

this section. Wherever transitions were made from a three to a four-lane road or vice versa, approximately 500 feet was allowed to permit traffic to accommodate itself to the changed roadway width.

MODERN SAFETY FEATURES

In the rebuilding of this road modern safety features have been incorporated. As already noted, the various opposing lanes of traffic have been separated by either a plant-mixed dividing strip or a painted one. In San Rafael, a Service Road was constructed with a plant-mixed surfacing to accommodate local traffic, making it unnecessary for it to encounter through traffic except at designated intersections and under controlled conditions.

An underpass was constructed to pass the traffic from the center of San Rafael along Lincoln Ave., under the new road and bring the vehicles into the main road headed in the same direction as the remainder of the traffic. This underpass also provides access to the Service Road, making it unnecessary for the local traffic to cross the main flow of traffic.

At the junction of the Black Point cut-off and U. S. 101, a channelization is being constructed. This will consist of widened accelerating and decelerating lanes defined by curbs and will serve to segregate and protect traffic at this point. By this channelization, traffic east and westbound over the Black Point Road will be separated, eastbound traffic being carried on one road, westbound on another, with access from the main road for Napa-bound south traffic. Acceleration lanes are provided for Black Point Road traffic southbound on U. S. 101 which will allow more ready assimilation into southbound traffic at times of peak loads, thus relieving another point where hazards and impeded flow have existed for years.

MORE WORK NECESSARY

Much remains to be done, particularly through San Rafael, before the full effect of this construction becomes operative in relieving traffic congestion and hazard but the problem has been attacked and we believe solved at the most critical point.

(Continued on page 28)



Two views of the realignment of U. S. 101 in Marin County looking from Puerto Suello cut south toward city of San Rafael. Through traffic bound north and south is separated from local traffic by the grade separation in the middle distance and the service roads at the left. Lincoln Avenue is shown on the right of the top picture with local traffic bound north coming through the underpass and up the service road on the left to merge with through traffic. At right of lower picture may be seen a loaded truck entering the truck route on former routing into the city via Lincoln Avenue.

Widening of Rose Canyon Gives San Diego Modernized Gateway

By EARL E. SORENSON, District Construction Engineer

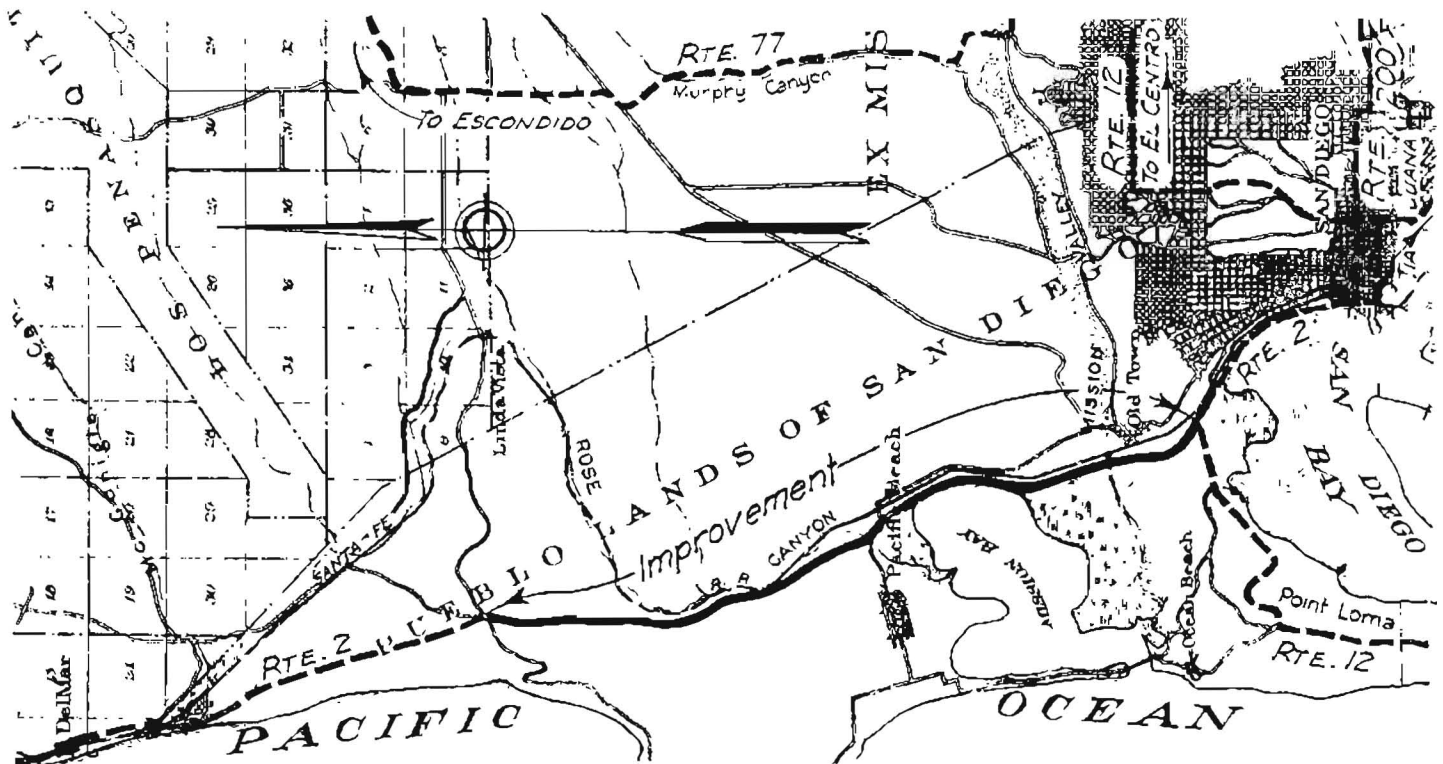
RECENTLY completed widening and modernization of the Rose Canyon gateway to San Diego will provide one of the finest approaches of any comparable city. Traffic can now enter the confines of the city and be distributed rapidly and directly to the industrial, shipping, military and business sections with a minimum of lost motion.

which was a great improvement over the older route and which adequately handled traffic for some years. At present, both these roads serve La Jolla, the Scripps Grade as a scenic drive and the La Jolla Canyon road as a more direct all-purpose route.

For many years prior to 1929, a connecting wagon road existed

became imperative, and its construction was started in 1929 when a joint city and State project was arranged to care for the grading from Balboa Avenue to Torrey Pines Mesa.

The present completed highway from Barnett Avenue to Miramar Road, a distance of 9.7 miles, is the culmination of this and several other



Prior to 1930, all traffic between San Diego and points north was routed through La Jolla, which lay some two miles west of a feasible and more direct line. Originally traffic, after leaving either the Torrey Pines Mesa or the Sorrento Canyon route, traveled down to the seacoast at La Jolla, over the steep and winding Scripps Grade, which present day large trucks would be unable to negotiate. This was later supplemented by the La Jolla Grade

through what is known as Rose Canyon, a direct short route from Balboa Avenue to a connection with the La Jolla road at the south end of Torrey Pines Mesa. This road, although approximately five and one-half miles shorter, was unpaved, and in such condition that traffic preferred the longer route through La Jolla. As passenger and freight traffic increased between Los Angeles and San Diego, the need for improvement of the shorter road

projects over the intervening years.

The first contract in 1929 provided for grading and necessary small drainage structures at a total cost of approximately \$110,000. A concrete bridge costing approximately \$27,000, over Rose Canyon Creek, was constructed during the same period under a separate contract. This completed the grading operations through the canyon proper, from Balboa Avenue to Miramar

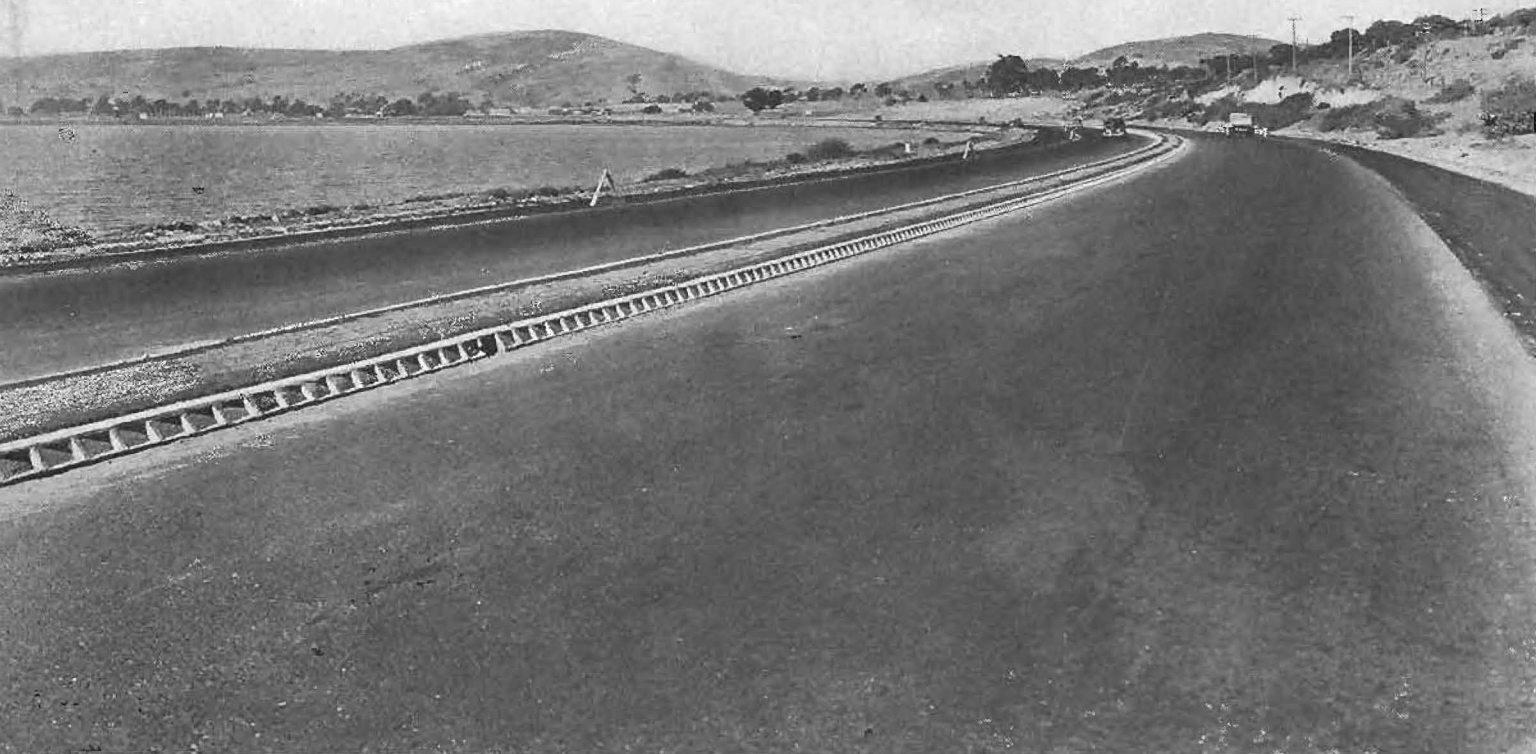
(Continued on page 18)



Rose Canyon improvement looking north from Elvira Station showing new divided highway, long easy curves and safety features.



Curbing of center dividing strip has recessed panels painted to reflect light at night as an added safety design.



New divided highway through Mission Bay Park area of Rose Canyon widening project showing recessed paneled curb of parting strip.

Road, but provided no surfacing and was uninviting to both light and heavy traffic.

In 1930 a contract was awarded and completed for placing a Portland cement concrete pavement 30 feet in width and providing for three lanes of traffic over the portion graded in 1929.

The completion of the above project gave traffic a direct route to San Diego, but a congested one from Balboa Avenue south to the city proper.

The need for a new road from Balboa Avenue through the uncongested area at the head of Mission Bay, to carry traffic to lower Broadway and the Coronado ferrys, on Pacific Boulevard, was acute. This route, while closely paralleling the old Moreno Boulevard, lay across the Santa Fe tracks in undeveloped territory, which permitted economical development. It also discharged traffic directly into Pacific Boulevard at Barnett Avenue from whence it could be easily dissipated through the various city streets.

The need for the new route resulted in the awarding and completion of four separate contracts during the year 1933. These contracts provided for the grading and small structures over the entire length, the construction of reinforced concrete bridges over the Cudahy Chan-

nel and Tecolote Creek, both providing for four lanes of traffic, the construction of a reinforced concrete bridge over the San Diego River of the same width and the paving with asphaltic concrete for a width of 30 feet over the entire length. An approximate total cost of \$347,000 was involved in these four contracts.

CONGESTION RELIEVED

The above work completed the road from Barnett Avenue to Miramar Road and provided a high standard minimum three-lane highway. It was anticipated that it would care for traffic for a considerable period of time. However, the unprecedented development and growth of the San Diego territory, together with enormous increase in the number of motor vehicles, resulted in congested and dangerous conditions before 1938, which necessitated even further development, and the project just completed provided for widening to a minimum of four lanes over the entire length of 9.7 miles.

The contract was awarded to the D. H. Ryan Company of San Diego on April 18, 1938, and the contractor, by excellent planning and timing of his work, together with efficient operation and some double shifting, completed the work in November,

1938, some five months ahead of schedule.

Due to heavy and fast traffic over this section of highway, the accident rate was high, and it was found advisable to separate opposing lanes of traffic by a fixed barrier consisting of raised curbs over the greater portion of the distance.

10-FOOT LANE ADDED

The design of the highway called for widening to a minimum of four lanes by the addition of a 10-foot lane to the existing asphalt concrete from Barnett Avenue north for a distance of two miles. From this point north to Balboa Avenue, the existing asphaltic concrete pavement was widened to 52 feet, permitting separation of opposing traffic lanes by raised curbs 6 feet apart and providing for interior traffic lanes of 12-foot width and exterior 11 feet in width.

From Balboa Avenue north an existing 30-foot concrete pavement was widened by the addition of 20 feet of Portland cement concrete which permitted a 4-foot separation of curbs, leaving interior and exterior lanes of 12 feet and 11 feet, respectively.

The most advanced theories of design were applied to these separating curbs, including sloping sides

(Continued on page 28)

La Cuesta Grade Opened, 59 Curves Eliminated

(Continued from page 10)

a maximum height of 170 feet. There were two cuts of particular note, one containing 190,000 cubic yards, the other 210,000 cubic yards.

GRADING PROGRESS NOTEWORTHY

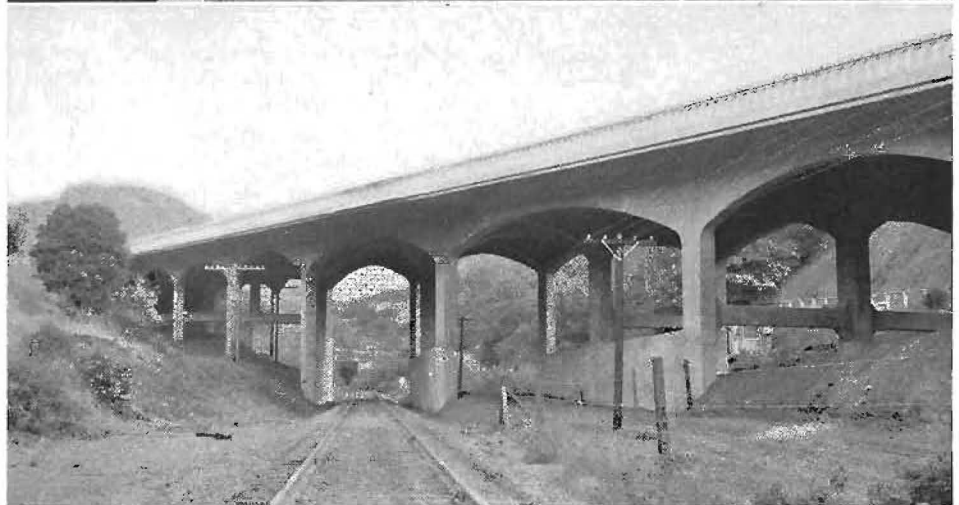
Despite an unusually severe winter, suspending operations for the better part of three months, the grading progress is noteworthy, an average approximating 100,000 cubic yards per month having been attained. The maximum for any one month was 150,000 cubic yards working two shifts.

Thanks to the exhaustive soil survey, slides exceeded the anticipated number only slightly. Attributable to this also is the fact that fill treatments functioned as contemplated, serving to stabilize all areas in spite of the enormous loads placed thereon. Of particular interest was the successful functioning of the 300 sand wells or piles constructed in School House Canyon by driving a 16-inch hollow seamless mandrel 70 feet long through the clay strata and filling the opening with sand as the mandrel was extracted. While the embankment settled two feet after its completion there has been no late movement nor any upheaval of adjacent areas lending to the belief that early settlement and stability of this 60-foot embankment has been obtained.

CONCRETE OVERHEAD BUILT

Two 21-foot traffic lanes of plant-mixed surfacing on crusher run base separated by a raised 4-foot dividing strip are provided on a 52-foot width of roadbed. While the 3-foot plant-mixed surfaced shoulders do not permit vehicles parking clear of the traffic lanes, similarly surfaced turn-outs or parking areas have been provided at frequent intervals.

As a part of this project a reinforced concrete overhead crossing of the Southern Pacific Railroad was constructed under a separate contract at a cost of \$100,000. Design of this structure presented a problem, due to the small angle, 22 degrees, between the road and railroad. The structure



Grade separation in La Cuesta presented a problem due to small angle between road and railroad. Structure is 465 feet long with 50-foot roadway separated by curbed 4-foot division strip.

is a "rigid frame" type with parabolic arched girders and deck being continuous over several spans. It consists of 10 spans of various lengths and has a total length of 465 feet. A total roadway width of 50 feet is afforded divided by a 4-foot parting strip with concrete curbs on either side.

Completion of the project marks the end of two and one-half years of continuous work, approximately a year being required for surveys and studies, and one and one-half years for actual construction, at a total cost of \$1,050,000 or \$320,000 per mile.

There is a marked feeling of satisfaction to know that the road embodies all the safety features of modern engineering design and that the last traffic bottleneck has been eliminated from the main Coast Highway between Los Angeles and San Francisco.

The project was under the general

supervision of the writer. V. E. Pearson was Resident Engineer and the contract was performed by the Metropolitan Construction Company.

Formal opening of La Cuesta was followed by a colorful celebration in the city of San Luis Obispo, where a two-mile Pageant of Progress attracted thousands of spectators.

On Friday night the county and city of San Luis Obispo were hosts to three hundred officials and civic leaders of California. Governor Merriam was the guest of honor and seated with him were Mayor Angelo J. Rossi of San Francisco and Mayor Fletcher Bowron of Los Angeles.

Welcoming addresses were made by Mayor L. F. Sinsheimer of San Luis Obispo, Chairman Arnold of the county board of supervisors, and Cecil G. Evans, president of the San Luis Obispo Chamber of Commerce. Brief talks were made by Governor

(Continued on page 28)

TWENTY-FOUR MILE PROJECT ON INTERSTATE ROUTE COMPLETED

By F. W. HASELWOOD, District Engineer

WITHOUT any ceremony, workmen removed the barricades at each end of the newly completed road between Cougar and Macdoel, on U. S. 97 in Siskiyou County on November 2d and an unending stream of traffic began the use of a newly completed link of an interstate highway of major importance.

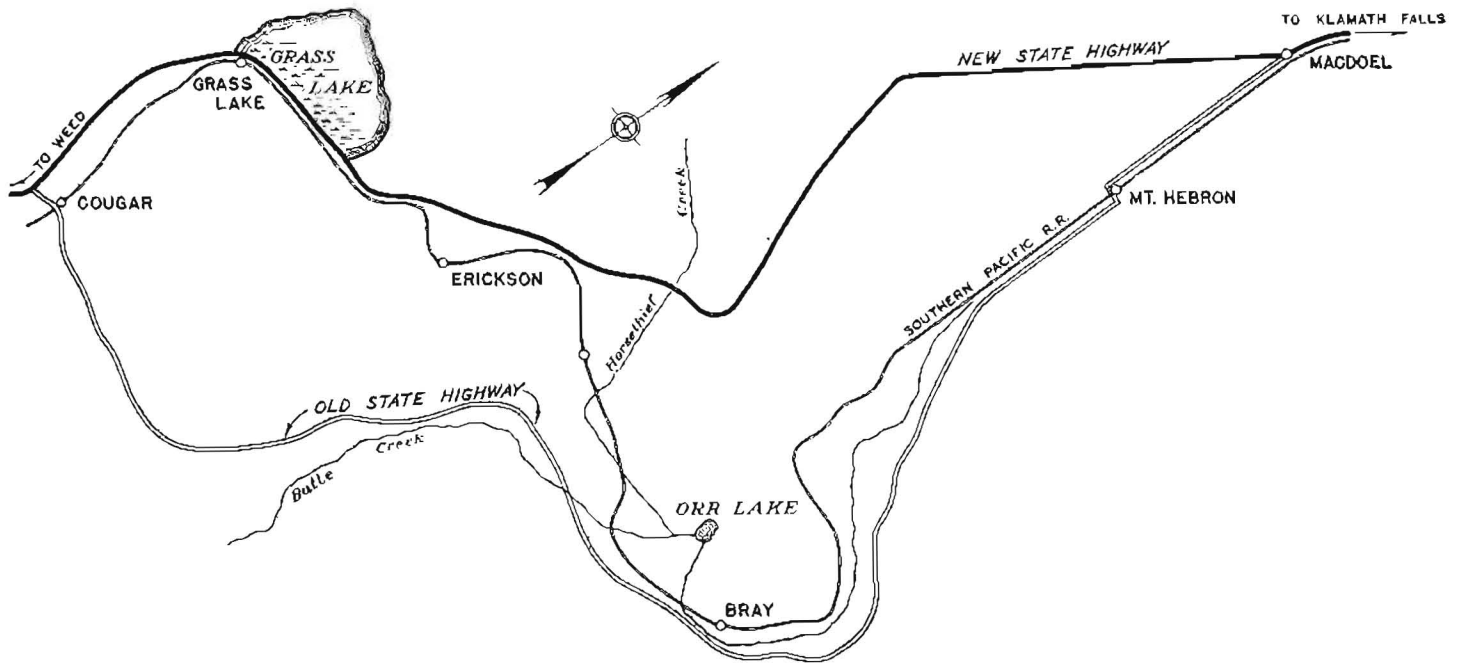
This 24-mile unit of the Weed-Klamath Falls highway, is on a new location that reduces the distance by 7 miles, the summit elevation by 600

72 and is locally known as a part of the Weed-Klamath Falls highway.

This road is a key unit of an extensive highway system, the major portion of which lies in Oregon, of much greater importance than its local name indicates. At Klamath Falls this road connects with and becomes an integral part of an improved highway extending north to The Dalles and known in Oregon as The Dalles-California Highway. A connection from Maupin over the moun-

Public Roads, a 73-mile connection between a point on The Dalles-California Highway about 10 miles south of Crescent and Goshen about 7 miles south of Eugene on the Pacific Highway. Comparative distances from Weed to Goshen on completion of this connecting route will then be, via Pacific Highway, 251 miles, via Klamath Falls, 234 miles.

Having in mind the relative importance of the Weed-Klamath Falls Highway as a unit of a major trans-



feet, and the safe traveling time by at least half an hour. The development of this route has been proceeding for several years. In view of the increasing use of this route, a brief resume of its present stage of development and its value to interstate traffic is offered.

In 1931 there was taken into the State Highway System, along with other roads then classified as eligible, a road from Weed on the Pacific Highway, to the Oregon line north of Dorris. This was designated as route

tain south of Mt. Hood serves Portland and makes this route an excellent alternate to the Pacific Highway.

The comparative distances from Weed to Portland are, via Pacific Highway, 380 miles, and via Klamath Falls and Maupin, 411 miles. In spite of the handicap in distance, the route via Klamath Falls offers better alignment and grade and fewer summits.

For some time there has been under construction jointly by the State of Oregon and the Federal Bureau of

portation system, both Oregon and California have been diligently improving the route as rapidly as finances permitted. In 1931, the distance from Weed to Klamath Falls was 63 miles in California and 21 miles in Oregon, a total of 84 miles of low standard, dusty, and, in California, mostly one-way county road.

In 1936 Oregon completed her portion of the route to a high standard of alignment, grade and surface, eliminating railroad grade crossings and

(Continued on page 20)



Views of recently completed portions of the Cougar-Macdoel sector of the Weed-Klamath Falls highway, U. S. 97, in Siskiyou County. The top and bottom pictures show long, straight stretches of the 22-foot bituminous mixed surface highway through rolling, partly timbered area. The center picture shows the route looking south across Wild Horse mesa with snow covered top of Mt. Shasta looming in the background.



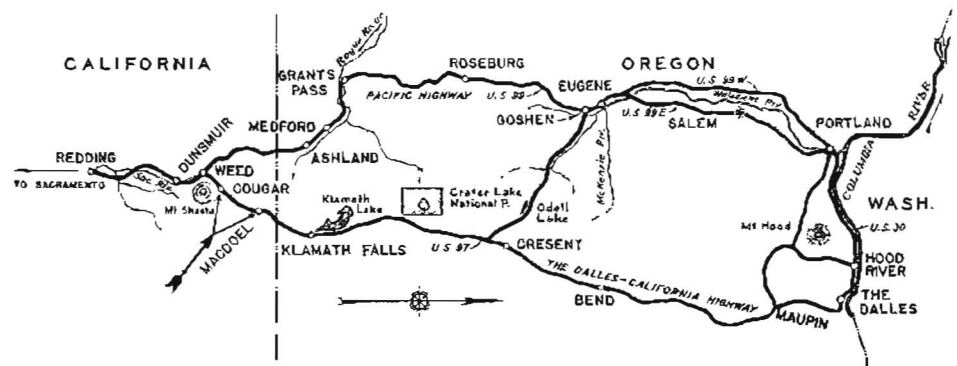
Tractors equipped with big rubber-tired wheels and weighted with bags of cement rolling soil-cement base construction.

reducing the distance from the State line to Klamath Falls to 17 miles.

In California the process has been somewhat slower but with the completion in October of a 24.2-mile unit between Cougar and Macdoel all but 1.4 miles of this road will have been brought to a high standard of alignment and grade, with an intermediate surface, serviceable and adequate for present requirements.

Immediately prior to the acquisition of this road as a part of the State Highway System, the Bureau of Public Roads and a joint highway district had graded 13 miles from 4 miles out of Weed to Cougar. The State's first move late in 1931 and early in 1932 was to improve grade and drainage on the remainder of the road to provide for two lanes throughout. The next move during the summer of 1932 was in accordance with established California practice to make the road dustless by the application of light oil.

The most difficult unit of the route from the maintenance point of view was about three miles from Dorris to the State line. This inferior earth road over poor soil quickly became impassable after light rainfall. In 1933 this three miles was constructed on new alignment and grade with a 6-inch base course of crushed rock and a temporary armor type of surface. About the same time the existing road between Dorris and Macdoel, 10 miles, was improved with a



Map showing relation of Cougar Macdoel improvement to interstate highway routes.

road mix of oil and local cinders.

In 1935 a permanent routing between Cougar and Macdoel was developed. This routing, via Grass Lake, is 24.2 miles long, as compared with 31.2 miles by the used road, via Bray. The estimated cost of a completed grade and standard intermediate type of surface consisting of a 6-inch base course and 2.5-inch bituminous-treated surface was \$600,000. The impossibility of allocating any such sum from the State's finances for a secondary road in even two bienniums gave a gloomy prospect to any proposal for improvement of this unit.

CALIFORNIA FINANCED SECTION

However, in 1935 the Bureau of Public Roads approved an allocation of \$150,000 from Federal Emergency funds for grading an initial unit of the road. The grading on this unit

of 8 miles, a portion of which crosses the bed of Grass Lake, was completed in 1936, and the fact that it was not usable until the remaining 16 miles was constructed imposed an obligation on California to finance this remaining section as well as to provide a surface on the 8 miles already graded.

The route traverses a partly open and partly timbered area. All of the formations are of igneous origin, although there are sedimentary deposits of weathered igneous rock. The problem, as it presented itself, was to get a usable road completed between the termini on what was believed to be permanent alignment and grade, after which strengthening of the surface could follow as required without loss of any work that had been done.

Accordingly, an intensive study was made of the quality of material from which the grade would be built, and it was found on about 80 per cent

of the road to be uniformly high in stability. Frequent deposits of excellent fine cinders and fine gravel testing high for use in subgrade and base and also for use with oil were located. By virtue of these deposits of good local material, the Division of Highways proposed to complete the grading of the remaining 16.2 miles and oil treat a stabilized subgrade in a manner to serve traffic for several years, before any additional increments of surfacing were required, for \$300,000.

The improvement of this 24.2 miles of road to a usable stage was completed November 2, 1938, at a total construction cost of \$434,317.73, accomplished in three contracts, as follows:

1935—Dunn & Baker, Klamath Falls, grading 8 miles at a cost of \$156,695.67.

1937—Harold Blake, Portland, Oregon, grading 16.2 miles at a cost of \$178,920.95.

1938—Oilfields Trucking Company, Bakersfield, surfacing 24.2 miles at a cost of \$98,701.11.

The grading done by Harold Blake was completed early in 1938, and, coincident with this completion, the work of surfacing was started.

The surfacing consisted of reinforcing the subgrade with applications of cinders or gravel at those locations where material in the grade lacked stability, it being the intention to bring the entire subgrade to a strength measured by saturated bearing value tests of 35 per cent. This subgrade for 21.2 miles was then primed with SC-2 oil at the rate of half a gallon per square yard, resulting in an average penetration of at least half an inch. On top of this a layer of pit run cinders, half inch minus, or screened gravel one inch minus, was road-mixed with ROMC-3, providing a bituminous mixed surface 1.75 inches thick and 22 feet wide. This mix is sealed with $\frac{1}{4}$ gallon per square yard of penetration emulsified 90-95 asphalt without cover. The quality of this local material for use with oil is such that tests show the stability of the mix to range between 45 and 50 and the swell to be .008 or less.

The northerly end of the project is in Butte Valley, across what was once a lake bed. The soil is a light,

Bay Bridge Traffic Report Reveals New High in November

SAN FRANCISCO-OAKLAND BAY BRIDGE traffic during November climbed to a new high for 1938, it was revealed yesterday by Chief Engineer C. H. Purcell in a monthly traffic report filed with Director of Public Works Earl Lee Kelly.

Total number of vehicles to cross the bridge last month was 783,252, averaging 26,108 vehicles per day. This is an increase of 12% or an increase of 2800 vehicles per day over November, 1937. High point of the month was Saturday, November 19, the day of the Big Game, when 40,761 vehicles crossed the span.

Freight pounds, too, increased last month with a total of 115,921,750. This was an increase of 86% over November a year ago. Total number of trucks and trailers to cross the Bay Bridge in November was 41,503, a 60% increase over November, 1937.

Total revenues for November were \$410,709.65, an increase of 11% over the same period last year. For the year 1938 to date 7,873,646 vehicles have crossed the bridge, bringing the grand total since the bridge opening on November 12, 1936, to 18,318,196 vehicles.

Comparative figures follow:

	Total November	Total October	Total since opening
Auto Trailers -----	859	1,149	29,780
Passenger Autos -----	708,587	688,232	16,967,986
Motorcycles -----	2,461	2,077	63,534
Tricars -----	1,210	983	20,486
Buses -----	13,239	13,594	234,018
Trucks -----	39,760	39,384	680,056
Truck Trailers -----	1,743	1,653	37,972
Toll Vehicles -----	767,859	747,672	18,033,832
Auto Passes -----	13,767	13,720	258,832
Truck Passes -----	1,626	1,591	25,532
Total Vehicles -----	783,252	762,983	18,318,196
Extra Passengers -----	238,999	235,728	4,502,196
Freight Pounds -----	115,921,750	108,683,917	1,707,260,076

sandy silt deposited by water from weathered igneous rock. About the time this project was being developed the proposal to stabilize local soil with the addition of Portland cement was under consideration, and it was decided to use this method on the northerly 3 miles.

Experimental sections of soil-cement base had been constructed in 1937 in southern California by day labor, and the value of the process had already been demonstrated. The only experimental phase of the soil-cement construction on this project was the determination of the ability of a contractor to coordinate his equipment and organization to secure the proper timing of the various operations involved. The field work is comparatively simple and does not require any special high-priced equipment. It consists of loosening, pulverizing and moistening the grade to the depth to be treated, applying the

cement, usually by hand-spreading from sacks at the specified rate, incorporating the cement in the soil by mixing with gang plows, disk cultivators and spring tooth harrows, adding additional moisture, compacting with sheepsfoot rollers and finishing with a blade and tandem or rubber-tired rollers.

The finished base which is 22 feet wide and 6 inches thick, is smooth and hard, having a high stability, and is comparable to an equal thickness of crusher run base.

Soil-cement bases have been used with and without bituminous treatment. On this project the base received a prime of $\frac{1}{4}$ gallon per square yard of SC-1A road oil and a one-inch thickness of road-mixed gravel, sealed with $\frac{1}{8}$ gallon of emulsified 90-95. The cost per mile of the completed base was \$6,093, and of the prime, mix and seal \$1,575, making a total cost of \$7,668 per mile.

Railroad Grade Separations Completed on Rosemead Arterial

By E. L. WALSH, Assistant Bridge Construction Engineer

TWO railroad grade separations were completed last month on Rosemead Boulevard (State Highway 168) near the city of Los Angeles by the Division of Highways—one under the Southern Pacific tracks near Rudell Station, located one mile north of Rosemead, and the other under the Union Pacific tracks near Pico at Whittier Boulevard.

These structures on Rosemead Boulevard comprise two of the various construction units which have recently been completed as a part of the development of State Signed Route No. 19 as a through highway from Long Beach to Pasadena.

This route, extending from the connection with the Roosevelt highway (U. S. Alternate 101) at Long Beach to the Foothill Boulevard at Lamanda Park near Pasadena, was added to the State Highway System in 1933. At that time only portions of the route and locally known as El Cerritos Avenue and San Gabriel Boulevard were improved. The route is about twenty-six miles long and now comprises Lakewood Boulevard south of Rivera and Rosemead Boulevard to the north of Rivera.

DIVIDED HIGHWAY PLANNED

Skirting the most heavily settled areas of Los Angeles and adjacent communities, it provides a through and rapid means of communication among them. It connects at the north end with Colorado Street and the Foothill Boulevard via Altadena providing a direct route for through traffic from the north and east that wishes to avoid the congestion of metropolitan areas.

A modern four-lane, divided highway has been adopted for the improvement plans for this road in line with its growing importance. The future service is well predicted by the increase of traffic since its

partial improvement by the State. In July, 1934, the greatest daily traffic count at any of four points was 6200 vehicles. In July, 1938, the maximum count at any of the same four points was 17,312 vehicles. It is estimated that within a few years the peak traffic count on this road will exceed 20,000 vehicles per day.

One feature of this route that has great bearing on its improvement is the considerable number of grade separations required to attain its maximum service and safety to the public. Extending as it does in a north and south direction, this route must necessarily intersect the numerous main arteries of rail and highway traffic that converge at Los Angeles from the San Bernardino Valley to the east and from the Orange County urban districts to the south.

RIVERA SUBWAY

Among the highway projects which have been completed within the last two years was the important railroad grade separation under the Santa Fe Railroad tracks near Rivera. The Rivera structure provides a separation of traffic between the highway and the double tracks of the Atchison, Topeka & Santa Fe Railroad. This project was completed in March, 1937, at a total cost of approximately \$108,000. The project was located about $\frac{1}{4}$ mile west of Rivera and included 0.36 mile of highway improvement. The improved portion of the highway is 62 feet wide between concrete curbs, and has a four-lane Portland cement concrete pavement 40 feet wide. Plant-mixed bituminous surfacing eight feet wide was placed between the edges of the concrete pavement and the three-foot concrete gutters. A three-foot, nine-inch concrete sidewalk was provided along one side of the underpass.

The two railroad tracks are carried over the highway on a ballasted deck through plate girder structure supported on reinforced concrete "U" abutments. The two steel girders are 76' 6" long and provide a clear span of 66' 3" normal to the highway. A total of 303,000 pounds of structural steel was used. The excavation slopes are protected with concrete slope paving throughout the underpass. The subway was built under contract by J. E. Hadcock, Ltd.

PICO UNDERPASS

The contract for the Pico Grade Separation under the Union Pacific Railroad tracks, which has just been completed, included 0.49 mile of highway improvement from Whittier Boulevard to Beverly Boulevard. The total cost of this project was approximately \$159,000. The new highway in the vicinity of the Pico Underpass is 76 feet wide between curbs and has a four-lane Portland cement concrete pavement 46 feet wide. The paving is extended to the three feet wide concrete gutter by a twelve-foot strip of plant-mixed surfacing along each side.

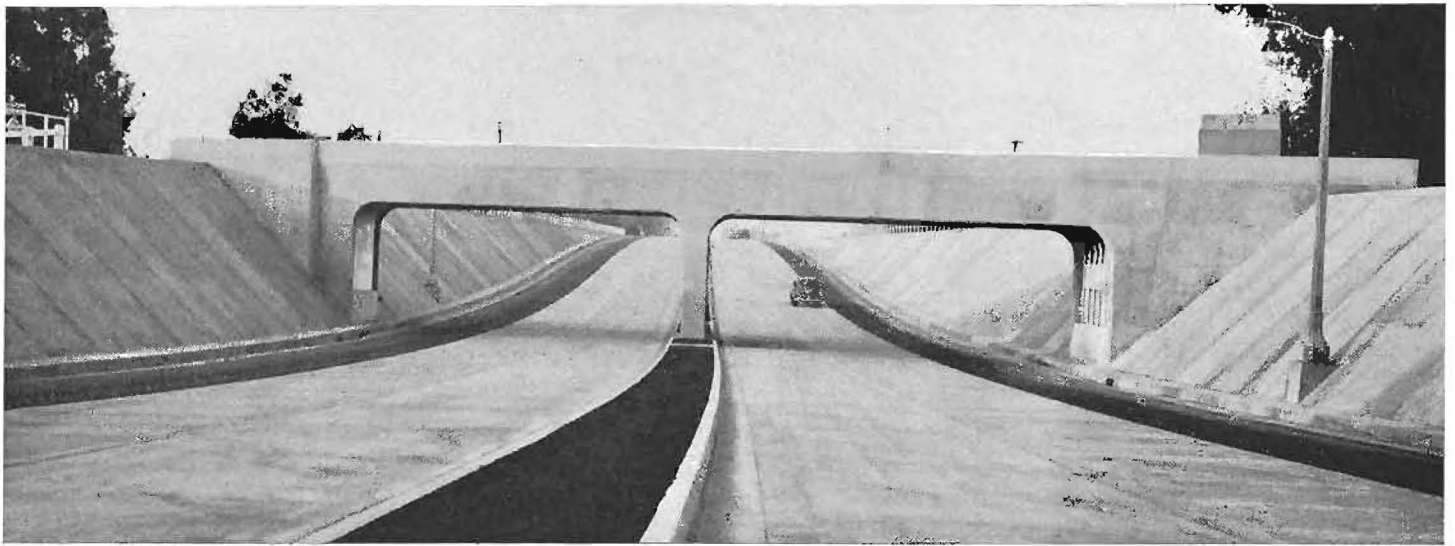
The highway through the underpass structure is 64 feet wide between curbs and is similar to the adjacent highway surfacing, except for the addition of a three-foot concrete sidewalk on each side and the reduction in width of the plant-mixed surfacing from twelve feet to six feet. The excavation slopes are protected by concrete slope paving for the entire length of the depressed portion of the roadway. A service road with a 25-foot plant-mixed pavement is provided along the east side of the underpass to serve the developed properties at that location.

The double tracks of the railroad are carried over the highway by a

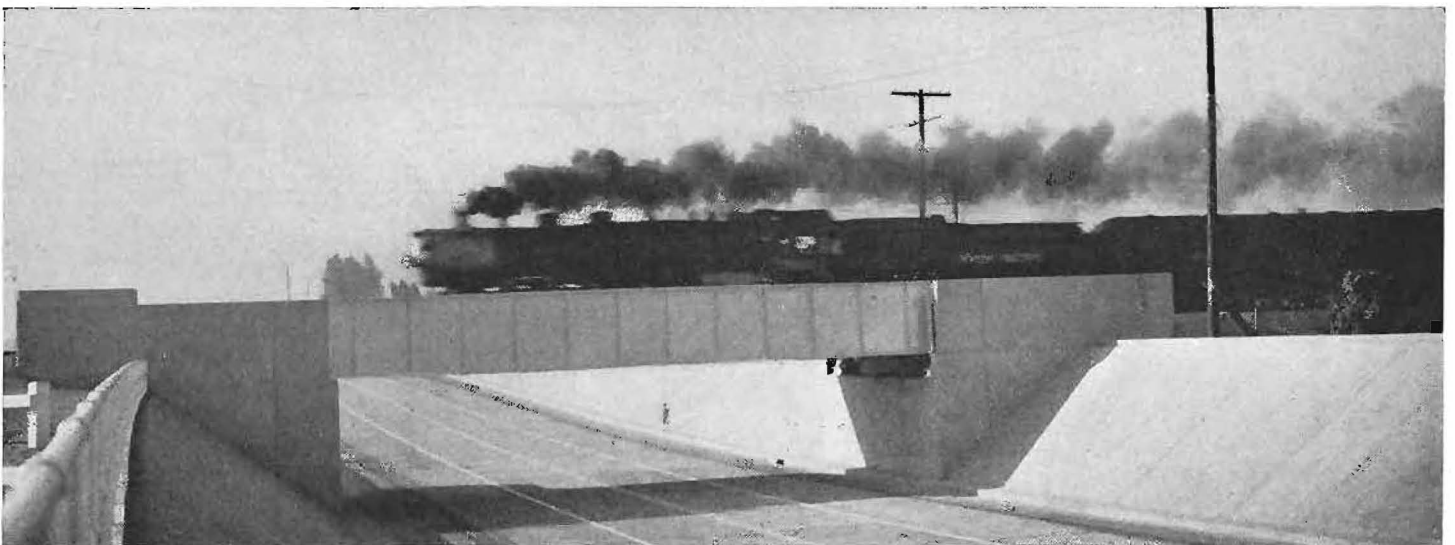
(Continued on page 24)



Grade separation on State Sign Route 19 carrying Atchison, Topeka and Santa Fe railroad tracks over highway near Rivera.



Underpass beneath Southern Pacific near Rudell station on Rosemead Boulevard provides two 23-foot traffic lanes with 6-foot curbed dividing strip and two 3-foot concrete sidewalks.



Pico underpass beneath Union Pacific at Whittier Boulevard provides four traffic lanes in addition to 3-foot sidewalks on each side.

New Markers To Curb Speed On Curves Placed

TO HELP motorists in answering safely the question of what speed should be used on a curve ahead, State Highway Engineer C. H. Purcell announces the installation and testing of a new system of road markers designating speeds at which curves may be safely negotiated.

The new road markers, of the diamond-shaped caution type, will be placed just below standard curve signs. Both signs will be reflectorized.

Motorists have long depended on the reflectorized arrow to warn them of the type of curve ahead. The safe-speed sign will indicate "SLOW 30 MILES" or some other safe speed at which the curve can be driven safely under ordinary circumstances. All miles-per-hour signs will be in five-mile increments.

In announcing the test program Purcell stated that the question of posted safe speed limits has been under consideration as a safety measure by the Division of Highways for some time. The accident records indicate a high percentage of driving-off-the-road and turning-over accidents as occurring at curves, the contributing factor being too much speed for the safe negotiation of the curve.

Safe speeds at curves will be carefully determined by expert drivers with the assistance of specially prepared equipment, said Purcell. The motoring public can greatly assist the Division of Highways by cooperating both in carefully complying with the recommended safe speed limits and in writing to the Division, indicating the reaction to the new safety markers.

Safe-speed curve markers will be placed immediately at many locations throughout the State. If the public will read roadway warning signs, these new markers should do much to cut down the accident toll of California.

Overheard on the Beach—"Mummy, may I go in for a swim?"

"Certainly not, my dear, it's far too deep."

"But daddy is swimming."

"Yes, dear, but he's insured."

"I hate people who are vague and noncommittal, don't you?"

"Mmmmmmm."



Safe speed signs being placed at curves in test program.

"HIGHWAYS OF TOMORROW" TOPIC OF A. R. B. A. CONVENTION

"Highways of Tomorrow" will be the keynote of the 36th annual convention and highway exhibit of the American Road Builders Association when that organization meets in San Francisco March 7-10, 1939. This will be the first conclave of the road builders in the west and it will be held concurrently with the national convention of the Associated General Contractors of America.

Charles Upham, engineer-director of the American Road Builders' Association, and Edward J. Harding, managing director of the Associated General Contractors of America, agreed that the concurrent meetings of the two associations will bring together representatives of the highway industry and profession from all parts of the nation, especially the western states, and will help immeasurably to solve many problems of the highway program.

Wife: "No, I didn't sew a button on your pants; I was too tired. Which is more important—your wife or your pants?"

Husband: "Well, there are places I can go without a wife."

Rosemead Boulevard Grade Separations Are Completed

(Continued from page 22)

ballasted deck through girder superstructure supported on reinforced concrete abutments. A total of 377,000 pounds of structural steel was placed. The two steel girders are 76' 11" long over all and have a depth of approximately nine feet. Each girder weighs 82,000 pounds.

The concrete abutments are of the "U" type, supported on spread footings. This project was constructed by the C. O. Sparks and Mundo Engineering Company.

The underpass under the Southern Pacific Railroad near Rudell Station was included in a 0.39 mile project consisting of 1300 lineal feet of depressed highway, 800 lineal feet of connection to the existing highway, and a two-span rigid frame steel structure with reinforced concrete abutments to support the railroad. A 24-foot service road was constructed along each side of the depressed highway to serve adjacent properties. This project cost approximately \$128,000.

The new highway through the underpass is 80 feet wide between curbs and consists of two 23-foot uni-directional traffic ways of reinforced concrete pavement, separated by a central dividing strip, and curbs six feet wide. The concrete pavement is flanked on each side by an eleven-foot strip of plant-mixed surfacing and a three-foot concrete curb. Two three-foot concrete sidewalks are provided for pedestrian traffic. The 24-foot service roads are paved with plant-mixed bituminous surfacing.

The ballasted deck railroad structure provides two 41½-foot clear spans normal to the highway, is of modern rigid-frame design, and required 189,000 pounds of structural steel. The appearance of the structure is enhanced by the provision of reinforced concrete fascia beams.

The drainage system of each of these subways included the installation of two electrically operated automatic pumps having a combined pumping capacity of approximately 1100 gallons per minute.

This contract was completed by the United Concrete Pipe Corporation.



California Nautical School

Operating Training Ship California State

November 9, 1938

California Highways and Public Works,
Sacramento, California.

Gentlemen:

For the past year I have been receiving the California Highways and Public Works publication and wish to express my appreciation for the opportunity to keep abreast of the activities in connection with our California highways.

I find the material contained highly instructive and well presented.

Thanking you for placing my name on your mailing list, I am

Very truly yours,

(Signed) CAPT. R. C. DWYER.

RCD:R

Gemeentelijke Technische Dienst Rotterdam

Rotterdam, 22nd September, 1938

Department of Public Works,
Public Works Building,
Sacramento.

Dear Sir:

The August issue of the periodical "California Highways and Public Works" contains an article on the tow service in connection with the San Francisco-Oakland Bay Bridge.

As for the Maastunnel at Rotterdam, a vehicular under-river tunnel now under construction, similar measures are planned, I beg to ask you for a number of details in connection with the said service.

Very truly yours,

THE CHIEF ENGINEER OF THE
MAASTUNNEL,

J. P. VAN BRUGGEN.

Dear Sir:

I could use to great advantage your publication, "California Highways and Public Works" in my adult education classes, so I shall appreciate receiving it.

Most sincerely,

J. C. BROWER,
18 Hillside,
Fairfax, Cal.

Anderson Union High School

Anderson, California

Division of Highways,
P. O. Box 1499,
Sacramento, California.

Gentlemen:

Will it be possible to put the Anderson Union High School on your mailing list to receive copies of "California Highways and Public Works?"

The publication has definite educational value and could be used for reference work in several classes as well as for general reading purposes.

Yours very truly,

LAURENCE HARPER,
Principal.

California Highways and Public Works,
Sacramento, California.

Dear Sir:

I have read your publication, "California Highways," and think it is very instructive and educational. It is indeed a pleasure to read articles, written by men who know and are acquainted with the facts of highway problems.

I would appreciate having my name placed on the subscription list. I am employed by the county surveyor of Alameda County.

Yours very truly,

C. H. CLIFFORD.

Pittsburg Chamber of Commerce

10th and Los Medanos Streets.

November 11, 1938.

Mr. John W. Howe, Editor
California Highways and Public Works,
Sacramento, California.

Dear Mr. Howe:

Will you kindly add to your mailing list the:

High School Library,
Pittsburg, California.

Of all the literature received by us for counter use, none is more popular than your magazine, and I am sure it will be an appreciated addition to the reading table of the school library.

Very truly yours,

(Signed) JULIUS JORGENSEN,
Secretary.

Pasadena City Schools

Charles W. Eliot Junior High School,
2350 North Lake Avenue,
Altadena, California

November 9, 1938.

Division of Highways,
P. O. Box 1499,
Sacramento, California.

Dear Sirs:

Please place my name on your "California Highways and Public Works" magazine mailing list.

I teach in the above school, as conference counselor instructor, handling our guidance program for the eighth grade numbering 320 students.

Please send it to 370 Woodbury Road, Altadena, California.

Yours truly,

HERBERT S. CHESEBERG.

Appreciated by Liberia Engineer

Cape Palmas, Liberia,
West Africa,
October 25, 1938

California Highways and Public Works
Sacramento, California

Gentlemen:

Through my father, Gilbert H. Hogue, United States Bureau of Reclamation engineer, Friant, California, I have enjoyed the privilege of receiving your official journal for the past year.

Please accept my congratulations for making available to the engineering profession so splendid a publication. As a construction engineer for the Republic of Liberia in conjunction with the Firestone Plantation Company, engaged entirely in road and bridge construction, each copy of "California Highways and Public Works" has been of much interest and assistance.

Particularly enjoyable was a recent issue showing in detail the damage to highways and bridges resulting from the spring flood, and describing the immediate and efficient manner in which highways were opened and damage repaired. Faced here in Liberia with the problem of handling an annual rainfall of 120 inches, most of which falling in five months, I can to some extent appreciate the fine highway organization now functioning in California.

Again, my congratulations on your splendid work and equally fine magazine.

Cordially yours.

(Signed) W. O. HOGUE,
Civil Engineer.



THE filing of applications for allotments from money appropriated to the Emergency Fund by Chapter II, Statutes of 1938, Extra Session, for the restoration of property, levees, flood control works, county roads and bridges, damaged by the floods of the 1937-38 winter season throughout the State, has continued. The making of investigations and the preparation of reports on applications have also been continued, and more than 200 reports and recommendations have been prepared by the Division of Water Resources and State Reclamation Board and submitted to the Director of Finance, pursuant to his instructions. During the month no further allocations were made by Governor Frank F. Merriam for flood damage repair work. A total of \$4,109,300 has been allocated for this work to date. The Division of Water Resources is performing some of the work for which these allocations were made, and the remainder is being done by the applicants under contracts entered into with the Department of Public Works. There are now 123 such contracts in force covering work which will cost \$3,175,000.

IRRIGATION DISTRICTS

The El Dorado Irrigation District has purchased the Diamond Ridge Ditch System and plans rehabilitation of the canals and structures by means of a WPA project. A camp site near Placerville has been selected on which improvements will be made by State Relief Administration for housing about 200 men. Another project proposed by the District, including construction of storage on Sly Park Creek tributary to Cosumnes River, is now under investigation by the State Engineer.

La Mesa, Lemon Grove and Spring Irrigation District awarded a contract in the amount of \$14,706 for installing the Fourth Unit in the District's pipe line replacement project which has been under construction during the past year. This will complete the program approved for replacing deterior-

ated water mains with cast iron pipe at a total estimated cost of \$263,636.

SUPERVISION OF DAMS

The run-off from the last storm filled the Mad River Dam and water is now flowing over the crest. The dam itself is practically completed, there being some minor matters to be cleaned up prior to final completion.

At the present time work is being rushed to complete a number of construction jobs. These include Suttentfield, Lower St. Helena, Charles Lee Tilden Park, North Fork, and some work being done by the East Bay Municipal Utility District on Piedmont Reservoir No. 1.

WATER RIGHTS

Fifteen applications to appropriate water were received during October, 6 were denied, 24 were approved; 17 permits were revoked and the rights under 4 permits were confirmed by the issuance of licenses.

On October 1st progress reports were requested from 1242 permittees and on October 15th reports were requested from 571 licensees. These reports are being received daily and are in process of analysis.

TOPOGRAPHIC MAPPINGS.

Advance sheets of the Branch Mountain and the east half of Tobias Peak quadrangles are now available. The first sheet covers an area in San Luis Obispo and Santa Barbara counties. It is published on a scale of 1:48,000 with a contour interval of 50 feet. The east half of Tobias Peak quadrangle covers an area in Tulare and Kern counties. It is published on a scale of 1:96,000 with a contour interval of 100 feet.

SACRAMENTO-SAN JOAQUIN WATER SUPERVISION

The irrigation season is now complete and the rice and bean crops harvested. Sampling of water in the delta channels for salinity is being carried on at a number of stations.

The flow of the Sacramento River at Sacramento on November 22d was 9000 cubic feet per second; on October 22d the flow was 8500 cubic feet per second. The flow of the San Joaquin River at Vernalis

on November 22d was 3900 cubic feet per second; on October 22d the flow was 2500 feet per second. These figures show the increase of these two streams at the end of the irrigation season.

CENTRAL VALLEY PROJECT

Engineering studies in connection with the Central Valley Project were continued. These studies included analyses of field data previously obtained through comprehensive hydrographic, hydrologic and topographic surveys, for the preparation of a report to be used in connection with negotiations for the acquisition of water rights of the lands bordering the San Joaquin River, which are now being served by that stream.

Negotiations were continued with public utility companies for the relocations of power and communication facilities for the complete project and for temporary relocations necessitated by construction activities.

FLOOD CONTROL AND RECLAMATION

The units of the flood control project under the care of this Department are now in fair condition for the next flood season. Routine maintenance has been carried on during this period.

The wave wash protection bulkhead at the southeast corner of Reclamation District No. 1660 in the Sutter By-pass is being rebuilt and is approximately 65 per cent complete at this time.

Relief Labor Work

An average of 125 laborers have been employed in clearing in the Feather River overflow channel, repairing the current re-tards at Nicolaus and constructing a wing dam at Robinson Bend. Fifty laborers have been employed continuously from the SRA transient camp in Sutter Basin. On account of the staggered work periods, this represents the labor of 100 men.

Emergency Levee Repair

The work of completing flood damage repairs in Glenn, Butte, Shasta and Tehama counties under Executive Order No. E 177 has been practically completed, the only work now under way being on Stony Creek, in Glenn County. The Chico office, which handled this work, has been discontinued.

The construction of a wing dam in the Feather River at Robinson Bend in Butte County is nearly completed.

Highway Bids and Awards for the Month of November, 1938

KERN COUNTY—Between 4 miles and 12 miles east of Mojave, about 7.6 miles to be graded and road-mix surface treatment and Class "B" seal coat applied. District IX, Route 58, Section A. Oilfields Trucking Co., Bakersfield, \$35,997; Piazza & Huntley, San Jose, \$36,188; Griffith Company, Los Angeles, \$36,254; Dimmitt & Taylor, Los Angeles, \$36,611; Martin & Schmidt Contractors, Long Beach, \$37,454; Warren Southwest, Inc., Los Angeles, \$38,409; Oswald Bros., Los Angeles, \$40,215; C. R. Butterfield-Kennedy Co., San Pedro, \$40,313; Clyde W. Wood, Los Angeles, \$40,671; Young & Son Co., Ltd., Berkeley, \$41,307; R. E. Hazard & Sons, San Diego, \$42,248; R. M. Price, Huntington Park, \$44,252; Basich Brothers, Torrance, \$45,787; G. W. Ellis, North Hollywood, \$46,953; R. L. Oakley, Pasadena, \$48,859. Contract awarded to J. A. Casson, Hayward, \$33,571.25.

LOS ANGELES COUNTY—At Big Tujunga Wash, about 0.5 mile to be graded and paved with Portland cement concrete and bank protection to be constructed. District VII, Route 9, Section L. A. Contracting Engineers Company, Los Angeles, \$27,877; United Concrete Pipe Corp., Los Angeles, \$29,250; Griffith Co., Los Angeles, \$29,296; C. O. Sparks and Mundo Engineering Co., Los Angeles, \$30,174; Matich Bros., Elsinore, \$30,962. Contract awarded to Claude Fisher Co., Ltd., Los Angeles, \$21,493.

LOS ANGELES COUNTY—Arroyo Seco Parkway between Hough Street and Meridian Avenue, about 0.8 mile to be graded and paved with Portland cement concrete, asphalt concrete, and plant-mixed surfacing, and two bridges to be constructed. District VII, Route 205, Section L.A., S.Pas. J. E. Haddock Co., Pasadena, \$157,430; Griffith Co., Los Angeles, \$161,633; W. E. Hall Co., Alhambra, \$165,980; United Concrete Pipe Corp., Los Angeles, \$168,987; C. O. Sparks & Mundo Engineering Co., Los Angeles, \$177,772. Contract awarded to Claude Fisher Co., Ltd., Los Angeles, \$154,870.15.

LOS ANGELES COUNTY—At San Martinez Chiquito Canyon, about 1.4 miles to be graded and paved with Portland cement concrete. District VII, Route 79, Section A. J. E. Haddock, Ltd., Pasadena, \$70,711; Griffith Co., Los Angeles, \$73,544; C. G. Willis & Sons Inc., & Chas. G. Willis, Los Angeles, \$77,305; C. O. Sparks & Mundo Engineering Co., Los Angeles, \$78,259; R. E. Campbell, Los Angeles, \$78,356; S. Edmonson & Sons, Los Angeles, \$83,737; United Concrete Pipe Corp., Los Angeles, \$85,920; Hueser & Garnett, Glendale, \$88,314; Johnston & Perscallo, Los Angeles, \$93,714. Contract awarded to Matich Bros., Elsinore, \$70,345.

ORANGE COUNTY—Doheny Park, at the mouth of San Juan Creek, about 0.15 mile, embankment protection to be constructed. District VII, Route 60, Section C. C. G. Willis & Sons, Inc., & Chas. G. Willis, Los Angeles, \$35,724; S. A. Cummings, San Diego, \$37,706; V. R. Dennis Construction Co., San Diego, \$39,832; H. H. Peterson, San Diego, \$41,952; R. M. Price, Huntington Park, \$47,532; C. O. Sparks & Mundo Engineering Co., Los Angeles, \$48,722; R. H. Travers, Los Angeles, \$48,952. Contract awarded to R. E. Campbell, Los Angeles, \$34,036.

ORANGE COUNTY—Between Sulphur Slide and Riverside County line, about 1.3 miles, portions to be graded and paved with Portland cement concrete and bank protection work to be constructed. District VII,

Secretary Wallace Stresses Need of Reconstruction

Secretary of Agriculture Henry A. Wallace in an address at a dinner of the National Safety Council in Washington on April 12, 1938, said:

"We have a two-fold task—to rebuild highways as nearly accident proof as possible as rapidly as we can afford where these are badly overloaded by traffic, and at the same time not to overlook the thousands of miles of existing highways which must certainly continue into the distant future to carry a large part of our nation's travel.

"Much can be done to make these safely usable through the application of ingenious and intelligent engineering, persistent and comprehensive education, courteous, impartial, effective enforcement."

Route 43, Section B. United Concrete Pipe Corp., Los Angeles, \$188,670; Griffith Co., Los Angeles, \$150,276; C. O. Sparks & Mundo Engineering Co., Los Angeles, \$171,361; Oswald Bros., Los Angeles, \$172,080; Hueser & Garnett, Glendale, \$173,471; Johnston & Perscallo, Los Angeles, \$195,186. Contract awarded to V. R. Dennis Construction Co., San Diego, \$135,054.10.

SAN DIEGO COUNTY—A reinforced concrete slab bridge across San Luis Rey River, about 2 miles south of Rincon, consisting of eighteen 25-foot spans and two 8-foot 4-inch spans on cast-in-place concrete pile bents. District XI, Feeder road, V. R. Dennis Construction Co., San Diego, \$43,856; Oberg Bros., Los Angeles, \$42,969; S. A. Cummings, San Diego, \$1,899; The Contracting Engineers Company, Los Angeles, \$46,868; H. H. Peterson, San Diego, \$42,239. Contract awarded to B. G. Carroll, San Diego, \$40,120.

SANTA CLARA COUNTY—Between 1 mile east of Bells Station and 3 miles west of Merced County line, about 2.6 miles, to be graded and surfaced with gravel base and armor coat, and two reinforced concrete girder bridges to be constructed. District IV, Route 82, Section C. Heafey-Moore Co., Frederickson & Watson Construction Co., Oakland, \$360,511; Bodenhamer Construction Co., Oakland, \$378,934; Clyde W. Wood, Los Angeles, \$383,380; Fredericksen & Westbrook, Sacramento, \$396,918; Hemstreet & Bell, Marysville, \$410,171; A. Teichert & Son, Inc., Sacramento, \$423,294; Union Paying Co., San Francisco, \$437,644; George K. Thompson & Company, Los Angeles, \$462,

257; Griffith Co., Los Angeles, \$562,877. Contract awarded to Granfield, Farrar & Carlin, San Francisco, \$355,731.60.

SANTA CRUZ COUNTY—Between one-half mile south of Davenport and Waddell Creek, about 8.2 miles to be graded and road-mix surface treatment applied. District IV, Route 56, Sections B, C. Hemstreet & Bell, Marysville, \$271,412; Clyde W. Wood, Los Angeles, \$293,280; Daley Corporation, San Diego, \$335,678; Granfield, Farrar & Carlin, San Francisco, \$236,811; Fredericksen and Westbrook, Sacramento, \$237,647; Larsen Bros., Harms Bros. and H. Earl Parker, Sacramento, \$242,354; Louis Biasotti & Son and Claude C. Wood, Stockton, \$253,734; Heafey-Moore Co., Fredrickson & Watson Construction Co., Oakland, \$260,335; A. Teichert & Son, Inc., Sacramento, \$261,681; United Concrete Pipe Corporation, Los Angeles, \$262,060; The Utah Construction Co., San Francisco, \$277,336; Macco Construction Co., Clearwater, \$289,877; Griffith Co., Los Angeles, \$398,815. Contract awarded to N. M. Ball Sons, Berkeley, \$232,492.30.

SISKIYOU, SHASTA, MODOC, AND LASSEN COUNTIES—At maintenance stations located at Mt. Shasta, Redding, Alturas and Susanville, 12 radio poles, each 100 feet long, to be erected. District II. Thomas Rigging Co., Oakland, \$2,187; Edward Green, Los Angeles, \$2,280; M. A. Jenkins, Sacramento, \$3,288; A. A. Tieslau, Berkeley, \$3,870; Underground Construction Co., Oakland, \$4,740; A. Young, Yreka, \$5,760. Contract awarded to R. M. Taylor, Cottonwood, \$1,992.

VENTURA COUNTY—Repairs to the bridge across Santa Clara River, at Bardsdale, to be constructed; and the roadway approach to be graded and surfaced with plant-mixed surfacing. District VII, Route 155, Section C. White & Wilberg, Santa Monica, \$52,493; United Concrete Pipe Corp., Los Angeles, \$53,288; Ralph A. Bell, Monrovia, \$54,559; Gibbons & Reed Co., Burbank, \$55,305. Contract awarded to Griffith Co., Los Angeles, \$50,143.

VENTURA COUNTY—Reconstruction of a bridge across the Santa Clara River at Saticoy and approaches thereto. District VII, Route 9, Section A. Gibbons & Reed Co., Burbank, \$112,410; United Concrete Pipe Corp., Los Angeles, \$114,475; Oscar Oberg, Los Angeles, \$117,663; Ralph A. Bell & Donald E. Metzger, Los Angeles, \$119,500; White & Wilberg, Santa Monica, \$123,409; The Contracting Engineers Co., Los Angeles, \$132,552; Byerts & Dunn, Los Angeles, \$138,273. Contract awarded to Paul J. Tyler, Oroville, \$111,985.20.

"Do you use tooth paste?"

"What for? None of my teeth are loose."

Contractor (in drug store): "I want to buy a plow."

Clerk: "I'm sorry sir, but we don't carry plows."

Contractor: "This is a heck of a drug store."

Small Boy: "Shine your shoes, mister?"

Grouch: "No!"

Small B: "Shine your shoes so you can see your face in them?"

Grouch: "No!"

Small B: "Coward!"

Widening of Rose Canyon Completed

(Continued from page 16)

with recessed panels, painted for reflection of light at night and strategically located openings for cross-overs. At Balboa Avenue, where the bulk of La Jolla traffic turns off, the curb separation was widened to sufficient width to provide an intermediate stopping zone between opposing streams of traffic, making it necessary to await a break in only one line of traffic at a time.

This section of divided highway connects directly with that crossing Torrey Pines Mesa and beginning at the north end of the project. This section of the Mesa has long been publicized and used as an example of ideal separation, and pictures of it have been used in highway publications throughout the country. Including this and the recently finished section, there is now a continuous section of divided highway extending for approximately fifteen miles over which there should be a minimum of accidents which are preventable by separation of opposing streams of traffic.

The work completed under the current contract involves major items in approximate quantities as follows: roadway excavation 175,000 cubic yards; imported borrow 30,000 cubic yards; overhaul 4,000,000 station yards; asphaltic concrete 30,000 tons; Portland cement concrete 13,000 cubic yards and other miscellaneous items, the total reaching an approximate cost of \$380,000.

As outlined, the 9.7 miles from Barnett Avenue to Miramar Road have been developed over the period from 1929 to the present date by progressive projects, all designed to culminate in the ultimate result which we have today. This work is a splendid example of planning for current needs, using construction that can be expanded to take care of additional traffic as it develops, without the loss of preceding investments. The total cost of construction through the various stages over this period of years has been approximately \$1,034,000 or slightly more than \$100,000 per mile.

In Memoriam

Charles Arthur Marsh

C. A. Marsh, Supervising Right-of-Way Agent for Northern California, Division of Highways, passed away suddenly at his home in Berkeley on November 6th.

Mr. Marsh was born in Oakland, California, on February 26, 1887, and received his education in the Alameda and San Joaquin county schools. After finishing his education, he entered the employ of the Southern Pacific Company as a rodman in August, 1904. In 1911 he moved to the office of the Right-of-Way and Contract Agent in San Francisco and served successively as Assistant Industrial Agent and Land Appraiser.

In October, 1924, he entered the employ of the McMillan Oil Company at Long Beach as manager of the wholesale and retail distribution of petroleum products. Leaving there, he returned to San Francisco to James G. Stafford & Associates as Assistant Superintendent and Industrial Land Appraiser and appraised the heavy industrial area for the City and County of San Francisco and the county of Alameda.

On May 7, 1928, he entered the employ of the Division of Highways as Right-of-Way Agent, District IV, where he remained until June 1, 1933, when he assumed the duties of obtaining rights-of-way for the San Francisco-Oakland Bay Bridge project, including the interurban railroad, the bridge approaches and arterials leading thereto, a responsibility which may have been equalled but never surpassed in the history of the State of California.

On March 1, 1936, he was appointed Supervising Right-of-Way Agent for Northern California.

His high ideals, great ability and integrity, together with his unflinching courtesy and affability, endeared him to all with whom he came in contact.

San Rafael Bottleneck Broken

(Continued from page 12)

The contract for this project was approved on May 18, 1938, with the very short time limit of 150 working days, making it imperative that the work be prosecuted vigorously in order to complete the project within the allotted time.

The contractor A. G. Raisch, attacked the work from all possible points at the same time. Many operations were progressing simultaneously: grading, hauling imported borrow, placing asphalt and concrete surfacing, constructing drainage structures, and every other operation that could be carried on without conflict. Due to this, all major portions of the work were completed in advance of the seasonal rains in spite of the heavy traffic that was maintained with two usable lanes always open.

LA CUESTA GRADE OPENED

(Continued from page 17)

Merriam, Mayor Rossi, Mayor Bowron, Senator Jespersen and others.

Among the distinguished guests at the speakers' tables were: H. W. Saunders, vice president of the Oakland Chamber of Commerce; Ray Judah, chairman of the State Highway Commission; Harry Chandler, publisher of the Los Angeles Times; A. J. McFadden, president of the State Chamber of Commerce; J. R. Knowland, publisher of the Oakland Tribune; Alfred J. Cleary, chief administrative officer of San Francisco; George Hearst, publisher of San Francisco Examiner, representing W. R. Hearst; Earl Lee Kelly, director of the State Department of Public Works; Congressman A. J. Elliott, Mayor E. J. Leach of Salinas.

Customer: "I'd like some rat poison."

Clerk: "Will you take it with you?"

Customer: "No, I'll send the rats over after it."—*Malteaser*.

Office Boy—Someone to see you sir, a gentleman with a mustache.

Absent-Minded Employer—I can't see him. Tell him I have one already.

STATE OF CALIFORNIA
Department of Public Works

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

FRANK F. MERRIAM.....Governor

HARRY A. HOPKINS.....Assistant Director

EARL LEE KELLY.....Director

EDWARD J. NERON.....Deputy Director

CALIFORNIA HIGHWAY COMMISSION

H. R. JUDAH, Chairman, Santa Cruz
PHILIP A. STANTON, Anaheim
PAUL G. JASPER, Fortuna
WILLIAM T. HART, Carlsbad
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DIVISION OF HIGHWAYS

O. H. PURCELL, State Highway Engineer
G. T. McCOY, Assistant State Highway Engineer
J. G. STANDLEY, Principal Assistant Engineer
R. H. WILSON, Office Engineer
T. E. STANTON, Materials and Research Engineer
FRED J. GRUMM, Engineer of Surveys and Plans
R. M. GILLIS, Construction Engineer
T. H. DENNIS, Maintenance Engineer
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L. V. CAMPBELL, Engineer of City and Cooperative Projects
R. H. STALNAKER, Equipment Engineer
J. W. VICKREY, Safety Engineer
E. R. HIGGINS, Comptroller

DISTRICT ENGINEERS

E. R. GREEN, District I, Eureka
F. W. MASELWOOD, 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

SAN FRANCISCO-OAKLAND BAY BRIDGE

C. E. ANDREW, Bridge Engineer

DIVISION OF WATER RESOURCES

EDWARD HYATT, State Engineer, Chief of Division
GEORGE T. GUNSTON, Administrative Assistant
HAROLD CONKLING, Deputy in Charge Water Rights
A. D. EDMONSTON, Deputy in Charge Water
Resources Investigation
R. L. JONES, Deputy in Charge Flood Control and Reclamation
GEORGE W. HAWLEY, Deputy in Charge Dams
SPENOER BURROUGHS, Attorney
EVERETT N. BRYAN, Hydraulic Engineer Water Rights
GORDON ZANDER, Adjudication, Water Distribution

DIVISION OF ARCHITECTURE

W. K. DANIELS, Assistant State Architect, in Charge of Division
P. T. POAGE, Assistant State Architect

HEADQUARTERS

H. W. DeHAVEN, Supervising Architectural Draftsman
C. H. KROMER, Principal Structural Engineer
CARLETON PIERSON, Supervising Specification Writer
J. W. DUTTON, Principal Engineer, General Construction
W. H. ROCKINGHAM, Principal Mechanical and Electrical
Engineer
O. E. BERG, Supervising Estimator of Building Construction

DIVISION OF CONTRACTS AND RIGHTS OF WAY

C. C. CARLETON, Chief
CLARENCE W. MORRIS, Attorney, San Francisco
FRANK B. DURKEE, Attorney
C. R. MONTGOMERY, Attorney
ROBERT E. REED, Attorney

DIVISION OF PORTS

Port of Eureka—E. S. MACKINS, Surveyor

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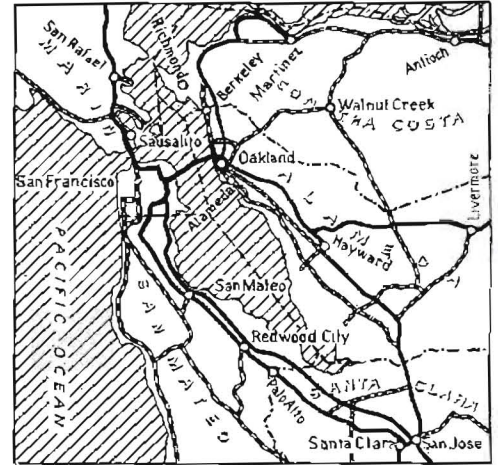
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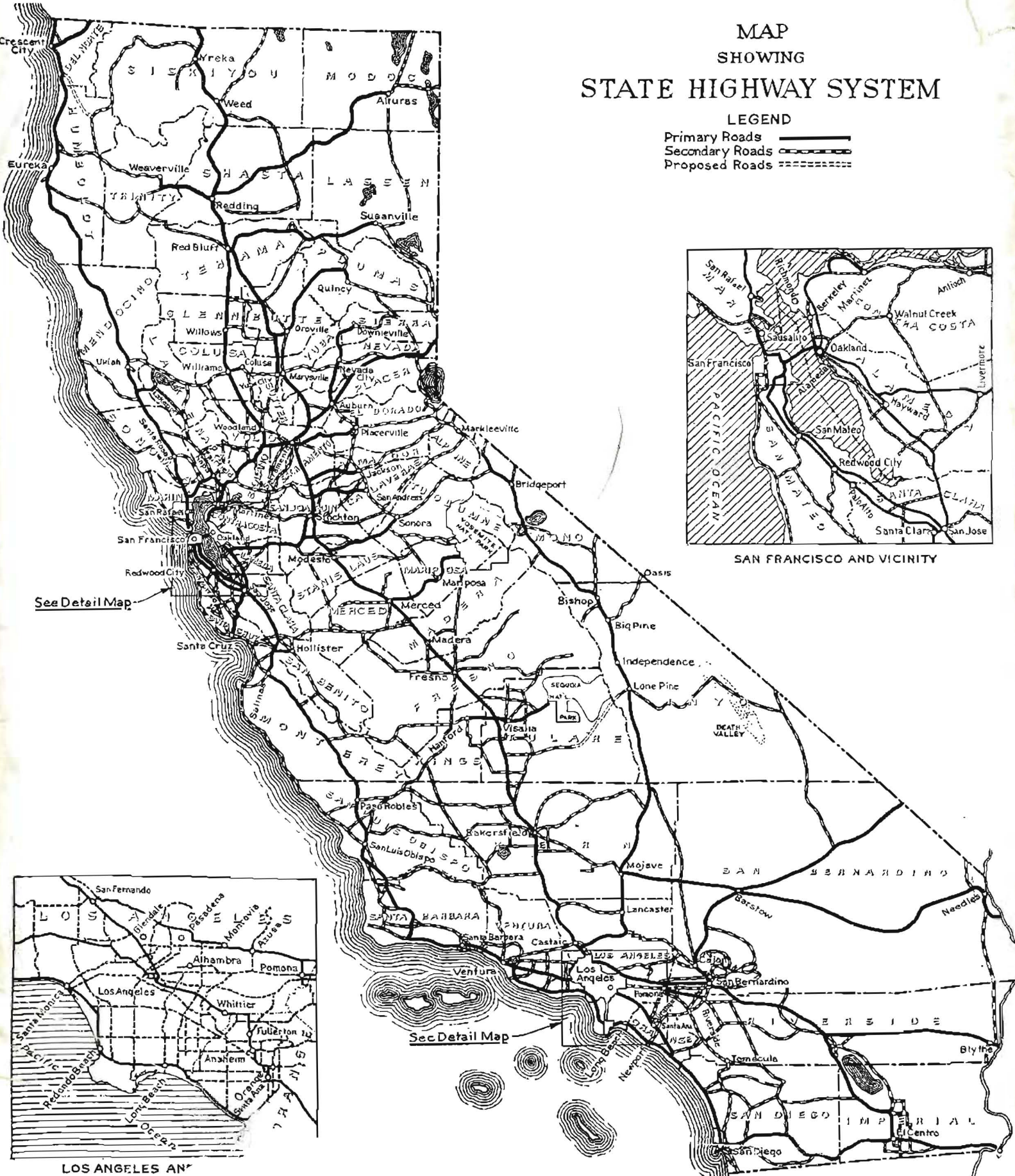
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MAP
 SHOWING
STATE HIGHWAY SYSTEM

LEGEND
 Primary Roads —————
 Secondary Roads - - - - -
 Proposed Roads = = = = =

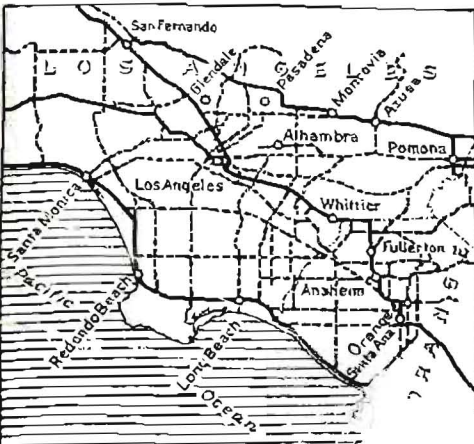


SAN FRANCISCO AND VICINITY



See Detail Map

See Detail Map



LOS ANGELES AND VICINITY