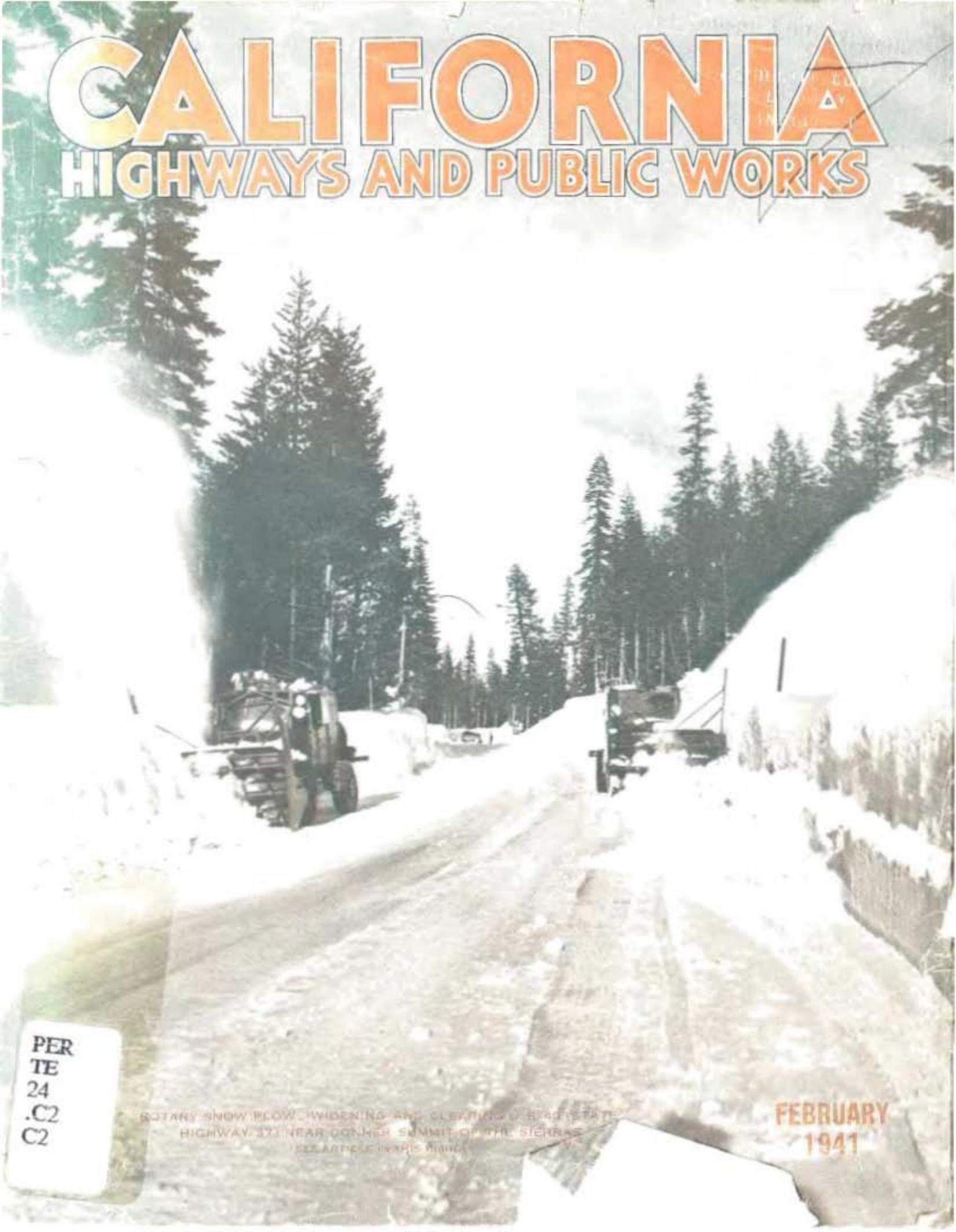


CALIFORNIA HIGHWAYS AND PUBLIC WORKS



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ROTARY SNOW BLOWER WIDENING AND CLEARING OF STATE
HIGHWAY 373 NEAR DONNER SUMMIT OF THE SIERRAS
(SEE ARTICLE IN THIS ISSUE)

FEBRUARY
1941

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

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

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

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Federal Defense Road Program In California Presents Serious Financial and Traffic Problems

By RICHARD H. WILSON, Office Engineer, Division of Highways

PROPOSED construction and improvement of highways for defense and military purposes throughout the United States confront highway officials with serious problems of financing. These problems must be solved immediately if the program for development of necessary highways is to be consummated in the near future and in time to furnish adequate facilities to the many camps now under construction.

The demands of Army and Navy authorities for an articulated system of defense highways divide the program into three distinct phases. The largest order is the development of an adequate interlocking strategic road system throughout the entire Nation; the second phase requires the construction of access roads connecting the numerous military cantonments, training camps, naval and marine bases and reservations with the strategic system; and the third necessitates development of highways and streets around industrial areas where increased activity caused by defense orders is resulting in traffic congestion.

MOST URGENT NEED

The most urgent need for the moment is for satisfactory access roads to the sites of cantonments, training camps, reservations and bases, as construction of them is now progressing rapidly.

While locations of industrial plants where defense orders are being filled are less widespread than the camps, nevertheless, traffic congestion on existing road facilities around such plants presents a most serious problem for immediate solution.

The problem of bringing the strategic road network to required military standards within a reasonable time is also most urgent and is of a most serious nature in that it will probably upset normal highway development programs to a marked degree.

Access Roads First Says U. S. Authority

A few months ago it was thought that the improvement of the strategic network, its 75,000 miles, with minor exceptions, coinciding with the most important traffic routes of the Nation, would be a matter of first concern. But now, according to Thos. H. MacDonald, U. S. Commissioner of Public Roads, the situation is "quite reversed." It has become apparent that access roads, and not the strategic network must be given first consideration.

Mr. MacDonald explains: "A vast program of essential equipment, ordnance and military supplies is under way, necessitating many new plants and the enlargement and transformation for new uses of many old ones. The partial estimates now available indicate that the Army and Navy alone have need for 2,900 miles of access and reservation roads, which, if adequately improved, will cost around \$200,000,000. The job of planning these access roads is under way, and in many cases the actual construction with the regularly available Federal and State funds is going forward.—*Better Roads.*"

SPEEDY PROGRESS ESSENTIAL

To Californians, the effect of these three phases of the defense road program on the progressive expansion and improvement of the State Highway System is most important. That defense road construction be prosecuted rapidly with a minimum disruption to planned highway development on the State system as a whole

is most essential. Some of the more pressing phases of the problems confronting California State highway officials in this connection are included in the following paragraphs.

Because California is a border State, it must of necessity be the locale of numerous military, marine, and naval bases. Because over large portions of the State, climatic conditions during the entire year are favorable for training operations, many sites for large cantonments and camps are being located in California by the Army, Navy and Marine Corps.

These military reservations and cantonments are now in the process of construction and the facilities being built are planned for housing and training of many hundred thousands of men. The construction of adequate access roads to serve these camps and bases is yet to be started.

ACCESS ROAD PRIORITY

Thomas H. MacDonald, United States Commissioner of Public Roads, in addressing the Asphalt Institute in Dallas, Texas, on December 10, 1940, stressed the priority of access road construction, particularly in border States. The Public Roads Administration has issued memoranda to all States, which outline the procedure for designation of specific roads as access roads to military camps, reservations and industrial areas.

In accordance with the memoranda, conferences have been called by commanding officers and held at various military camps, reservations, naval and marine bases situated in California. Present at these conferences have been representatives of the Army or Navy, the Public Roads Administration, the State Highway Department, the WPA, and various local agencies, such as cities and counties, concerned with specific projects.

The purpose of these meetings has been to determine the minimum re-



Factory parking area and traffic congestion on 4-lane U. S. Highway 101 at Consolidated Aircraft Corporation plant near San Diego

quirements in the matter of access roads for each of the individual camps, reservations, and bases and the priority in need of construction for each project.

FUNDS NOT AVAILABLE

The matter of availability of any funds that any of the agencies might have for use towards access road construction also was investigated at the conferences. In practically all instances, no money was available, with the possible exception, in some instances, of contributions by the WPA.

While all access roads for California have not been designated, at the present time it appears that in this State there will be a total of some 300 miles of such roads, including many bridges and expensive grade separation structures, which need construction. It is estimated that construction and right of way costs required for the program will amount to about \$28,600,000.

Most of this access mileage is situated off the State highway system and expenditures of State highway funds for right of way and improvement to such roads is not possible under California statutes. This leaves the counties as the only source of local aid for financing such right of way and construction, and county road funds are almost completely exhausted in every instance.

SURVEY UNDER WAY

Under authority of the Public Roads Administration acting in accordance with provisions of the Federal Aid Highway Act of 1940, Federal funds allocated to California for regular Federal Aid and Feeder Road Construction were taken from the various scheduled projects and set up for the survey of the several access and tactical roads required by the marine, naval, and military camps and reservations.

Surveys are now in progress on practically all roads which have been

agreed upon as included in the category of access roads at the various conferences. There still remain several proposed conferences which have not been called and which will undoubtedly require additional expenditures to provide access to camps now in course of construction.

In some instances WPA funds will be available for this type of defense work, such as certain roads within military reservations in the San Francisco Bay area and Fort Ord. Work on these roads will be supervised by the Public Roads Administration or the State Highway Department.

RIGHT OF WAY PROBLEM

In these instances right of way is not a problem, but as the majority of access roads are situated on county roads and the WPA Act does not allow expenditures for right of way, any assistance from the WPA is eliminated until right of way is obtained.

(Continued on page 4)

TENTATIVE LIST OF PROPOSED ACCESS ROADS IN DEFENSE PROGRAM

Location	Miles and Type	Estimated Construction Cost	Location	Miles and Type	Estimated Construction Cost
BENICIA ARSENAL					
U. S. 40 near Vallejo to Arsenal Gate in Benicia	7 miles, grading and surfacing, 2 lanes.....	\$225,000	U. S. 60 from U. S. 395 to Riverside	4.1 miles, grade and P.C.C. pave widen R.R. separation, 4 lanes, divided	\$375,000
Benicia northerly	4.5 miles, grade, surface and bridge, 2 lanes....	300,000	Iowa Avenue from U. S. 60 to State Sign Route 18	3.1 miles, grade and surface 8" improved shoulders, 2 lanes channelization	100,000
FORT ORD					
Camp Ord to Salinas	4.9 miles, grade, surface and bridge, 4 lanes....	1,000,000	County Road, March Field-Riverside Mockingbird Canyon	12.2 miles, surfacing (county project), 2 lanes	150,000
Laguna Seco to State Route 117	1.7 miles, grade and surface, 2 lanes.....	45,000	MUROC BOMBING FIELD		
Salinas to Salinas Airport	6.0 miles, grade and resurface, 2 lanes.....	200,000	From U. S. 395, about 12 miles south of Kramer to West Cantonment Area near Muroc	26 miles, grade, base and plant mixed surf., 2 lanes	600,000
State Sign Route 1, Del Monte Jct. to Castroville	14.5 miles, grade, pave, bridges and grade separation, 4 lanes, divided	2,010,000	MOJAVE DESERT ANTI-AIRCRAFT RANGE Bicycle Lake Access Road		
Del Monte Ave., Monterey to Seaside Jct.	2.8 miles grade and pave, 4 lanes.....	250,000		35 miles, grade and surf., 2 lanes.....	700,000
State Sign Route 156, Castroville near Prunedale	5.2 miles, grade, surface and grade separation, 2 lanes.....	325,000	LOS ANGELES, TERMINAL ISLAND		
HEARST RANCH RESERVATION					
Kings City to Jolon	18.2 miles, grade and surface, 2 lanes.....	840,000	From U. S. Fleet Operating Base to Willow Street	3.0 miles, grade and P.C.C. Pave, 6 lanes, divided, bridge and separations	5,750,000
Jolon to Bradley	21.5 miles, grade and surface, 2 lanes.....	750,000	SAN DIEGO AREA		
Jolon to Coast	26.5 miles, grade and surface, 2 lanes.....	1,500,000	U. S. 101 from Market St. to 1 mile north of San Diego River	5.2 miles, grade and P.C.C., 6 lanes, divided, 2 pedestrian overheads, 3 highway separations, 3 bridge widenings....	1,520,000
SAN LUIS OBISPO NATIONAL GUARD CAMP					
State Sign Rte. 1 from San Luis Obispo to Camp San Luis Obispo	6.4 miles, grade and P.C.C. pave, Chorro Creek Br. and R. R. separation, 4 lanes, divided	730,000	Relocated U. S. 395 from A St. to 1/2 mile south of City Limits	7.0 miles, grade and P.C.C. Pave, 4 and 6 lanes, divided, 6 lanes double bore tunnel University Avenue, 7 separation structures..	1,925,000
County Road from San Luis Obispo to Camp San Luis Obispo via Osos Valley	5.4 miles, base and surfacing, 2 lanes.....	75,000	In Fort Rosecrans from Ballast Point to Upper Cantonment	2.0 miles, grade and P.C.C. Pave, 2 and 4 lanes	170,000
HAMILTON FIELD					
	6.2 miles, grade and surface, 2 lanes, channelization	225,000	Barnet Ave. from Rosecrans St. to U. S. 101	1.2 miles, grade and P.C.C. Pave, 4 lanes, divided	90,000
SACRAMENTO AIR DEPOT					
U. S. Air Depot to Government Docks on Sacramento River	10 miles, 60' grading, 40' base and surfacing....	450,000	Harbor Drive, from U. S. Destroyer Base to Junction Rosecrans St. and Talbot Ave.	8.2 miles, grade and P.C.C. Pave, 4 lanes, divided, 4 structures..	1,750,000
Air Depot to Mather Field	10.5 miles, 60' grade, 40' base and surface, American River Bridge	1,000,000	Rosecrans St., Lytton to Route 2	1.0 miles, grade and P.C.C. Pave, 4 lanes, divided	110,000
SAN FRANCISCO AREA					
Moffett Field	Pedestrian separation on U. S. 101.....	20,000	Route 2 to Route 11, with Spur connection from Camino del Rio to U. S. 101	2.2 miles, Grade and P.C.C. Pave, 4 lanes, divided	200,000
Presidio, Fort Barry, Fort Funston, Fort Scott, Fort Miley, Fort Baker	Grade, surface, resurfacing various Post Roads	1,750,000	Subtotal.....		
MARCH FIELD			\$25,475,000		
U. S. 395 from 1 1/2 miles South March Field to U. S. 60	4.7 miles, grade and P.C.C. Pave, highway separation over U. S. 60, 4 lanes, divided....	340,000	Total Estimated R/W Cost.....		
			2,483,000		
			Anticipated Access Roads at Mare Island, Torrey Pines and Camp McQuaide, Stockton.....		
			600,000		
			GRAND TOTAL ESTIMATED COST.....		
			\$28,558,000		



Congestion of traffic on Atlantic Boulevard north of Long Beach where thousands of workers are employed in the Vultee airplane plant

If access road construction is to be accomplished immediately, and immediate action is most necessary, the funds must be provided by early Congressional appropriation of money in sufficient amount to care for both right of way and construction.

Access roads to most of the camps are just as much required facilities as are barracks and administration buildings, and the cost of access road construction should be borne by Federal appropriations.

The accompanying tentative list of proposed access roads shows the location and desired improvements and estimated cost. This list does not, however, include certain defense roads in addition to the access roads shown which are being or will be constructed by the WPA.

A conception of the traffic load which these access roads will be called upon to carry may be had from the following official estimates of activities at a few of the camps and industrial plants served by such access roads.

6,000 MEN EMPLOYED

Construction operations now under way at Camp San Luis Obispo require the employment of approximately 6,000 at the camp. About 60 per cent of these men travel back and forth daily between the camp and San Luis Obispo.

Traffic on January 10 of this year amounted to 1,020 vehicles per hour. Future traffic on the road will probably increase by 4,000 or 5,000 vehicles daily when the camp is up to the planned strength of 20,000 men. It is expected that this will be about March 15.

Plans for the camp anticipate some 2,600 motor vehicles as military equipment and about 2,500 private cars for officers and men. Movement artillery units from Camp San Luis Obispo to the artillery range near Jolon in Monterey County, a distance of 87 miles, will result in long lines of traffic over the highway about once a week, as well as continual movement of supply trucks between the camp and the range.

HOUSE 30,000 TROOPS

Camp Nacimiento which is now under construction in the upper Salinas Valley is expected to house 30,000 troops with some 1,500 or 2,000 motor vehicles. At the present time there are about 7,000 men working at the camp and maximum traffic to and from San Miguel amounts to some 1,200 cars per hour. With the camp in full operation, this congestion will be greatly increased.

The two garrisons at Fort Ord between Salinas and the coast are planned for about 50,000 men by the end of May or the first part of June. This camp will require approximately 3,000 army vehicles and a number of privately owned vehicles will probably exceed the army equipment.

With some 14,000 civilian workers and troops now stationed at the garrisons, traffic congestion is quite serious at the time of shift changes and movement of a convoy of army trucks between Monterey or Salinas and the camp. When the camp is in full operation, traffic conditions will be much worse in the evenings and when

troop movements are in progress to and from the Jolon range.

It is anticipated that troop convoys will be as much as ten miles in length, which, with present two-lane facilities, will practically eliminate civilian traffic.

ARTILLERY RANGE TRAFFIC

The Hearst Military Reservation at Jolon in Monterey County is the site of the artillery range, and while no large permanent encampment is planned for this site, the movement of some 2,000 vehicles to the range from the surrounding camps every few days will periodically disturb normal traffic.

In Riverside County, on the Riverside-Perris Road are situated March Field and Camp Haan.

Camp Haan is an anti-aircraft unit for the training of draftees and is located on the Perris Road about three miles south of the junction with the State highway between Riverside and Beaumont.

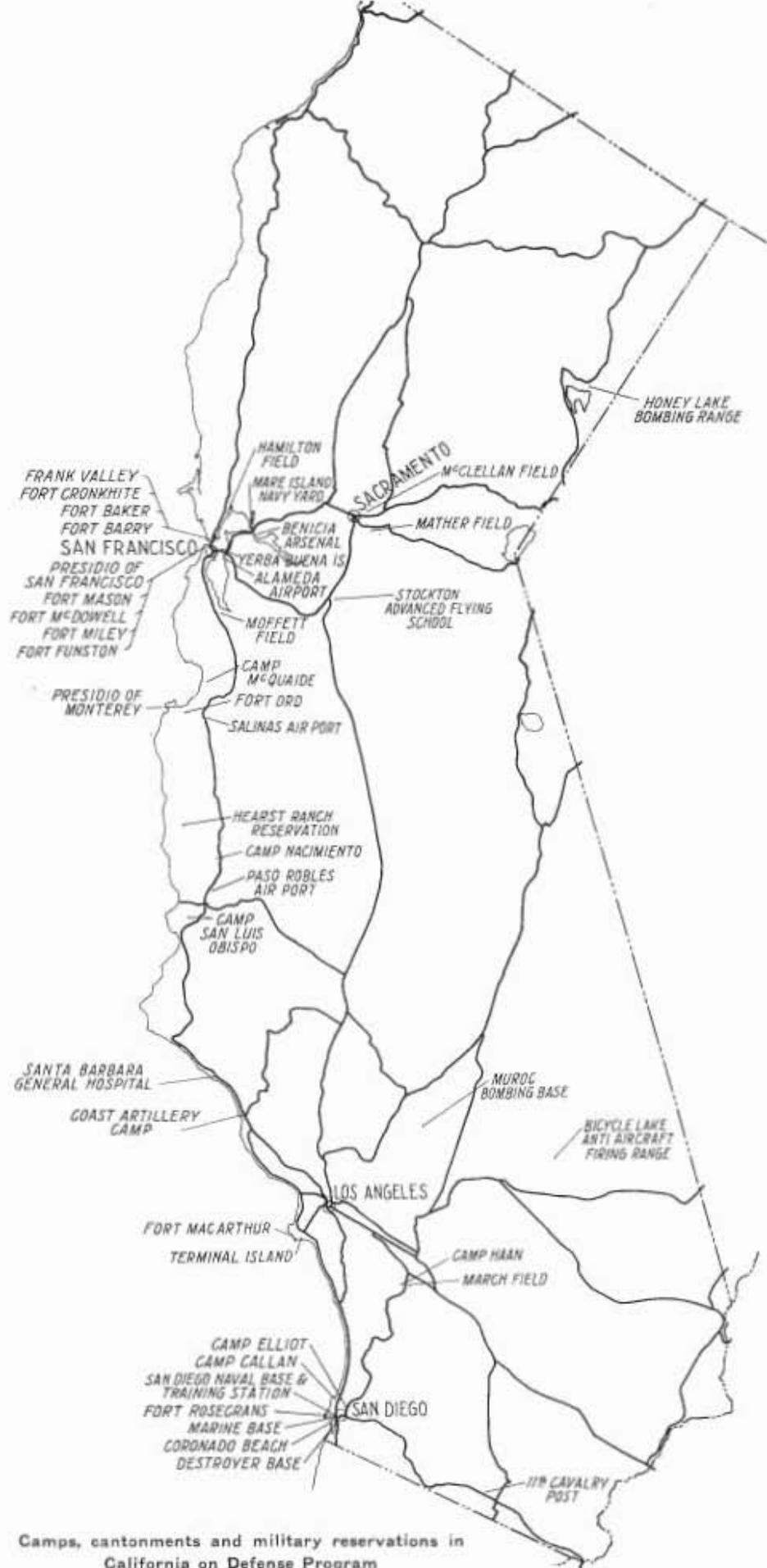
It is anticipated that at this camp will be stationed from 15,000 to 17,000 men. Excluding military trucks and equipment there will be some 1,000 private cars at the camp and some 400 additional vehicles will travel to the camp daily carrying civilian workers and furnishing local supplies.

It is expected that around 10,000 to 12,000 of the personnel will leave the camp week ends to spend their free time in the various local communities and in Los Angeles. This migration will require a great number of buses to serve the camp at that time.

Periodically a regiment will be moved from the camp to the firing range at Bicycle Lake, north of Barstow. This will involve a two-way movement of a caravan about seven miles long, moving at a rate of approximately 25 miles per hour over the 130 miles from the camp to Bicycle Lake.

FROM MARCH FIELD AREA

March field is a Military Aviation Reservation situated on the northeasterly side of the Perris highway opposite Camp Haan. While only a personnel of 7,000 men is anticipated for March Field, it will proportionately contribute to highway congestion in this vicinity, particularly when large units move to the bombing range at Muroc, 120 miles northerly.



Camps, cantonments and military reservations in California on Defense Program



Traffic to and from March Field Military Aviation Reservation and Camp Haan on Perris Highway in Riverside County

It is estimated that by early summer when both camps are in full operation traffic will average about 8,000 cars daily.

On Torrey Pines Mesa north of San Diego, Camp Callan is now under construction, preparing for 9,000 men by July first. When the camp is in operation, it is estimated that the daily average of trucks serving the camp will be about 300 per day. The main entrance to Camp Callan will open on the old Biological Grade some 600 feet off U. S. 101, and traffic from the camp will undoubtedly cause congestion at the junction of Miramar Road and U. S. 101.

CONGESTION IN SAN DIEGO

In the City of San Diego U. S. 101 passes the plant of the Consolidated Aircraft Corporation, the Ryan and the Solar Aircraft Companies and also serves traffic from the nearby Marine Corps Base and the Naval Training Station, Torrey Pines and Fort Rosecrans. Traffic congestion from these various sources presents a most serious problem at this time and certainly will become more aggravated with expansion of the plants and military bases.

In close proximity to these sites there is also to be a proposed Naval Housing Project and a 5,000 unit housing project on the mesa near Chesterton for workers in this vicinity which will both materially add to traffic volumes.

The Consolidated Aircraft Corporation, situated on U. S. 101, presents a typical example of the rapid expansion of war industry. In 1935 this plant had 300 employees, by December, 1939, these had increased to 3,200 and on January 21, 1941, the number was 15,000, 9,000 on the day shift and 6,000 on the night shift.

TIES UP TRAFFIC

The capacity of the plant will soon reach a maximum of 20,000 and a second plant is under construction nearby on U. S. 101. At the present time the 15,000 employees park 5,500 cars in the lot across the highway from the plant and at the times of shift changes the congestion resulting from the workers walking across U. S. 101 to the parking lot and the cars moving on and off the lot completely ties up traffic on this main artery.

These are briefly some of the problems confronting the Division of

Highways in access road construction and for which no definite funds are available.

Conditions similar to that at the Consolidated Aircraft Corporation in San Diego exist on other highways and streets around industrial plants as at the Lockheed plant in Burbank, the Douglas plant near Santa Monica, the Vultee plant north of Long Beach, and many other industrial sites located on main highways. To relieve congestion at these locations will require construction of the highest type of highway facilities and in many instances there is some doubt as to the permanency of the congestion. The State, city or county should not be held responsible for the complete financing of such improvements without very material assistance from the Federal Government.

STRATEGIC SYSTEM ROADS

The problem of bringing the designated strategic system of highways up to the standards required by the War Department is equally as important.

The strategic highway system in California totals approximately 5,600 miles, most of which is located on the Federal Aid System or major State



Photo by U. S. Signal Corps

Movement of heavy mechanized army equipment such as above stops all other traffic over that road

highways. The majority of the improved roads in this State conform to the standards specified by the Federal Government with the exception of shoulder widths and some bridges.

There are about 2,000 miles of sub-standard sections on the system in California and some 650 bridges below the required minimum of an H15 loading on secondary roads and the preferable H20 on more heavily traveled roads.

Estimates made by State highway engineers at the request of the Public Roads Administration show that approximately \$150,000,000 will be necessary to bring the strategic system in California up to the required standards. This amount is entirely in addition to the needs for access roads.

These improvements must be taken into consideration in the allocation of Federal funds apportioned to California under the Federal Aid Act. Regular Federal Aid apportionments to California for the fiscal years ending June 30, 1942 and 1943 will amount to only \$7,600,000, and this amount is about 10 per cent less than this State received for the previous

(Continued on page 26)



Photo by U. S. Signal Corps

Typical scene on access roads to camps and cantonments

\$2,256,000 Bay Bridge Bonds to Be Retired, Saving \$90,240 Annually

SAN FRANCISCO-OAKLAND Bay Toll Bridge sinking fund bonds having a par value of \$2,256,000 and due September 1, 1976, will be retired ahead of schedule on March 1st, by exercise of the call privilege. This accomplishment after four years and three and one-half months of operations and four toll reductions since June, 1939, effected by Governor Culbert L. Olson as chairman of the California Toll Bridge Authority is but one of many outstanding events in the financial history of this remarkably successful public ownership project.

Much has been said and written concerning the engineering features of the bridge; that its foundations are the largest and deepest on record; its tunnel the world's largest in diameter of bore and its main cantilever span the longest and heaviest of that type in the United States.

To cope with these problems successfully and to accomplish within reasonable financial limits what most laymen and many engineers considered to be impossible, it was necessary to develop new theories of design and new construction methods. That the bridge was completed well ahead of schedule and at a saving of \$7,000,000 is ample evidence of the careful design and engineering skill which went into the project.

REVENUE BOND PROJECT

Remarkable as the engineering features of the bridge may be, its financial record is even more outstanding. In considering the original financing of the project it should be remembered that in 1932 the theory of financing projects of this type through the issuance of revenue bonds was comparatively new and untried, and it is doubtful if public support could have been secured for such a large project on that basis.

Fortunately, after much negotiation, the Reconstruction Finance Corporation agreed to purchase a sufficient amount of bonds to yield the California Toll Bridge Author-

ity the sum of \$62,050,000 for the purpose of constructing the bridge. The interest rate was fixed at 5 per cent.

Ground was broken for the project on July 9, 1933.

As of April 1, 1934, the interest rate on self-liquidating loans made by the R. F. C. was reduced for a period of five years to 4 per cent, thereby effecting a considerable saving in interest during construction. The reduction was later extended to cover the entire period that the bonds were held by the R. F. C.

NEW AGREEMENT SECURED

In the original agreement with the R. F. C. the Bridge Authority expressed the intension of requesting the purchase of additional bonds to provide for the construction of interurban rail facilities on the bridge. In accordance with this understanding a new agreement was entered into on April 21, 1938, providing for the cancellation of the old bonds and for the issuance of \$73,000,000 of new revenue bonds to complete the financing of the vehicular bridge and interurban facilities.

A saving in future interest charges was thus effected in that the new agreement provided for the issuance of \$33,000,000 of serial revenue bonds bearing 4 per cent interest and \$40,000,000 of sinking fund bonds bearing 4½ per cent interest. Anticipating the possible sale of the bonds by the R. F. C. it was also agreed that the Bridge Authority would on behalf of the San Francisco-Oakland Bay Bridge, share equally with the R. F. C. in any profit made on the sale of the bonds at more than 101.

On June 5, 1939, the bond agreement with the R. F. C. was again amended reducing the interest rate on the serial revenue bonds from 4½ per cent to 4 per cent. On June 22, 1939, the R. F. C. sold \$31,700,000 of the serial bonds and \$39,300,000 of the sinking funds at 103 with a resulting profit of \$2,130,000 of which \$1,065,000 was applied as a

credit to the San Francisco-Oakland Bay Bridge.

\$1,500,000 BONDS RETIRED

Serial bonds amounting to \$500,000 had been retired on March 1, 1939, and on June 22, 1939, the \$1,065,000 combined with \$500,000 of funds not needed in the Bridge Construction Fund was used to retire \$800,000 of serial bonds and \$700,000 of sinking fund thereby reducing the bonds outstanding to the \$71,000,000 of bonds which were sold by the R. F. C. to a syndicate and through the syndicate to the public.

These transactions bring the financing phase of the project up to date except for the retirement of \$260,000 of serial bonds which matured on March 1, 1940, and were redeemed on that date in accordance with the retirement schedule.

Results from the operation of the bridge have exceeded the most optimistic estimates made during its developmental stages. It was opened to traffic on November 12, 1936, with the toll for passenger cars fixed at 65 cents per car and driver and 5 cents for each additional passenger.

By February 1, 1937, the traffic and revenues had been such that a flat rate of 50 cents was established with no charge for additional passengers and with corresponding reductions in the rates for trucks and freight.

FOUR MORE REDUCTIONS

These basic rates were again reduced by Governor Olson's initiative through the Toll Bridge Authority to 40 cents on June 15, 1939; to 35 cents on January 1, 1940; to 30 cents on May 25, 1940, and to 25 cents on July 1, 1940.

In spite of the substantial reductions that have been effected in the toll rates the bridge has during the short four and one-third year period of its operation not only built up the entire reserve of \$4,000,000 that is required by the bond indenture but excess funds have been avail-

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Highway Men Answer Call to Colors

THIRTY-NINE employees of the Division of Highways of the State Department of Public Works have answered the call to the colors and have enlisted in the military service of their country.

They have been granted leaves for the duration at the end of which they may return to their positions which will be held for them. During their absence, their jobs either will be filled by eligibles drawn from the Civil Service list of the Personnel Board or their work will be performed by personnel in the departments with which they were associated.

MANY TRAINED ENGINEERS

Many of those who have gone into army service are trained engineers whose services are required by the War Department. Others are enrollees under National conscription and some have been commissioned.

One employee of the Division of Water Resources has been called to duty. He is Assistant Hydraulic Engineer David B. Willets, a first lieutenant in the Ordnance Reserve, who has been assigned to the Chief of Ordnance at Washington, D. C.

A number of other employees of the Department of Public Works are Reserve Officers and expect a call in the near future.

The names on the Honor Roll of the Division of Highways to date and the departments with which they are connected, are as follows:

Central Office				Planning Survey			
Cullivan, Raymond.....			Junior Clerk	Zook, Harry.....			Junior Engineering Aid
Packard, L. D.....			Associate Highway Engineer	Highway Districts			
Bridge Department				Bates, Thad J., Jr.....			Junior Clerk, District IV
Barnes, F. M.....		Associate	Bridge Engineer	Charle, Julien R.....			Title Draftsman Delineator, VII
Cordero, F. P.....		Junior	Bridge Engineer	Daswell, L. H.....			Highway Maintenance Leadingman, X
Ferns, John H.....		Junior	Bridge Engineer	Davis, Cedric B.....			Timekeeper-Clerk, XI
Haight, William T.....		Associate	Bridge Engineer	Freeman, Edgar M.....			Laborer, III
Howard, Thomas L.....		Assistant	Bridge Engineer	Hon, Richard.....			Junior Highway Engineer, X
Miller, DeWolfe.....		Assistant	Bridge Engineer	Laughter, Fred W.....			Laborer, XI
Murphy, R. P.....		Junior	Bridge Engineer	Longfellow, E. S.....			Junior Highway Engineer, IX
Payson, Stephen.....		Assistant	Bridge Engineer	McCrea, John A.....			Laborer, IV
Sagehorn, E. H.....		Junior	Bridge Engineer	McQueeney, Raymond T.....			Timekeeper-Clerk, VIII
Silliman, J. W.....		Assistant	Bridge Engineer	Mohr, William H.....			Junior Highway Engineer, VII
Walters, Gordon.....			Structural Engineering Office Aid	Nicholson, R. N.....			Junior Engineering Aid, X
Willett, Albert B.....		Associate	Bridge Engineer	Rowe, Harry C.....			Junior Highway Engineer, IV
San Francisco-Oakland Bay Bridge				Sedgwick, W. D.....			Associate Highway Engineer, X
Gray, James N.....			Toll Collector	Shafter, E. A.....			Junior Highway Engineer, IX
Mapes, Lynne R.....			Toll Collector	Webb, Harry J.....			Junior Highway Engineer, X
Morian, Harold L.....			Junior Bridge Engineer	West, Melbourne H.....			Junior Highway Engineer, XI
Testing Laboratory				Wing, R. W.....			Laborer, IV
Geib, William S.....			Junior Physical Testing Engineer	Equipment Shops			
				Ames, Charles S.....			Junior Mechanical Engineering Draftsman (Headquarters Shop)
				Darling, W. V., Jr.....			Heavy Equipment Mechanic, VIII



Snow surveyors learn to be good cross-country skiers. Rangers Smith and Rogers climbing grade en route to Chilkoote Lake

First Snow Survey Completed

By FRED H. PAGET, Associate Hydraulic Engineer

ONE after the other, like the waves of the ocean, in from the Pacific this winter came storm after storm. From the middle of December until almost the close of January the succession was unending. December was the wettest December ever recorded in California. Many of the January figures exceeded the normal for that month. Rain and more rain fell in the valleys and foothills of the State.

And while all this rain was falling in the lowlands, what was going on up in the mountains? In California during the winter, rain at low elevations usually means snow higher up and this season's weather has been no exception to that general rule. The skiers that flock to the hills as soon as the first patches of white appear on the hillsides brought back word of lots of snow. While the rain was making records in the lowlands, the snowfall was keeping pace

in the mountains and the big white flakes floating down in their myriad millions had covered the Sierra with a dense blanket of snow many feet deep.

And this snow, the joy of the skiers, is also a boon to the farms and industries of California. When winter ends and summer comes with its months of sunny weather, the irrigationist and the industrialist have to depend to a great degree upon the melting snowpack to furnish them with the steady supply of water vital to their existence.

FIRST MEASUREMENTS MADE

These water using organizations keep an anxious eye on the snowpack all winter and not satisfied with general statements of conditions, they cooperate with the Division of Water Resources of the State Department of Public Works to secure periodically accurate measure-

ments not only of the average depth of the snow over whole watersheds but, also, of the amount of water contained in the snowpack. The first series of this winter's measurements at many key locations in each watershed has just been completed and the situation analyzed.

The deepest snow measured was on the snow course near Lake Helen, on the southerly slopes of Mt. Lassen at an elevation of 8400 feet. Here measurements revealed an average snow depth on the level of 195 inches, containing 78 inches of water. Mount Shasta at 8000 feet reported 152 inches of snow with 64 inches of water—slightly more than the normal supply for the entire winter at this location.

At the Donner Summit, the high point of U. S. Highway 40 between Sacramento and Reno the measurements averaged an even 8 feet of snow—96 inches—with a water con-



Snow surveyors on the job. 1. Paget of State Division of Water Resources and Ranger Madsen gliding down slope. 2. Weighing core of snow taken in aluminum measuring tube as shown in picture 3. Two ways of obtaining drinking water in the snow country are shown in 4 and 5. Ranger Madsen gets snow at cabin door for melting down. Ranger Smith risks filling can from channel 8 feet below



Snow surveyors arrive at cabin in Sierra National Forest en route to San Joaquin watershed country

tent of 37 inches. Normal water content there for the whole season is 42 inches.

RESULTS ABOVE NORMAL

At the southern end of the Sierra, measurements in the Kern River Watershed at Round Meadow, elevation 9000 feet, showed an average snow depth of 65 inches, containing 23 inches of water. The normal for the entire winter at this station is 28 inches of water. Throughout the Sierra, very few stations above 6000 feet reported less than 20 inches of water in the snowpack; most stations reporting over 30 inches.

The average water content in most of the mountain watersheds now approximates 70 per cent of the total seasonal normal; a very healthy condition at the first of February when usually only about one half of the season's supply is expected to be on the ground. With the almost certain prospect of more snow during the next two months it would seem that an adequate water supply for all normal requirements of the 1941 season is already assured.

In measuring the snowpack at the end of January, men sent out by the Division of Water Resources were added by the field forces of many

other organizations. Irrigation district men, power company employees, and the forest and park rangers of the Federal services all helped with the snow surveys. A break in the weather during the last week in January favored the field work and the men had good weather and traveling conditions while carrying out their assignments. The field notes of their measurements were forwarded to Sacramento immediately upon their return from the snowfields.

FIRST BULLETIN ISSUED

A bulletin issued by the State Division of Water Resources on February 10th sets forth in detail all measurements made during this first checkup on the snowpack. No forecasts of runoff are included in this winter's first snow survey bulletin as the present snowpack will no doubt change considerably during the remaining two months of winter.

Another progress measurement will be made and another bulletin issued early in March. At the end of March the detailed snow survey of the total winter's snowpack will be made at all snow measuring stations throughout California and from the information gathered will be made forecasts of runoff of the Sierra

streams for the coming spring and summer. These forecasts will be contained in the snow survey bulletin to be published on or about April 10th. All bulletins are available upon request to State Division of Water Resources.

Some of the more hardy snow surveyors, not minding the additional weight upon their backs, took along their cameras on the trips. On this and the opposite page are reproduced a few of the pictures they brought back.

Four More States Bar Diversion of Gas Taxes

Constitutional amendments prohibiting diversion of highway funds to non-highway purposes were adopted by four States in 1940. This is the largest number of States to take such action in any single year.

At the November election the amendments were adopted by Nevada, Idaho and South Dakota, while North Dakota adopted a like measure in June. The previous record year was 1938, when anti-diversion amendments were adopted by California, Michigan and New Hampshire.

Easterly Gateway to Los Angeles Involves Structure for Freeways

By A. N. GEORGE, District Construction Engineer

ONE of the most congested routes into down-town Los Angeles feeds traffic into the Civic Center and business section over the Aliso Street Bridge across the Los Angeles River.

The need of improved facilities for carrying Aliso Street traffic over the Los Angeles River and adjacent main line railroad tracks has been evident for many years.

This old bridge carried the double track lines of the Pacific Electric Railway Company which serve all of their lines to the east and northeast of the city, together with a single lane of highway traffic in each direction.

This bridge carried the traffic of State Highway Route 26, the Los Angeles to Pomona arterial, also U. S. 60 and 70 transcontinentals through Imperial Valley, and U. S. 99 from the Mexican border to Canada, besides other traffic originating east and north of the Los Angeles area.

The bridge, recently demolished to

make way for new construction, spanned only the river and traffic was obliged to cross at grade the Santa Fe main line tracks to San Diego on the west side of the river and the Union Pacific tracks on the east side.

Aliso Street passes immediately southerly of the new union depot and leads directly towards the Civic Center of Los Angeles. Plans are now under way for extending Aliso Street into and across the Civic Center, which will make it one of the most important thoroughfares of the city.

A COMPLICATED PROBLEM

Active efforts to finance the construction were started by the City of Los Angeles in 1937. The financing was extremely difficult due to the many private organizations whose facilities would be involved and who would benefit by the proposed construction to such an extent that it was proper to expect them to contribute

largely to the proposed construction.

Early plans for the project contemplated a single span across the river at a higher elevation than the original bridge which would provide for a separation of grades between the traffic using the bridge and the Santa Fe and Union Pacific tracks which parallel the river.

These early plans also contemplated carrying the Pacific Electric Railway tracks above the north roadway of State Highway Route 26 on to their private right of way which is parallel to and on the north side of the highway for some distance east of this point.

The plans also provided for carrying Mission Road under both the highway and the Pacific Electric tracks and to provide ramp connections with Mission Road for automobile traffic.

TWO FREEWAYS INVOLVED

Meantime plans for the ultimate construction of a freeway to Pomona utilizing portions of the alignment of



Construction begun on western approach to Aliso Street Bridge over Los Angeles River and distribution structure

River Span and Distribution Structure to Carry Traffic of Two

Ramona Boulevard and a freeway to Santa Ana which would have its main entrance to Los Angeles by way of the proposed structure over Aliso Street have forced the inclusion of a rather elaborate distribution structure on the east side of the Los Angeles River as a part of the Aliso Street Project. The project is further complicated by the fact that the present route over Ramona Boulevard occupies the low land which originally drained a large area of the city.

With the construction of Ramona Boulevard this drainage was carried in a gunite lined ditch between the highway and the Pacific Electric. However, the plan for the Pomona freeway will not leave sufficient room for this open ditch and an item of \$200,000 has been included in the current biennium budget for the construction of a reinforced concrete box to carry this drainage.

WPA PROVIDED SOLUTION

Many conferences were held which were attended by representatives of the Los Angeles City Engineer's Office; the Union Pacific Railway; the Santa Fe Railway; the Pacific Electric Railway; the State Highway department and various Federal agencies.

An attempt was made to finance it with the help of a PWA grant, the City, County and three railroads to combine in furnishing the money necessary to match the proposed Federal grant.

This attempt was unsuccessful and financing under a PWA grant failed due to the rigid time limit which

was placed on all PWA projects by the Federal Government, there being insufficient time to get the plans completed and a contract awarded and the construction completed prior to the deadline set by the Federal Government for the completion of all PWA projects.

OFFERS RELIEF EMPLOYMENT

The need for employment in the metropolitan area to help reduce the relief rolls was so acute that an application was then made to the WPA authorities that this project be carried out under a WPA allotment and unusually liberal terms were arranged for the allotment. This method of financing and construction was finally agreed upon and the project is now being constructed under WPA authority.

The Los Angeles City Engineer's office have prepared the plans and are furnishing the engineering supervision for the construction work.

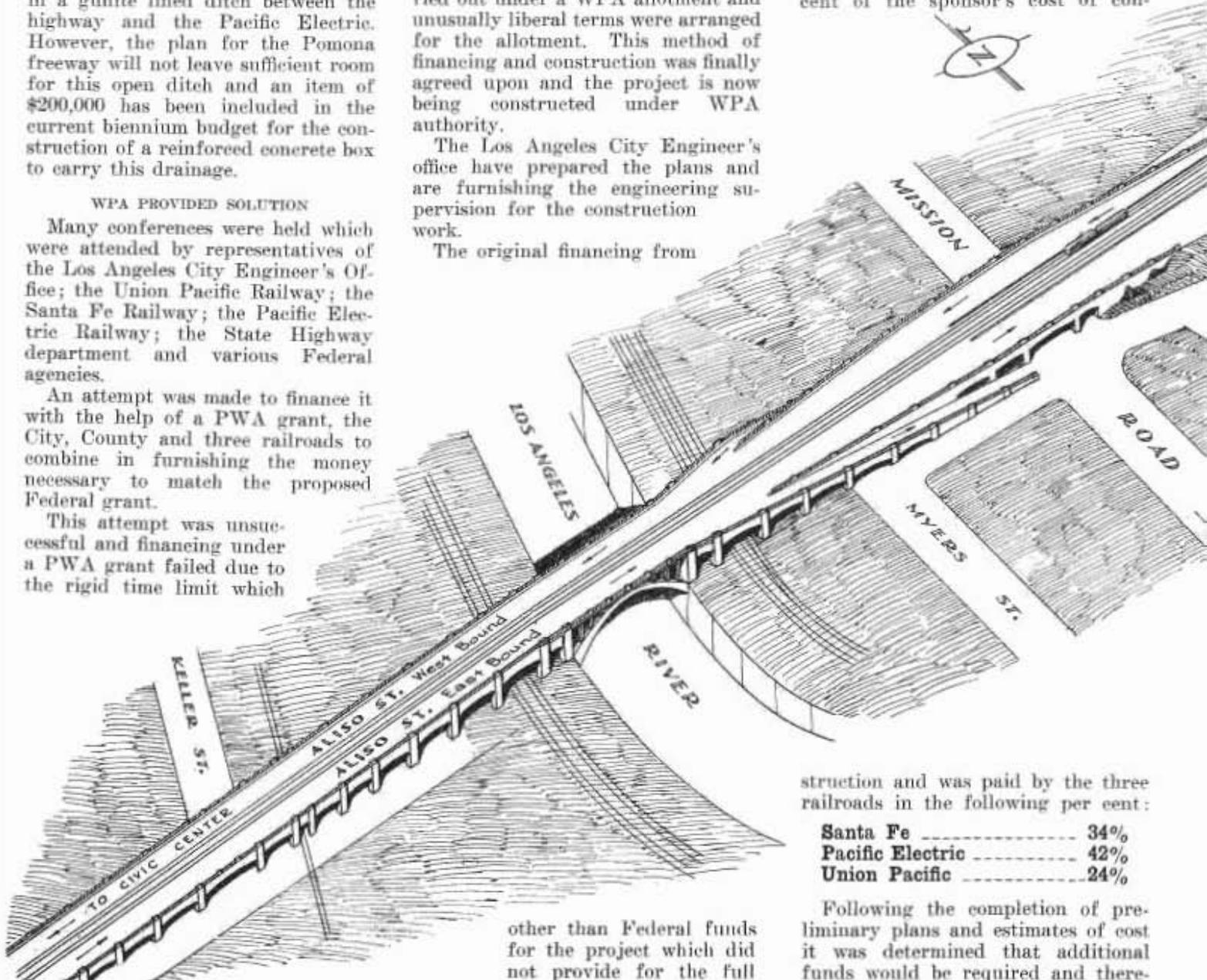
The original financing from

distribution structure on the east, was predicated on the following contributions:

Railroads	\$450,000
Los Angeles County	220,000
Los Angeles City from 1/4¢ City Street funds	220,000
State Highway funds	220,000
Total	\$1,110,000

RAILROADS SHAVE EXPENSE

The railroads' contribution was based on 40.54% of the cost of right of way acquisition and the same per cent of the sponsor's cost of con-



struction and was paid by the three railroads in the following per cent:

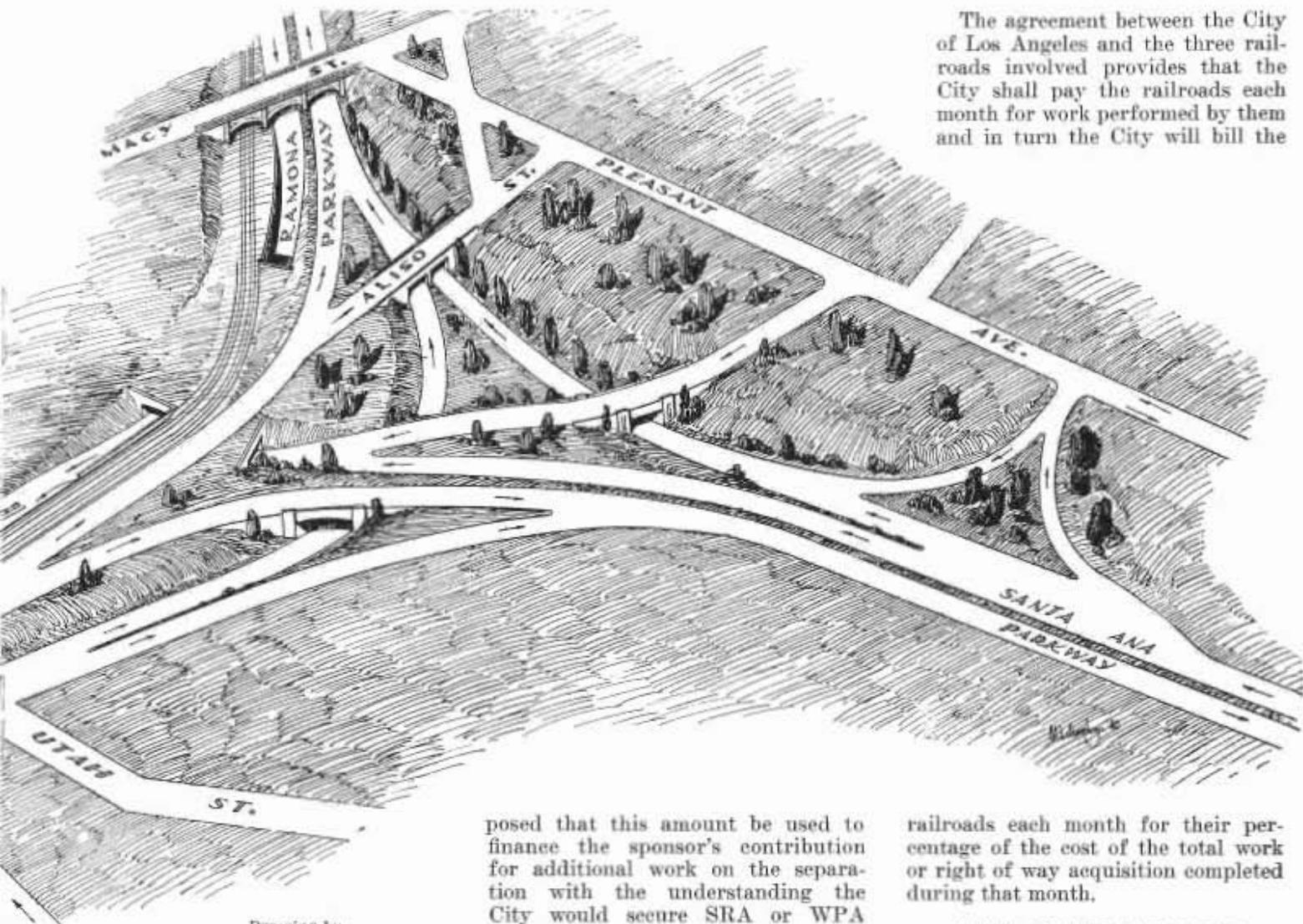
Santa Fe	34%
Pacific Electric	42%
Union Pacific	24%

Following the completion of preliminary plans and estimates of cost it was determined that additional funds would be required and there-

other than Federal funds for the project which did not provide for the full

Two Freeways Into Civic Center of Los Angeles at Aliso Street

The agreement between the City of Los Angeles and the three railroads involved provides that the City shall pay the railroads each month for work performed by them and in turn the City will bill the



*Drawing by
W. L. Humphreys*

fore the State's contribution was increased to \$291,223, the County's contribution to \$291,000, and the city's contribution from 1/4-cent City Street funds to a like amount, and \$1,256,187 provided from the WPA.

Before the completion of final plans it became apparent that provision should be made at the easterly end for a connection with the proposed Santa Ana Freeway towards Orange County which necessitated an increased sponsor's contribution.

As the 1939-41 biennium budget included \$200,000 of State Highway funds to construct a storm drain along Ramona Boulevard (State Highway Route 26), the City pro-

posed that this amount be used to finance the sponsor's contribution for additional work on the separation with the understanding the City would secure SRA or WPA labor and contributions to construct the Ramona Boulevard storm drain without any additional cost to the State.

FINANCING SET-UP

The financing now stands as follows:

Railroad funds	\$550,271
County funds	291,000
Los Angeles City 1/4¢ City	
Street funds	291,000
State Highway funds	491,223
WPA funds	1,981,002
Total	\$3,604,496

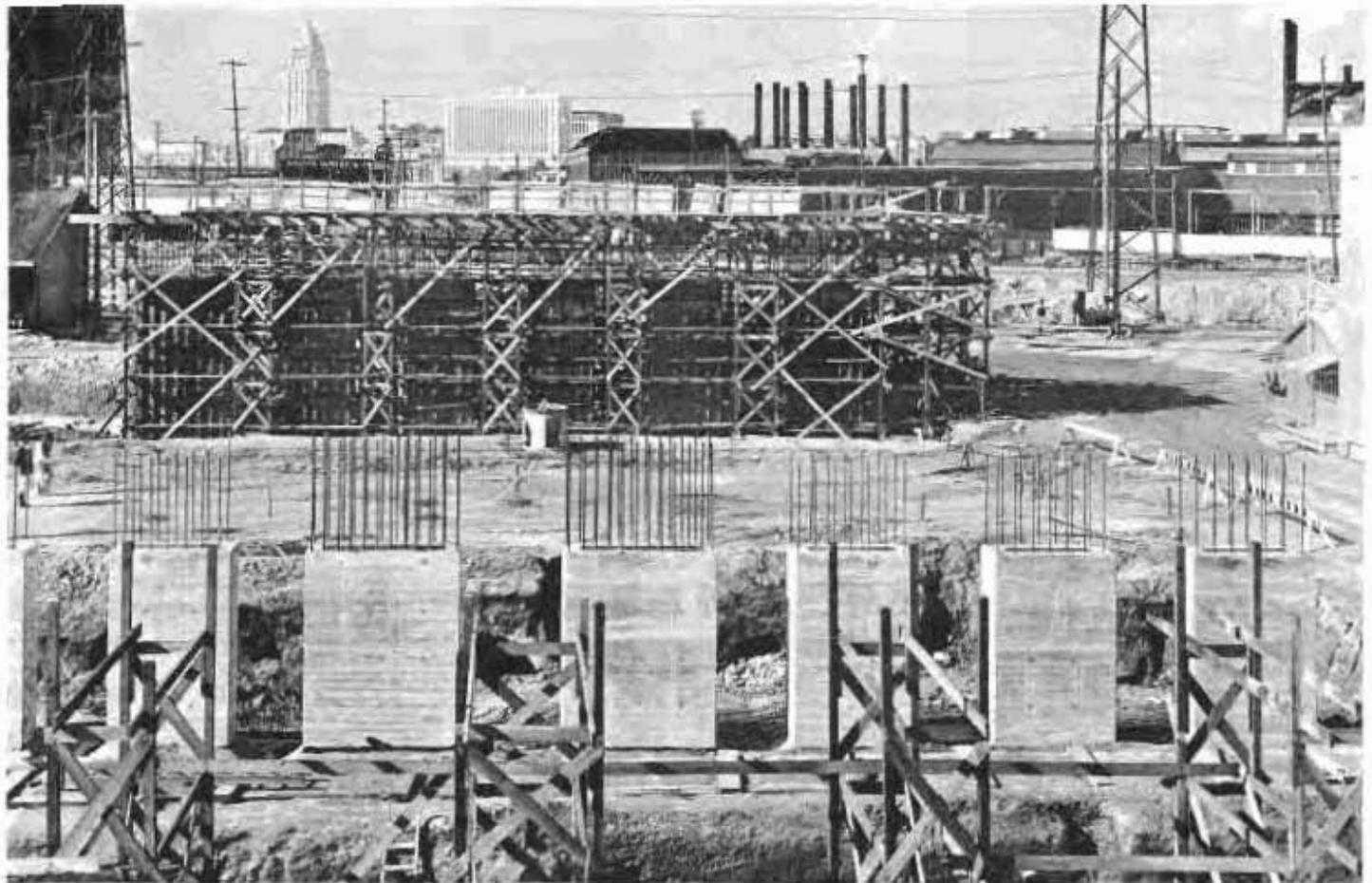
The railroads' proportion of the total cost of the sponsor's contribution as now provided is 40.54% of the total cost of the right of way and 32.64% of the total sponsor's contribution for construction.

railroads each month for their percentage of the cost of the total work or right of way acquisition completed during that month.

ACTUAL CONSTRUCTION BEGUN

Work was started on this project on December 14, 1939, by the construction of a shoofly to carry the Pacific Electric around the work by way of Macy Street bridge, but ground breaking for the construction work itself was celebrated on February 20, 1940, at which time actual construction work on the new project was started.

To date the Pacific Electric has built their shoofly track around the construction; the Santa Fe and Union Pacific Railroads have lowered their tracks to a temporary location during construction work. The retaining walls for the westerly approach to the bridge have been completed and the footings and piers are nearly completed for that part of the structure. The deck to the west-



Footings poured on the easterly approach to Aliso Street Bridge and distribution structure. Los Angeles City Hall and State Building in background

erly approach will be started in the very near future.

Work is now in progress on the easterly footings for the river span section of the bridge and a portion of the footing has been poured. No work is proposed to be done on the westerly river span footing until April, 1941, because of the hazard of high water during the winter months. Work is being carried on on the footings and piers for the easterly approach.

It is proposed to push the work on the distribution structure to the east. Meanwhile work is advancing on the Ramona storm drain. Connection to the river from East Mission Road has already been made by means of tunneling under the maze of railroad tracks and roadways which it was necessary to cross, and the main storm drain structure is completed from the river to the Macy Street bridge.

Ramona Boulevard has been closed to traffic from St. Louis Street westerly and it is not anticipated that it will be possible to reopen it for approximately one year.

The completion of this structure will relieve much of the congestion of traffic to the east of Los Angeles and will be a notable milestone in the efforts to make it possible for traffic to flow smoothly, swiftly and safely into and out of the business district of Los Angeles.

\$2,256,000 Bay Bridge Bonds to be Retired

(Continued from page 5)

able and used for the purpose of purchasing \$934,000 par value of its bonds in the market thereby effecting a saving in annual interest charges of \$37,360.

Now additional excess funds are available to retire \$2,256,000 of the

sinking fund bonds by call on March 1st which will make a further saving of \$90,240 annually.

During the next year, therefore, the saving in interest resulting from the retirement to date of bonds ahead of schedule will amount to \$127,600. Additional savings will be effected by the retirement in the same manner of approximately \$1,000,000 of bonds on September 1, 1941.

At the dedication ceremonies in 1936 this statement was made: "By 1950 we estimate the bridge will be carrying 12,600,000 automobiles and trucks per year."

During the year ending December 31, 1940, ten years sooner, over 15,264,000 vehicles crossed the bridge or 25 per cent more than was predicted for bridge traffic by 1950.

R. O. T. C. (drilling frosh): "Attention! Stand erect! Let your legs hang down!"

Highway Division in 1940 Put 200 Road Contracts Under Way in 54 Counties

By GEORGE T. McCOY, Assistant State Highway Engineer

DURING 1940, maintenance expenditures and the cost of construction projects initiated by the California Division of Highways amounted to a total of \$39,034,800. Of this sum, \$28,572,600 is the cost of the construction work placed under way during the calendar year.

To finance these construction projects, State funds derived from motor fuel taxes and vehicle fees were available in the amount of \$20,056,300, reimbursements from Federal funds allocated to California are anticipated totaling \$8,446,700, and county funds amounting to \$69,600 were provided to match Federal funds on projects off the State Highway System. Approximately 30 per cent of the year's construction program was financed by Federal funds.

SOURCES OF FUNDS

Segregation of the amounts making up the total for construction to the various funds is shown in the following tabulation:

Funds	Amount
Regular Federal Aid	\$6,336,700
Secondary or Feeder Road, Federal Aid	581,100
Grade Crossing Elimination, Federal Aid	870,500
Emergency Relief Federal Aid (Storm Damage Repair)	307,300
U. S. Bureau of Reclamation (Highway Relocation at Shasta Dam Reservoir)	351,100
County Funds	69,600
State Highway Fund	20,056,300
Total	\$28,572,600

In the foregoing tabulation the State highway funds include appropriations from revenues received by the Division of Highways from the gasoline and Diesel oil taxes and motor vehicle fees for construction, minor improvements, betterments and State contracts financed from one-fourth cent funds allocated to cities.

The total amount of construction and maintenance work undertaken between January 1 and December 31,

1940, was segregated by classification as follows:

Construction	\$23,681,100
Maintenance	10,462,200
Engineering	2,916,800
Right of Way	1,974,700
Total	\$39,034,800

Progress of construction activities of the State Highway System as gauged by the \$18,046,900 of contracts awarded during the year covering 715 miles of highway and 113 bridges and grade separations is shown in the following tabulation:

Type	Miles	Amount
Portland Cement and Asphalt Concrete Pavement	58	\$3,956,100
Bituminous Treated Crushed Rock Surfacing	235	5,507,300
Bituminous Surface Treatment Oiled Gravel, and Oiled Earth	106	1,527,700
Armor Coat Retread Surfacing and Seal Coat	241	224,300
Grading and Shoulder Improvement	75	1,835,000
Bridges and Grade Separations	(113)	4,592,800
Miscellaneous Construction		403,700
Totals	715	\$18,046,900

200 CONTRACT AWARDS

Contract awards numbering approximately 200 were made during 1940 for construction projects in 54 of the State's 58 counties.

The following condensed data provide a brief review of the new work placed under way on the more heavily traveled trunk-line routes.

Thirteen contracts totaling \$2,107,000 provided for the construction of 18 miles of road, three bridges and a viaduct on the Redwood Highway between San Francisco and the Oregon line. Included in these contracts were two bridges across the Eel River in Humboldt County costing \$455,000 and \$330,000, and the 2,200-foot viaduct through San Rafael costing

\$381,000. The latter contracts are under construction.

Between Sacramento and Los Angeles on U. S. Route 99, eight contracts totaling \$953,000 were awarded for 21 miles of four-lane divided highway construction and five bridges. The largest of these was for grading six miles of the Ridge Route between Fort Tejon and Grapevine Station, and amounted to \$385,600.

SHASTA RESERVOIR RELOCATION

North of Sacramento on the Pacific Highway work was put under way on 18 miles of road and three bridges. The nine contracts on this route totaled \$852,200, the largest being for grading of the eight-mile section from O'Brien Summit to Antler, as a portion of the relocation at Shasta Dam Reservoir, which amounted to \$356,300.

Thirty-two miles of highway, four bridges and an underpass were provided for by award of 17 contracts totaling \$1,865,000 on the Coast Route, U. S. 101, between San Francisco and San Diego.

Expenditure of \$794,000 was involved in the four contracts for improving 29 miles of State Highway 26, which connects Los Angeles and El Centro. Further improvement of the travel facilities between the coast cities and the Imperial Valley was also provided by a contract for \$367,900 covering construction of 3.6 miles on U. S. Route 80 in Imperial County from Mountain Springs easterly.

DAVIS-DIXON REALIGNMENT

Progress toward the ultimate development of a through four-lane highway between Sacramento and the Bay Area was accomplished by the award of seven contracts totaling \$798,700 on this route. These contracts included seven miles of new realignment grading from north of Dixon to near Davis, six new bridges, an underpass south of Davis, and the redecking of the Yolo Causeway.

(Continued on page 27)

Grapevine Grade Sliding Hill to Be Stopped by Buttress Fill and Drains

By E. T. SCOTT, District Engineer

WHEN the first correction of the old tortuous Ridge Route section of U. S. 99 in Los Angeles County was broken through in 1933 with the opening of the twenty-seven miles between Castaic and Gorman, the average daily traffic over this main link between the San Joaquin Valley and Southern California was 2,500 cars and trucks per day.

Today with all of the 115 miles of this route paved to three- and four-lane width between Los Angeles and

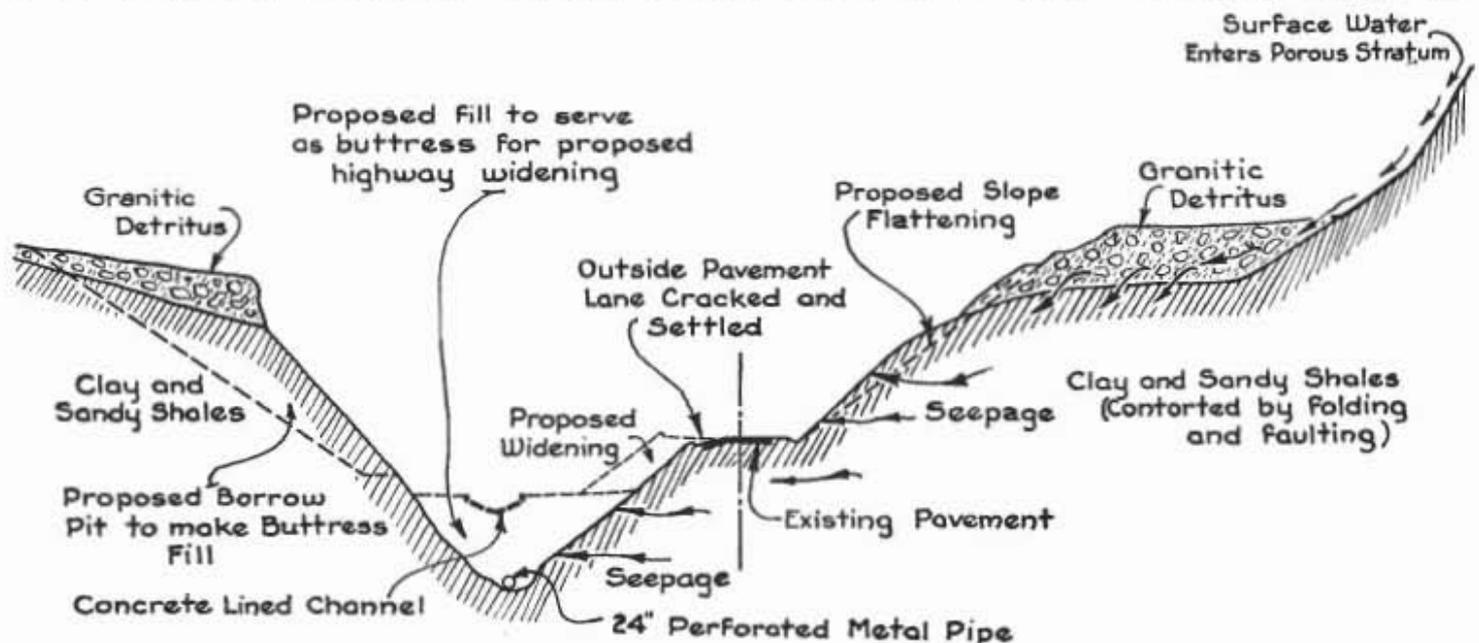
centage of large slow-moving trucks with fast passenger vehicles on this mountain road which rises from sea level up to four thousand feet in elevation and then drops down again, has developed an exceedingly serious traffic problem which makes additional lanes and further separation of traffic imperative.

Accident records show the worst section to be through the Grapevine Creek canyon from Old Fort Tejon northerly in Kern County where

Creek and the movement threatens to take out the highway.

FIRST CONTRACT AWARDED

As the first step in meeting this situation, the Director of Public Works on December 20, 1940, awarded to the Griffith Company of Los Angeles a three hundred and eighty-five thousand dollar contract for grading through the six miles of Grapevine Canyon. The work of this contract not only includes the construction of a grade wide enough for a four-lane



Sketch showing plan for proposed buttress fill and highway widening on Grapevine Canyon

Bakersfield in Kern County, the average daily traffic is nearly six thousand machines of which about 20% are trucks and trailers.

This average is increased on occasions by many special events such as football games and fiestas, reaching the maximum twenty-four hour count of over twenty thousand machines during the unusual display of wildflowers in the San Joaquin Valley in 1939.

The combination of the high per-

there is nearly six miles of continuous 5.5% grade down the hill.

In addition to the traffic problems, this portion of the highway has several serious slide areas which are a constant menace to traffic and require regular maintenance expenditures. One badly saturated hillside on which the roadway is carried on a grade below a large oil line pumping plant has been slowly settling towards the canyon of Grapevine

divided highway but also correction of the areas where slides are giving trouble.

The hillsides above the road that have been moving are to be drained and flattened back to stable slopes and the material from them will be used in widening the roadway embankments. The saturated hillside is to be treated by extensive drainage work in the wet areas above the roadway and by the construction of a buttress fill of over 180,000 cubic yards.

(Continued on page 26)



On upper left photograph of Grapevine Canyon the white lines indicate proposed fill construction and highway widening. Pictures on right show cracked and sliding hillside. In lower left, truck units pulling around slide

North Sacramento Viaduct Will Carry 4-Lane Divided Highway

By JAMES GALLAGHER, Assistant Bridge Engineer

THE California Highway Commission has set up in the budget the necessary funds, plans are being prepared and as soon as the funds become available construction can start on the new four-lane viaduct across the American River Flood Control project across the American River overflow area on Del Paso Boulevard (U. S. 40) between Sacramento and North Sacramento.

The present ground-level road extending from the north end of the 16th Street Bridge over the American River to North Sacramento is inadequate to carry the 20,000 to 25,000 cars which daily pass over this highway.

This ground-level road passes under the tracks of the Sacramento Northern and the Western Pacific. The

two subways and the section of road between them are flooded whenever the American and Sacramento Rivers reach an elevation of approximately 28 on the Sacramento River gauge U. S. E. D. datum.

During six of the past twelve seasons it has been necessary to close the road because of high water; ordinarily only for a few days in any one season. In the winter of 1937-1938 the road was closed for a total of fifteen days. In '39 and '40 season it was closed for a total of ten days. In '39 and '40 the road was closed continuously for six days.

When this road is closed, traffic is detoured by way of the Jibboom Street Bridge at the mouth of the American River and about three miles along a narrow levee road and back

into North Sacramento over Arcade Creek Bridge.

This route is about three miles longer, but since traffic must travel very slowly along the narrow levee road during the rush hours of morning and evening when traffic is heaviest, this detour adds from 30 to 60 minutes to the time required to travel from North Sacramento to Sacramento.

Another detour is by way of the H Street Bridge over the American River, which route, although not so congested, is about 8 miles longer. During periods of extreme high water the H Street Road is also flooded and forced to be closed to traffic.

The existing ground-level road and the subways under the two railroads were constructed in 1925 and



Del Paso Boulevard on U. S. 40 between Sacramento and North Sacramento that is flooded at high water periods of American River



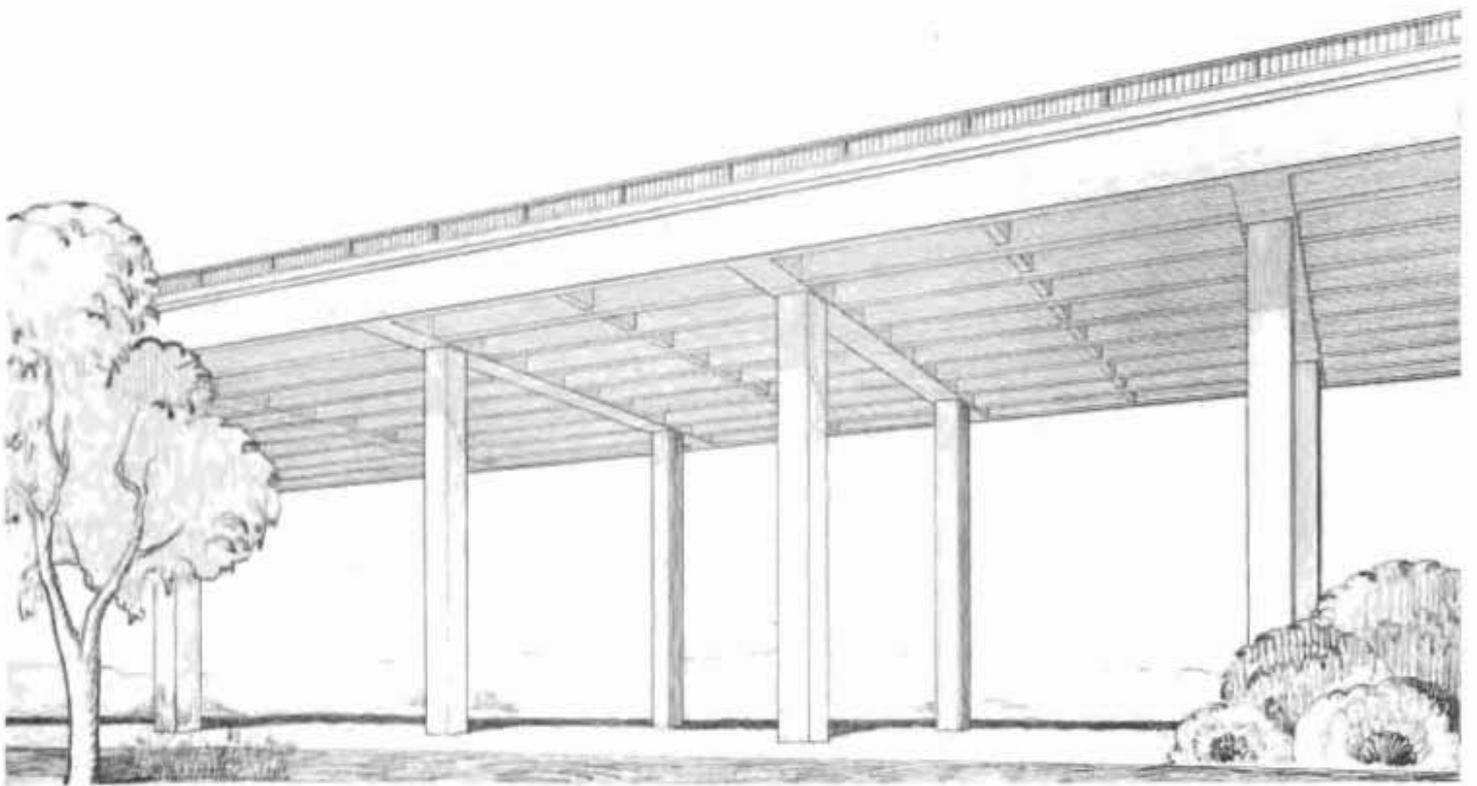
View of Del Paso Boulevard section flooded by overflow waters of American River and closed to traffic

provide for three lanes of traffic. They replace an old narrow timber trestle which crossed the overflow area and intersected the two rail-

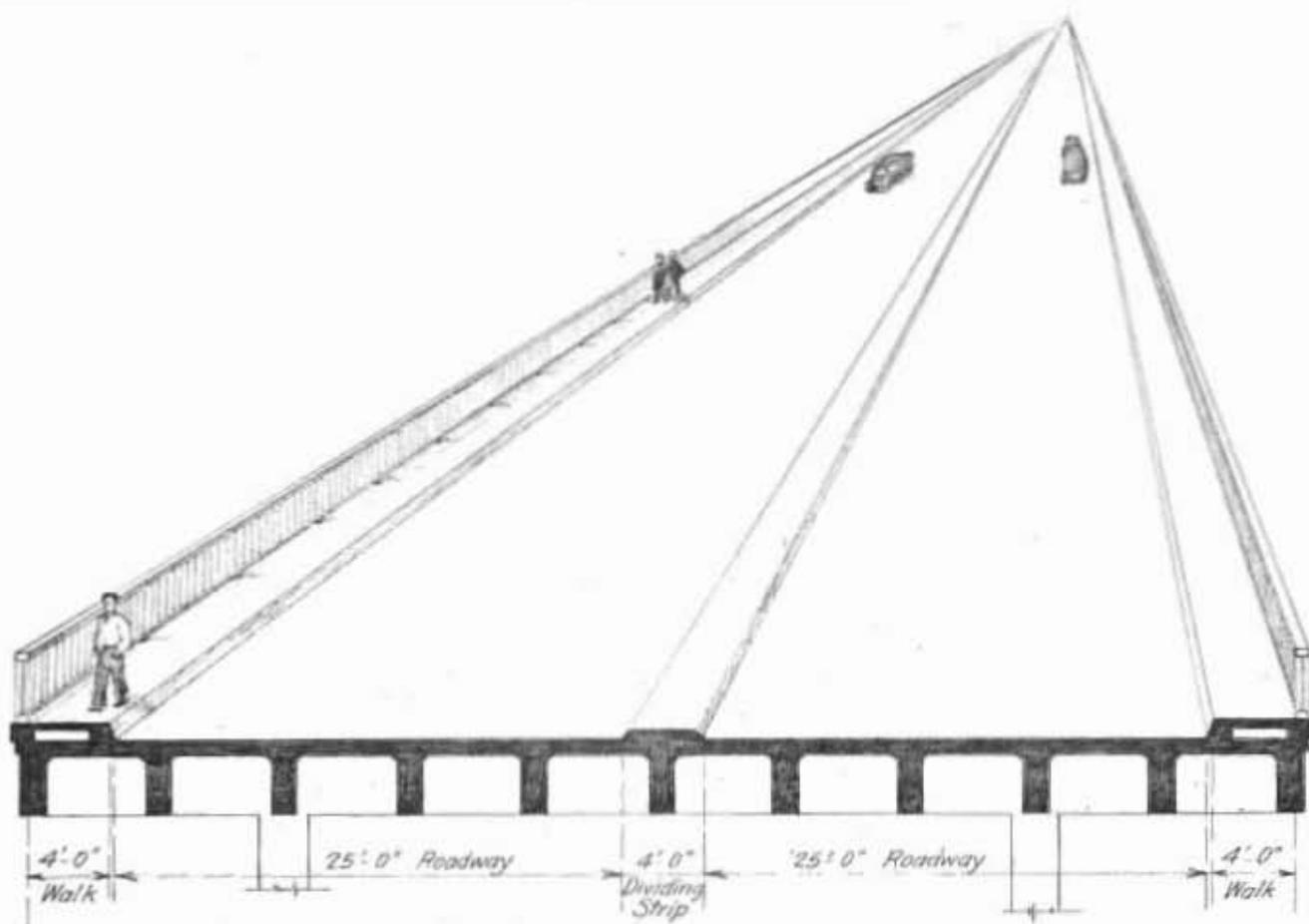
road trestles at two very dangerous grade crossings.

At the time it was replaced this old trestle, on account of its narrow

width with two grade crossings, was entirely inadequate to handle the then existing traffic. It was also in a very dangerous structural con-



Sketch of proposed viaduct that will carry a four-lane divided highway section of U. S. 40 across American River overflow



Perspective sketch of 4-lane divided roadway with two 4-foot sidewalks for North Sacramento viaduct

dition and required constant attention and expense to prevent failure under traffic.

Prior to the construction of the ground-level road, studies were made for an overhead viaduct, passing over both of the railroad trestles. Such a viaduct was estimated at that time to cost between five and six times the cost of the ground-level road with the subways.

Although it was then realized that the construction of a viaduct was the only complete solution to eliminate both the grade crossings and the flood menace; nevertheless, on account of the lack of highway funds at that time, it was necessary to proceed with the cheaper ground-level road which would adequately take care of the then existing traffic, except for the few days every other year or so when the highway was flooded.

In 1932 a levee was built along the north side of the American River Flood channel to confine the overflow

to a definite channel. This levee crosses the highway about 1700 feet northeast of the American River Bridge. This levee protects a portion of North Sacramento from inundation during periods of extreme high water such as occurred in 1928. Where the highway passes through this levee, the Division of Highways in the fall of 1932 constructed flood gates to be closed when the highway was flooded, to prevent the flood waters from flowing through the highway gap in the levee.

The American River Flood Control project is based on a discharge of 180,000 second feet. This is about 25% greater than the discharge for the 1928 flood, as estimated by the U. S. Geological Survey. The project flood plane is 36.1 California Highway Commission datum where the channel crosses the highway. The levees provide about four feet of freeboard above the flood plane. The maximum river stage of record was 32.4 in March, 1928, before the con-

struction of the levee. If the levee had existed, the stage would have been about three feet higher. The peak stage in December, 1937, was 30.6.

The American River channel is about 2400 feet wide between levees. The Sixteenth Street Bridge is 620 feet long across the main channel, which is along the south levee. The proposed viaduct will cross 1700 feet of overflow channel north of that bridge.

The elevation of the existing highway pavement between the railroad subways is elevation 25 C. H. C. datum or 28.7 U. S. E. D. and corresponds to the river stage which requires the closing of the road. However, by placing sand bags along the road between the grade separations, it is possible to keep the road open until the stage is one to two feet higher than this.

The present highway grade, therefore, is about 11 feet below the

(Continued on page 28)



Close-up view of two of the rotary snow plows engaged in widening operations in the Donner Summit area

Snow Removal on State Highway

ALTHOUGH snowfall in California is confined almost entirely to the mountain regions, snow removal is a routine winter task on approximately 3,400 miles of State highways. However, only the more heavily traveled interstate connections and certain important recreational roads are maintained as all-year routes, the balance of the roads being closed with the first heavy snowfall.

The date for the reopening of these roads depends upon the severity of the winter but the policy is to open them for traffic as early as practicable in the spring. The roads over the high passes of the Sierra Nevada Mountains may not be open for summer travel until May or June. Tioga Pass, which reaches an elevation of 9,941 feet, is frequently not opened for summer travel until July.

Donner Highway, U. S. 40, crosses Donner Summit at an elevation of

7,130 feet. This is the main trans-continental route between northern California and the East, and this highway is kept open to all-year traffic under extremely severe winter conditions.

598 INCHES MAXIMUM FALL

The records of the United States Government Weather Station near Soda Springs shows the snowfall in inches at that point during the past six years to have been as follows:

1934-35	-----	498 inches
1935-36	-----	455 inches
1936-37	-----	447 inches
1937-38	-----	598 inches
1938-39	-----	286 inches
1939-40	-----	414 inches

So far this season, up to January 30, 1941, the snowfall at this point has been 252 inches. The picture on the cover of this issue illustrates two three-auger rotary plows at work in widening U. S. 40 just west

of Donner Summit. Rotary type plows are indispensable in deep snow and for widening out after the first cut is made.

The job of maintaining the Red Bluff-Susanville lateral, State Sign Route 36, as an all-year route is second in magnitude only to U. S. 40. This route crosses Morgan Summit at an elevation of 5,713 feet, and Fredonyer Summit at 5,748 feet.

The snowfall on Morgan Summit is comparable to Donner, the pack on the ground at this point being 104 inches on January 30, 1941. Although Fredonyer is higher than Morgan, the snowfall is considerably less. It is difficult to see why this should be, but weather conditions present many inconsistencies.

16 FEET AT LASSEN

The point of greatest snowfall on the California State Highway System is on State Sign Route 89 at the

(Continued on page 28)

Ten Bridges Required for Davis-Dixon Realignment

THE work of realigning U. S. 40 in Solano and Yolo counties from a point about 1.3 miles north of Dixon to about 1.0 mile east of Davis is now well under way. The original grading contract for this 7.3 miles of new highway has been completed by Fredrickson Brothers, the general contractor.

Construction of the new subway under the Southern Pacific Railroad about 0.7 mile southwest of Davis by general contractor Heafey-Moore and Fredrickson and Watson Construction Company is approximately 75 per cent completed, and the work of constructing six bridges by general

many of the earlier highways, the existing highway in the vicinity of this new project more or less follows section lines.

The new project will cut diagonally across sections, thereby saving 3.25 miles of distance and reducing the curvature from approximately 612 degrees to about 144 degrees.

The first five miles of this project from Dixon toward Sacramento have been graded for two lanes of traffic with provision for the ultimate development of a four-lane divided highway. The remainder of the project is being constructed to four-lane divided highway standards. It is now planned

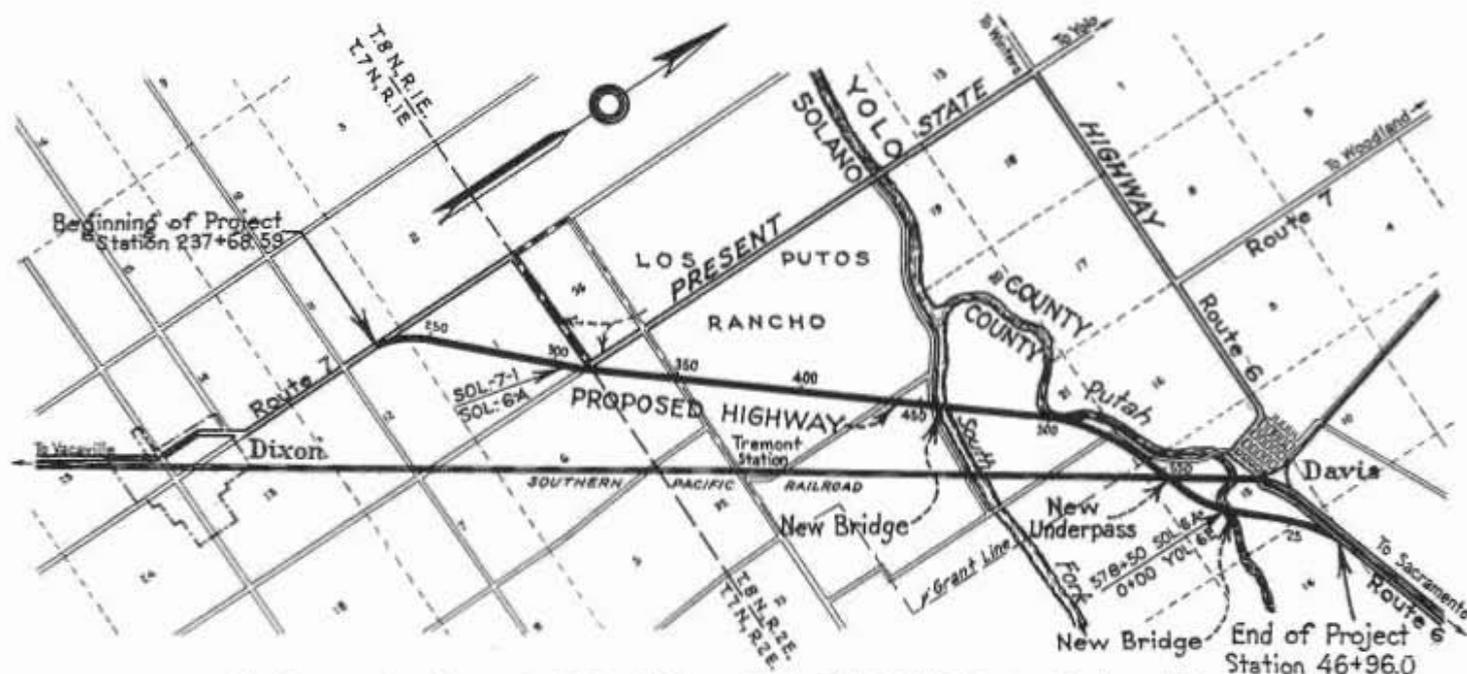
adjacent to the two-lane bridges now under construction.

All companion bridges are separated a distance of 28 feet between inside gutter lines, and approach roadways are separated by a 32-foot dividing strip.

TEN BRIDGES REQUIRED

The two bridges at Putah Creek will be 210 feet long, the two at the South Fork of Putah Creek will each be 478 feet long. The six at the Putah Creek overflows will each be 52 feet 6 inches in length.

All bridges will be of reinforced concrete construction and will each



Sketch map of realignment of State Highway Route 6 (U. S. 40) between Davis and Dixon

contractor E. T. Lesure across Putah Creek, the South Fork of Putah Creek and Overflows is well under way.

SAVES 3.25 MILES

The project consists, in general, of an urgently needed realignment of a portion of the principal cross-state highway in Northern California. This highway runs from the San Francisco Bay Area, through Sacramento and continues east to the Nevada State line. In common with

to make the entire project a four-lane divided highway throughout.

FOUR COMPANION BRIDGES

To provide the additional two lanes on that portion of the project now graded for two lanes, companion bridges will be required at the South Fork of Putah Creek and at the three Putah Creek Overflows. These four bridges are located between Dixon and the new railroad separation structure, and will be built parallel and

provide a 27-foot roadway with two narrow walkways.

The new subway consists of a steel and concrete structure designed for two 27-foot roadways with a six-foot dividing strip and two four-foot sidewalks. The cost of the subway will be approximately \$190,000.

The accompanying photographs show progress of the work at the subway and at the South Fork of Putah Creek.



Progress of construction on the realignment of U. S. 40 between Davis and Dixon is shown in the above pictures. At top—Graded section approaching newly completed subway under tracks of Southern Pacific near Davis. Center—Building companion bridges across Putah Creek. At bottom—Grading operations for four traffic lanes and division strip

California Finds Cause of Cement Concrete Failure

THE DECEMBER 1940 Proceedings of the American Society of Civil Engineers contain a paper descriptive of a notable piece of research work successfully carried out during the last two years by the Materials and Research Department of the California Division of Highways on the causes of the excessive expansion and disintegration of portland cement concrete in certain sections of the State.

Not only was the cause of the trouble ascertained, thus solving a problem which has mystified engineers for the last twenty years, but specifications and test procedure have been set up which will insure against similar failures in the future, thereby saving the State hundreds of thousands of dollars over a period of years; a saving many times the cost of the investigation.

The conclusions from the study with substantiating evidence that the excessive expansion was due to a chemical reaction between the cement and certain types of minerals in the rock and sand has attracted national attention.

Checking the work done by this department, the United States Bureau of Reclamation has since definitely traced some of the concrete troubles of that agency to a similar cause.

The implications are so broad and far reaching as to cause concern that similar conditions may be the occasion of other hitherto unexplained concrete troubles, and in this connection the bureau is proposing to submit for the consideration of the cement industry in the western States a comprehensive program of cooperative research.

WESTERN HEMISPHERE TRAVEL INCREASES

Travel increases between the United States and other areas in the Western Hemisphere ranged from 12 to 48 per cent in the first half of 1940 as compared with the same period in 1938, according to a report made to Secretary of the Interior Harold L. Ickes by W. Bruce MacNamee, chief of the United States Travel Bureau.

1,646,659 Vehicles Used Three State Toll Bridges in January

IN SPITE of continued wet and stormy weather throughout the month, the January traffic on the San Francisco-Oakland Bay Bridge held up well. On January 1, 1941, 69,077 vehicles crossed the bridge making it the third heaviest day since the opening on November 12, 1936. The total for the month was 1,369,871 vehicles, representing an increase of 61% over January, 1940.

This growth in traffic is attributable in part to the two toll reductions made effective during 1940, to the final abandonment of the automobile ferry service between San Francisco and Oakland, and to the general increases in traffic which have been

particularly noticeable in areas where National defense activities are under way.

The Carquinez Bridge, with a total of 265,422 vehicles for the month, showed an even greater proportionate increase over the same month of the previous year. The principal contributing causes in this case appear to be the toll reduction put into effect with State operation and the greatly accelerated construction program at Mare Island Navy Yard.

Traffic for January on the San Francisco-Oakland Bay Bridge and the Carquinez and Antioch bridges is tabulated below:

	San Francisco-Oakland Bay Bridge	Carquinez Bridge	Antioch Bridge
Passenger autos and auto trailers.....	1,254,602	241,413	9,462
Motorcycles and tricars.....	2,753	404	15
Buses.....	21,398	4,519	188
Trucks and truck trailers.....	67,235	18,894	1,695
Others.....	23,883	192	6
Total vehicles.....	1,369,871	265,422	11,366

Grapevine Grade Sliding Hill to be Stopped

(Continued from page 18)

This mass of earth will completely fill the narrow canyon of Grapevine Creek to a depth of about forty feet through the section where hillside movements are occurring. To prevent the possibility of the creek cutting out this fill, a concrete lined channel with a special spillway at its lower end will be constructed for a distance of nearly two thousand feet, requiring the use of some 3,800 cubic yards of reinforced concrete.

The fill will not only act to brace the moving hillside against the opposite side of the canyon but will also act as a counterweight to balance the earth pressures which now tend to heave or lift the stream bed.

WILL MAINTAIN TRAFFIC

Traffic will be maintained through the work at all times and the construction is to be so handled as to give the least possible interference to the convenience of the traveling public. Three hundred working days

are allowed for completion of the contract.

The work of widening the present three-lane pavement to a four-lane divided highway will be handled under a contract to be let after the present project has been completed. Funds for this purpose are provided in the budget for the coming biennium.

Federal Defense Road Program

(Continued from page 7)

two-year period and 25 per cent less than for the fiscal years ending June 30, 1938 and 1939.

If improvement to the designated access, industrial and strategic roads is to be accomplished within a reasonable time without complete disruption of normal State highway development, additional Federal appropriations must be made by the Congress to finance defense road construction and provisions made for the administration of such appropriations by the Federal agencies which handle regular Federal aid to the States for highway construction.

200 Road Contracts Put Under Way in 54 Counties in 1940

(Continued from page 17)

Five contracts for overhead structures to accommodate cross traffic led to the completion of the Arroyo Seco Parkway between Los Angeles and Pasadena and permitted the opening of this \$7,000,000 project to the residents of this congested area.

FEEDER ROAD CONTRACTS

In cooperation with the counties of Fresno, Modoc, San Diego, Santa Clara and Siskiyou, seven contracts totaling \$356,000 were awarded for constructing 22 miles of roadway, three bridges and a railroad underpass on roads off the State Highway System. These projects were financed entirely by Federal feeder highway and county funds.

On January 1, 1941, the Division of Highways entered the final quarter of the current biennial period with only about 37 major budgeted projects estimated to cost \$3,040,000 remaining to be placed under way before July 1 of this year, the beginning of the 93d-94th biennium.

This favorable condition places the Division of Highways in a position to begin the preparation of plans and specifications on major projects included in the proposed budget for the coming biennium estimated to cost \$48,615,000 as soon as the State Legislature adopts the budget.

Federal aid allocations to California to help finance the proposed construction program are estimated to amount to \$7,600,000 for the two-year period.

For Future Publication

Publication of the article describing activities and functions of the Department of Public Works announced to appear in this issue has been postponed owing to unavoidable delay in its preparation.

This feature will be published, however, in response to numerous requests in a future issue.

ATTENTION, PAINTERS!

Wife (rousing husband): "I believe a burglar's trying to open the drawing-room window."

Husband: "Good, I haven't been able to move it since the painter was here."

Highway Bids and Awards for January, 1941

FRESNO COUNTY—Remove existing roofing and install new roofing on Highway Equipment Shop, District VI. Faris-Osborne Co., Inc., Fresno, \$1,080. Contract awarded to C. E. McMullin Co., Fresno, \$948.

IMPERIAL COUNTY—Reinforced Portland cement concrete bridge across Central Main Canal, 2 miles west of Brawley. District XI, Route 26, Section G. Contracting Engineers Co., Los Angeles, \$18,905; J. S. Metzger & Sons, Los Angeles, \$16,950; W. H. Barber, La Mesa, \$15,766; H. L. Foster, San Diego, \$18,667; J. E. Anderson, Visalia, \$13,985. Contract awarded to Thomas Construction Co., Burbank, \$13,983.

INYO COUNTY—Between Otey's Corner and Bishop, about 1.9 miles to be graded and surfaced with roadmix surfacing. District IX, Route 76, Section B. Brown & Doko, Pismo Beach, \$19,632; Basich Bros., Torrance, \$20,452; Vido Kovacevich, South Gate, \$24,072; Oswald Bros., Los Angeles, \$27,331; Shea & Beebe, Hawthorne, Nevada, \$29,677. Contract awarded to James E. Anderson, Visalia, \$17,998.

KERN COUNTY—Between 1.7 miles south of McKittrick and the junction with Route 58 north of McKittrick, about 1.9 miles to be graded and surfaced with plant-mix surfacing on gravel base. District VI, Route 138, Section B. Rexroth & Rexroth, Bakersfield, \$59,918; J. E. Haddock, Ltd., Pasadena, \$62,729; Piazza and Huntley, San Jose, \$62,749; Claude C. Wood, Lodi, \$63,128; Macco Construction Co., Clearwater, \$64,264; A. Teichert & Son, Inc., Sacramento, \$65,063; Oswald Bros., Los Angeles, \$67,931; Griffith Company, Los Angeles, \$71,265; Clyde W. Wood, Los Angeles, \$73,423. Contract awarded to Fredericksen & Westbrook, Sacramento, \$58,249.

LOS ANGELES COUNTY—An undercrossing to be constructed under the tracks of the A. T. & S. F. Ry. on Foothill Boulevard in the city of Azusa, including the reconstruction of Virginia Avenue and the construction of service roads. District VII, Route 9, Section Azu. United Concrete Pipe Corp., Los Angeles, \$207,572; Griffith Co., Los Angeles, \$208,667; Carlo Bongiovanni, Los Angeles, \$212,222; Ralph A. Bell, San Marino, \$212,322; Werner & Webb, Los Angeles, \$227,053; Nick Perscallo, Los Angeles, \$227,602. Contract awarded to J. E. Haddock, Ltd., Pasadena, \$192,392.

LOS ANGELES COUNTY—Between Cypress Avenue and Azusa, at Big Dalton Wash, a bridge to be constructed, at San Dimas Wash a bridge to be widened and about 0.8 mile to be graded and surfaced with plant-mixed surfacing. District VII, Route 62, Section D. Werner & Webb, Los Angeles, \$53,875; J. S. Metzger & Son, Los Angeles, \$56,328; Griffith Co., Los Angeles, \$59,900; Carlo Bongiovanni, Hollywood, \$60,999; Dimmitt & Taylor, Los Angeles, \$64,596. Contract awarded to J. E. Haddock, Ltd., Pasadena, \$48,516.

LOS ANGELES COUNTY—In the city of Burbank between Broadway and Brighton Street an underpass under the tracks of the Southern Pacific Company to be constructed, about 0.7 mile to be graded and paved with asphalt concrete and Portland cement concrete. District VII, Route 4, Section Brb. Ralph A. Bell, San Marino, \$398,831; Mitty Bros. Construction Co., Los Angeles, \$400,070; J. E. Haddock Ltd., Pasadena, \$409,782; Carlo Bongiovanni, Los Angeles, \$415,547; Radich & Brown, Burbank, \$516,077. Contract awarded to Byerts & Dunn and Oscar Oberg, Los Angeles, \$366,050.

NAPA COUNTY—Between Capell Valley and junction with Route 6, about 2.6 miles to be graded, bituminous surface treatment to be applied thereto and a reinforced concrete bridge to be constructed. District IV,

Route 102, Section A. Claude C. Wood & L. D. Tonn, Lodi, \$109,781; Macco Construction Co., Clearwater, \$110,910; Grandfield, Farrar & Carlin, San Francisco, \$112,071; A. Teichert & Son, Inc., Sacramento, \$117,528; Heafey-Moore Co. & Fredrickson & Watson Construction Co., Oakland, \$120,379; Louis Biasotti & Son, Stockton, \$121,711; Parish Bros., Hollywood, \$125,755; Fredericksen & Westbrook, Sacramento, \$126,382. Contract awarded to Fredrickson Bros., Emeryville, \$106,689.

ORANGE COUNTY—Between Newport Beach Boulevard and Corona del Mar, about 6.3 miles to be graded and surfaced with plant-mixed surfacing on cement treated base. District VII, Route 184, Section A. Npt. B. Griffith Co., Los Angeles, \$219,973; J. E. Haddock, Ltd., Pasadena, \$227,471; Oswald Bros., Los Angeles, \$229,806; Match Bros., Elsinore, \$239,970; Clyde W. Wood, Los Angeles, \$255,381; Fredericksen & Westbrook, Sacramento, \$256,980; Sully-Miller Contracting Co., Long Beach, \$263,259; Ralph A. Bell, San Marino, \$276,646. Contract awarded to Mitty Bros. Construction Co., Los Angeles, \$197,408.

RIVERSIDE COUNTY—Between Dra-caea Avenue and Route 19, about 1.5 miles to be graded and surfaced with plant-mixed surfacing on cement treated base. District VIII, Routes 78, 19, Sections D, C. F. Gunner Gramatky, Pasadena, \$47,884; J. E. Haddock, Ltd., Pasadena, \$48,140; Match Bros., Elsinore, \$53,355; Dimmitt & Taylor, Los Angeles, \$58,170. Contract awarded to Oswald Bros., Los Angeles, \$44,091.

SACRAMENTO-SAN JOAQUIN COUNTIES—Between 0.5 mile west of Mokelumne River and Terminous, about 4.8 miles to be graded and bituminous surface treatment applied. District X, Route 53, Sections C, C. Basalt Rock Co., Inc., Napa, \$295,423; A. Teichert & Son, Inc., Sacramento, \$342,608; Lee J. Immel, Berkeley, \$350,739; Heafey-Moore Co. & Fredrickson & Watson Construction Co., Oakland, \$355,708; Macco Construction Co., Clearwater, \$384,728. Contract awarded to Clyde W. Wood, Los Angeles, \$248,683.

SAN DIEGO COUNTY—On Mission Boulevard in City of San Diego, between West Point Loma Boulevard and Pacific Beach Drive, about 2.7 miles to be graded and surfaced with Portland cement concrete base, asphalt concrete leveling course, a reinforced concrete slab bridge to be constructed and an existing reinforced concrete bridge and a timber and steel causeway to be remodeled. District XI, R. E. Hazard & Sons, San Diego, \$122,831; Griffith Co., Los Angeles, \$124,357; Daley Corp., San Diego, \$126,875. Contract awarded to V. R. Dennis Const. Co., San Diego, \$119,440.

SAN MATEO COUNTY—Construct a reinforced concrete arch culvert at Montana Creek. District IV, Route 56, Section D. A. A. Tieslau, Berkeley, \$3,283; Louis Biasotti & Son, Stockton, \$3,315; Peter Sorensen, Redwood City, \$3,745; Central California Construction Co., San Francisco, \$3,765; Albert H. Siemer & John Carcano, San Anselmo, \$3,940; R. G. Clifford, South San Francisco, \$3,989; C. C. Gildersleeve, Berkeley, \$4,045; Guerin Bros., San Francisco, \$4,100; A. Teichert & Son, Inc., Sacramento, \$4,300. Contract awarded to F. Fredenburg, South San Francisco, \$2,927.

SONOMA COUNTY—Between Llano Road and Wright St., about 1.6 miles to be graded and surfaced with plant-mixed surfacing. District IV, Route 51, Section C. Fredrickson Bros., Emeryville, \$57,734; Claude C. Wood, Lodi, \$64,408; Heafey Moore Co. & Fredrickson & Watson Construction Co., Oakland, \$66,149; E. A. Forde, San Anselmo, \$69,949; A. G. Ralsch, San Francisco, \$71,712. Contract awarded to Louis Biasotti & Son, Stockton, \$55,044.

North Sacramento Viaduct Plans

(Continued from page 22)

adopted flood plane and 7.4 feet below the 1928 flood stage. Since the highway is crossing an overflow channel, the Flood Control District and the State Reclamation Board would not permit construction of high levees to protect the highway, since such construction would raise the level of the flood waters and endanger the main levees with consequent flooding of adjacent area.

The alignment for the new structure going north from the Sixteenth Street Bridge deflects slightly to the right and crosses the north levee about 300 feet from the existing road. This permits the use of the present highway without interference during the construction of the viaduct except at the south end. The viaduct structure will start about 300 feet north of the north end of the bridge, will be 1496 feet long, consisting of 36 spans of 41 feet with a 10-foot cantilever span at each end.

FOUR-LANE HIGHWAY

The viaduct will have a 4-lane divided highway, two 25-foot roadways with a 4-foot dividing strip between, plus two 4-foot sidewalks. It will be a continuous reinforced concrete structure supported on two post reinforced concrete bents on pile foundations, since the soft silt and clay soil found near the surface is not suited to spread footings. There will be a total of five expansion joints in the length of the structure.

Profile grade over the new structure is controlled by the elevation of the existing bridge, the required vertical clearance over the two railroads and the desired sight distance over the crown.

A vertical curve 1050 feet long is to be used connecting approach grades, which are 6.2 per cent at the point where they intercept the inverted vertical curves running off on the approaches. At the point of maximum height, the new viaduct will be slightly more than 50 feet above the ground.

Where the viaduct crosses the railroad trestles, it is necessary to provide sufficient clearance above the railroad tracks to permit the future raising of the railroad trestles to

In Memoriam

James McCulloch Call

March 19, 1900—January 21, 1941

The untimely death of Jim Call on January 21, 1941, was a distinct shock to his host of friends and fellow workers in the Department of Public Works and the Division of Highways. Through his passing, the Division has lost a valuable and conscientious employee who rose through the ranks during eighteen years of loyal service to the responsible position of Supervising Outdoor Advertising Inspector in the Headquarters Maintenance Department.

Jim's kind and unselfish nature endeared him to all his associates, who will always remember his friendly disposition and willingness to lend a helping hand. He was widely known throughout the organization, having worked in the district offices of Districts III, VI, IX and X, with contacts in all the other Districts in his capacity as Supervising Outdoor Advertising Inspector.

The sudden ending of his successful career was a severe blow and great loss to his widow, Mrs. Ruby Call, and three weeks old daughter, Sharon. To Mrs. Call and her daughter is extended the deepest sympathy of all Jim's friends and employees of the Department of Public Works.

place the clearance line of these trestles three feet above the flood plane. This will require about a 2-foot raise of the Sacramento Northern trestle and a 6-foot raise of the Western Pacific trestle.

28-FOOT CLEARANCE

To provide for this raise in addition to the clearance over a railroad track required by the Railroad Commission the under side of the deck of the highway structure will be 28 feet above the present railroad trestle.

The north end of the viaduct will extend about 100 feet beyond the north levee where it will intersect the approach fill. The maximum height of the approach fill will be about 35 feet. From the north end of the viaduct the approach ramp will curve to the left and intersect the existing road at ground-level about 1600 feet north of the levee.

DETOUR ROADS NECESSARY

The construction of the southerly 250 feet of the new viaduct will interfere with traffic on the existing highway and will require the surfacing of short detour roads around the construction. These detour roads

Snow Removal On Highways

(Continued from page 22)

south entrance of Lassen National Park, where, as of this date, the snow pack is 16 feet in depth.

The usual procedure for maintaining an open road through snow country consists of removing the snow as it falls, the work being carried on continuously for the duration of the storm when necessary to keep traffic moving. In territory where only an occasional light fall of snow occurs, the regular maintenance equipment may be sufficient to keep the road open, or this may be supplemented by trucks equipped with push plows.

In territory where snow removal is routine, heavy four-wheel-drive trucks are provided, equipped either with straight or reversible blades, or V type of blade, or where snowfall is heavy, two- or three-auger rotary type plows are used.

At the present time, the State Division of Highways is operating 30 rotary snow plows. In addition to these, there are also in service 176 blade plows, 41 graders, 15 tractors, and about 195 trucks. This equipment represents an investment by the State of over \$1,300,000.

will serve as approach roads to the Garden Highway connection after the new viaduct has been completed.

Traffic from Sacramento for the Garden Highway will be carried under the new viaduct after crossing the Sixteenth Street Bridge without the necessity of crossing south-bound traffic.

As required by law, the plans for this structure over the overflow channel were submitted to the State Reclamation Board and were approved by that Board at their meeting on January 15. Plans will also be submitted to the State Railroad Commission since the structure involves an overhead over two railroads.

Detailed contract plans and specifications are now nearing completion and will be ready for advertising as soon as funds are available. Construction will take about one year after the contract has been awarded.

State of California

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Department of Public Works

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

FRANK W. CLARK, Director of Public Works

FRANZ R. SACHSE, Assistant Director

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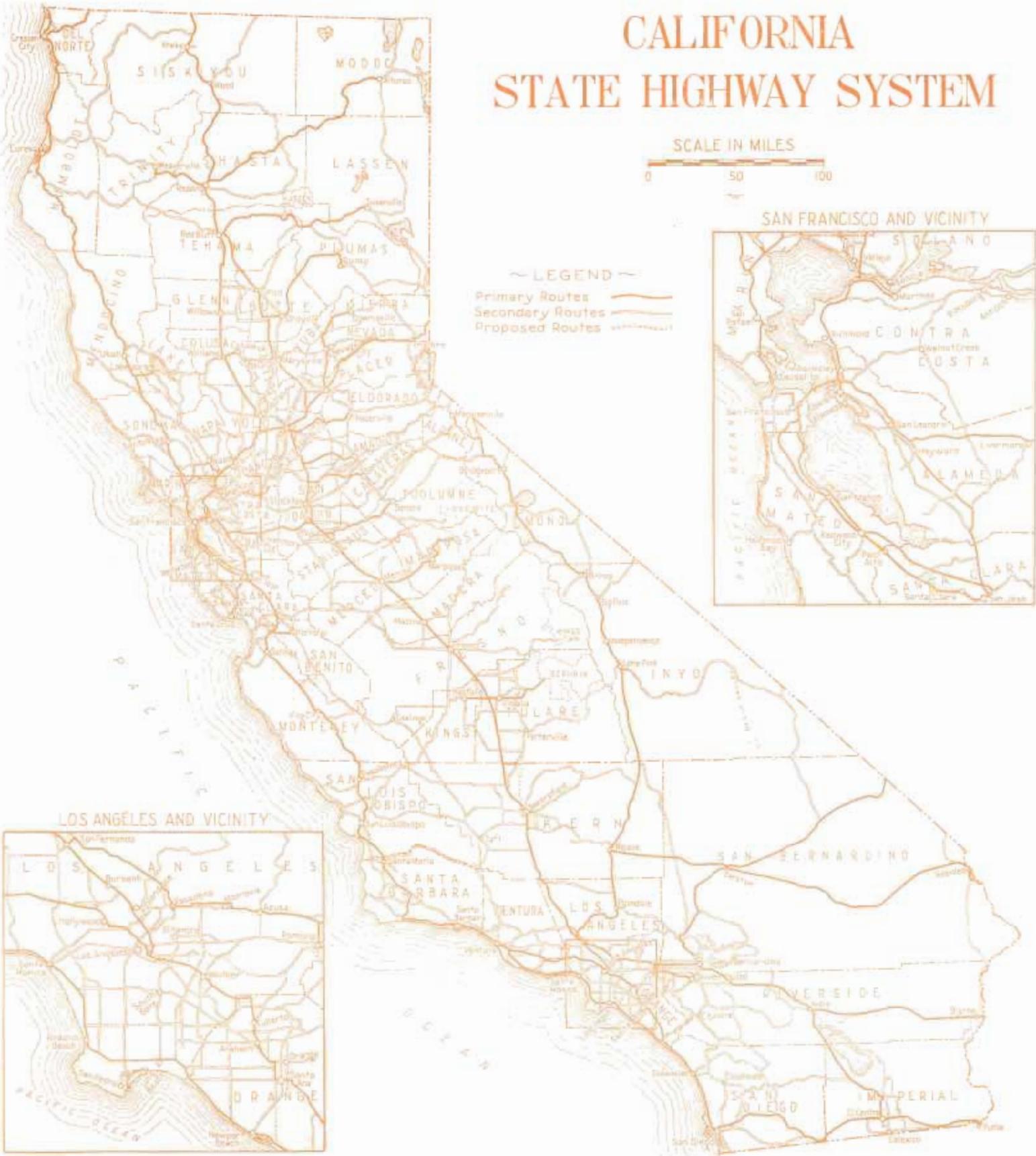
CALIFORNIA STATE HIGHWAY SYSTEM

SCALE IN MILES

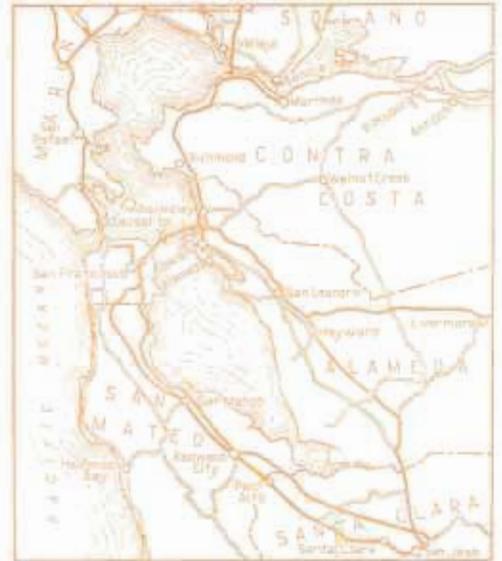


~ LEGEND ~

- Primary Routes
- Secondary Routes
- Proposed Routes



SAN FRANCISCO AND VICINITY



LOS ANGELES AND VICINITY

