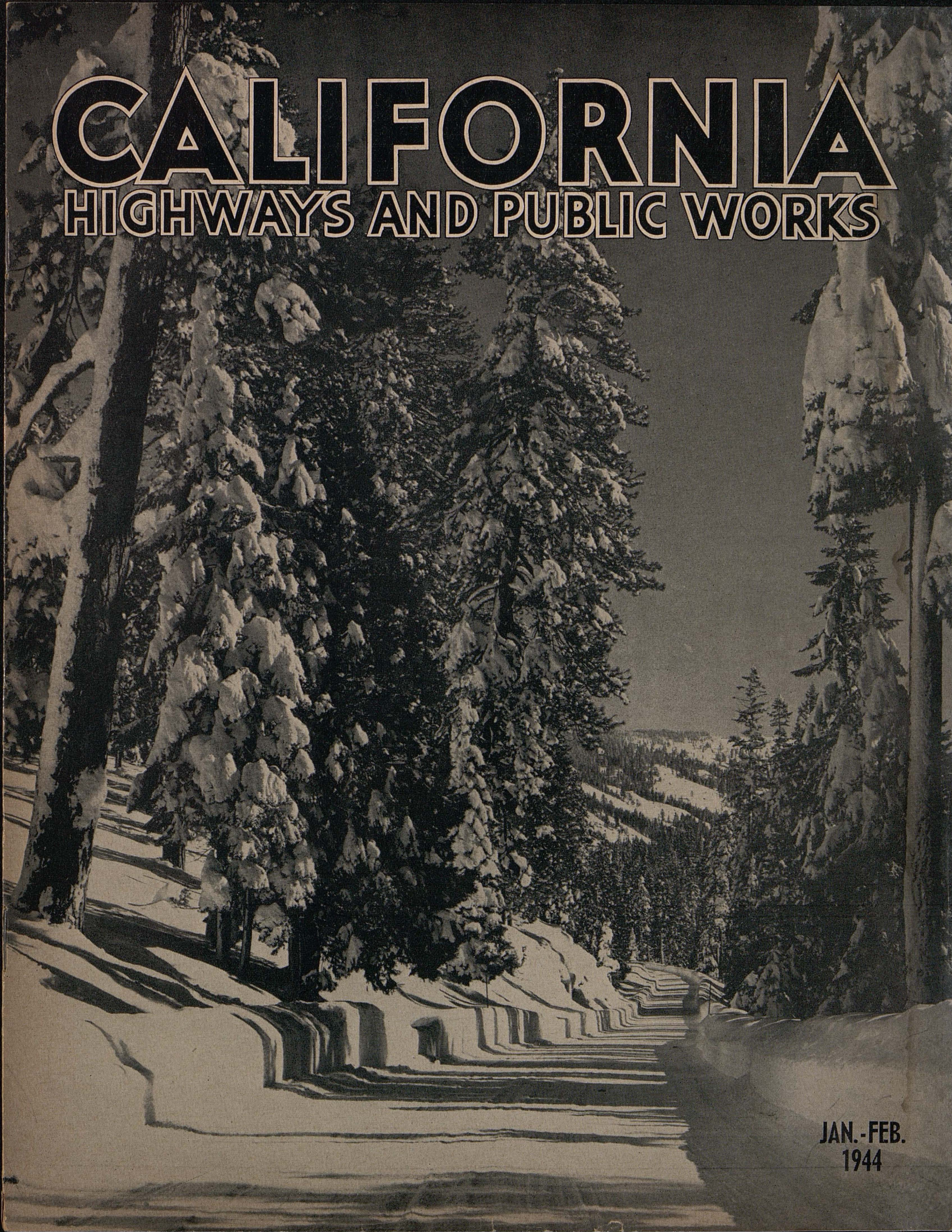


CALIFORNIA

HIGHWAYS AND PUBLIC WORKS



D50 Illuminant, 2 degree observer

inches

1	38.12	65.43	49.87	44.26	55.56	70.82	63.51	39.92	52.24	97.06	92.02	87.34	82.14	72.06	62.15
2	13.24	18.11	-4.34	-13.80	9.82	-33.43	34.26	11.81	48.55	-0.40	-0.60	-0.75	-1.05	-1.19	-1.07
3	15.07	18.72	-22.29	22.85	-24.49	-0.35	59.60	-46.07	18.51	1.13	0.23	0.21	0.43	0.28	0.19
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Density

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Golden Thread

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-0.25	38.62	29.86	16.19	0.29	3.44	31.41	72.46	72.95	23.37	54.91	43.96	82.74	52.79	50.87
-0.16	-0.19	0.54	-0.05	-0.81	-0.23	20.98	-24.45	16.83	13.06	-38.91	52.00	34.45	50.88	-27.17
0.07	-0.04	0.60	0.73	0.19	0.49	-19.48	55.95	63.50	-49.49	30.77	30.00	81.28	-12.72	-28.46

Colors by Munsell Color Services Lab

centimeters

Don Williams

JAN.-FEB.
1944

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

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

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Nos. 1, 2

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State Highway Commission Approves 61 Projects for Road Repairs This Summer Totaling 357.8 Miles

THE highway program proposed for postwar construction by Director of Public Works C. H. Purcell, State Highway Engineer George T. McCoy, and the California Highway Commission was modified to some degree by the commission at its meeting in Sacramento on January 20th when a few projects were added to the previously adopted list shown in the November-December issue of this magazine. The commission also approved a program for imperative repairs to highways this summer estimated to cost \$3,216,000.

With the added projects the postwar program now includes 124 projects covering approximately 588 miles of proposed road improvements as well as more than 100 bridges and grade separations.

The additional postwar projects voted by the commission as the result of more detailed and accurate estimates that had become available are as follows:

FOR POSTWAR CONSTRUCTION

Colusa County, Route 7, from Arbuckle to 4 miles south of Williams, grade and surface and five bridges, 6.4 miles.

Sonoma County, Route 1, from south county boundary to one mile south of Petaluma, grade and pave, 3 miles.

Sonoma County, Route 1, from 0.3 mile south to 1.7 miles north of Santa Rosa, relocation through city of Santa Rosa, grade and pave, 3.7 miles.

Santa Cruz County, Route 56, from Aptos to Santa Cruz, grade and surface (4-lane divided), 6 miles.

Inyo County, Route 23, between Independence and Division Creek, grade and surface, 10 miles.

Amador County, Routes 65 and 34, from north of Jackson to east and south of Jackson, grade and surface, 2.1 miles.

Lake County, Route 89, from 1.2 miles north of Rodman Narrows

Road to Route 15, Scott and Robinson Creeks bridges, grade and surface, bridges, 2.4 miles.

San Benito County, Route 119, from 0.5 mile north of Cottage Corners to Santa Clara County line, grade and surface, 8.2 miles.

The two projects included in the list published in the November-December issue for surfacing of portions of the Ducor cutoff (Route 129) between Bakersfield and Porterville in Kern and Tulare counties have been replaced by a single project to complete the Ducor cutoff by grading and surfacing the 24 miles between the junction of Routes 4 and 129 and Ducor.

SUMMER REPAIR WORK

The repair program necessary for the reconditioning of highways this summer is urgent, because under the cessation of construction and reconstruction, the State highway system is deteriorating through obsolescence, limited maintenance and the increased rate of damage resulting from large volumes of wartime heavy trucking. It comprises 61 projects totaling some 357.8 miles.

PRIMARY NORTH

Mendocino and Humboldt counties, Route 1, portions between Rattlesnake Summit and Garberville; repair base, place plant-mixed bituminous material and seal coat, 9.8 miles.

Tehama County, Route 29, from junction with Route 83 to easterly boundary; repair base, place plant-mixed bituminous material, 12.9 miles.

Tehama County, Route 29, portions between Paynes Creek and Mineral; repair base, place plant-mixed bituminous material, 16.8 miles.

Modoc County, Route 28, portions between 3 miles east of Rush Creek and Chambers Ranch; repair base, place plant-mixed bituminous material, 14.2 miles.

Lassen and Modoc counties, Route 28, from 3 miles west of Adin to 3 miles east of Rush Creek; repair base, place

plant-mixed bituminous material, 11.7 miles.

Plumas County, Route 29, portions between Tehama County line and Lassen County line; repair base and place plant-mixed bituminous material, 8.0 miles.

Sutter and Butte counties, Route 3, portions between Yuba City and Nelson; repair base and place plant-mixed bituminous material, 5.3 miles.

Butte County, Route 3, portions between Nelson and Chico, repair base and place plant-mixed bituminous material, 2.8 miles.

Sacramento County, Route 4, portions between McConnell and Sacramento; repair base and place plant-mixed bituminous material, 8.3 miles.

Yolo and Colusa counties, Route 7, portions between Bretona and Geneva; repair base and place plant-mixed bituminous material, 3.0 miles.

Placer County, Route 37, portions between Auburn and Colfax; repair base and place plant-mixed bituminous material, 2.0 miles.

Marin County, Route 1, from Manzanita to Golden Gate Bridge; place plant-mixed bituminous material, 3.2 miles.

Alameda County, Route 5, portions between Hayward and Livermore; repair base, place plant-mixed bituminous material and seal coat, 2.3 miles.

Marin County, Route 1, portions between San Rafael and Sonoma County line; repair base, place plant-mixed bituminous material and seal coat, 2.0 miles.

Alameda County, Route 5, from San Joaquin County line to connection with four-lane pavement; repair base and shoulders, place plant-mixed bituminous material, 2.0 miles.

Alameda County, Route 5, from Del Sur Avenue to south city limits of San Leandro; repair base and place plant-mixed bituminous material, 0.3 mile.

Marin County, Route 1, portions between Alto and San Rafael; place

(Continued on page 12)

Arroyo Seco Parkway Extension Adds Four Southbound Traffic Lanes

By A. N. GEORGE, District Construction Engineer

WHEN the Arroyo Seco Parkway was opened between Avenue 22 in Los Angeles and Glenarm Street in Pasadena on December 30, 1940, work had already been started on a road which was to become the southbound traffic lanes of an extension of this Parkway southerly from Avenue 22 to Adobe Street in Los Angeles.

At the time the Parkway was opened it fed southerly into a four-lane undivided highway which crosses over San Fernando Road, the Los Angeles River and the Southern Pacific Railroad on a viaduct which provided for two lanes of traffic in each direction and through four tunnels under Elysian Park to Adobe Street.

Riverside Drive connected with the road just southerly of the viaduct, making a left turn necessary across southbound traffic at grade. Solano Street made a grade intersection with

this road, as did Bishops Road, Cottage Home, Castelar and Bernard Streets.

The year 1941 proved to be a poor year for road construction as by the middle of summer a steel shortage had developed which prevented the steel companies from furnishing the girders for the new viaduct bridge over the Los Angeles River and Riverside Drive. Therefore, the completion of the southbound lanes, which would make it possible to eliminate all of the above mentioned grade intersections, became dependent upon the delivery of these steel girders.

Work on the roadway throughout and on the concrete portions of the new Los Angeles River bridge was carried on during the following years under a WPA project. On December 30, 1942, the WPA project was closed down by the Federal Government, but the major portion of all work necessary to make the highway usable, with the

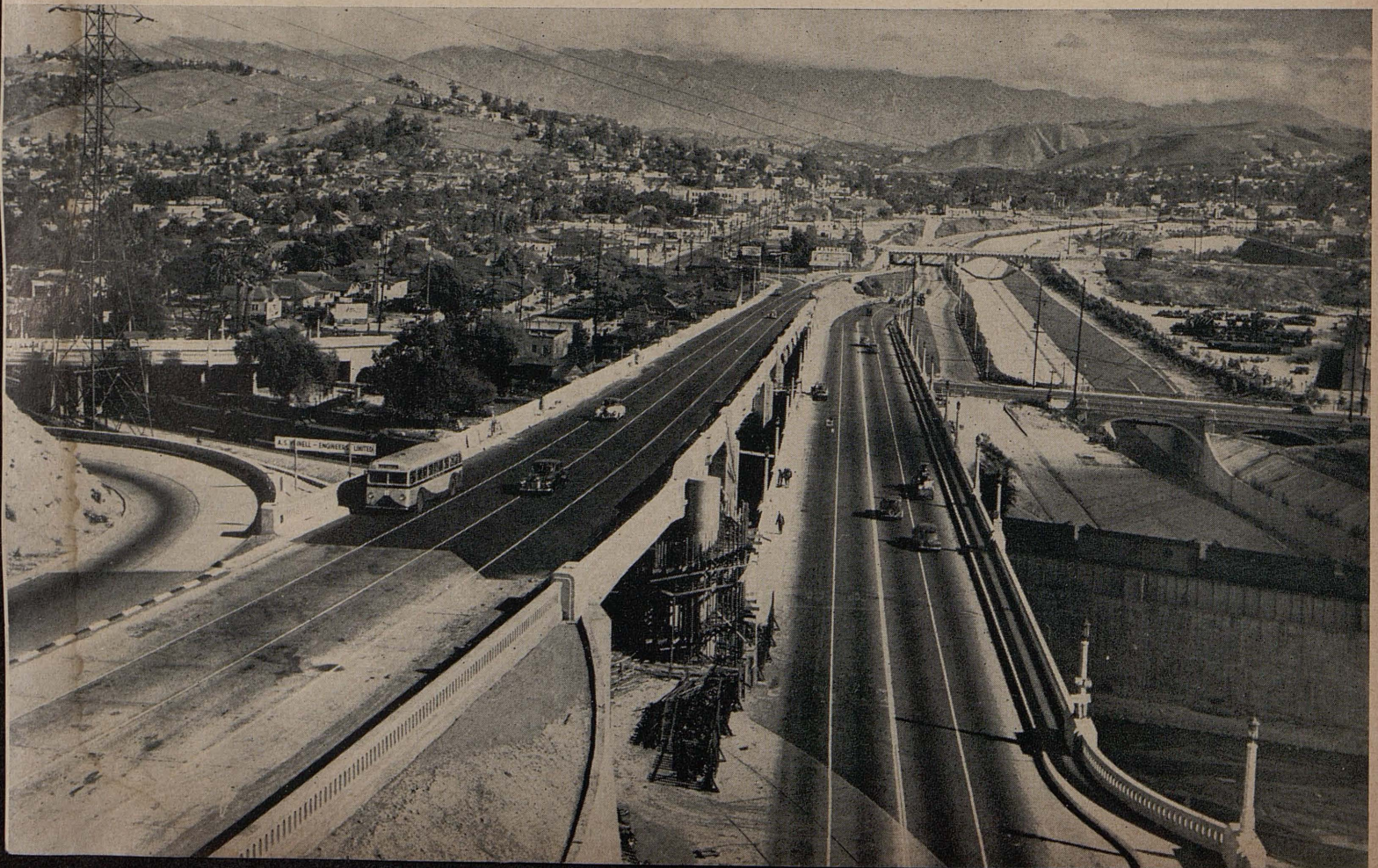
exception of the steel spans of the bridge, had been completed.

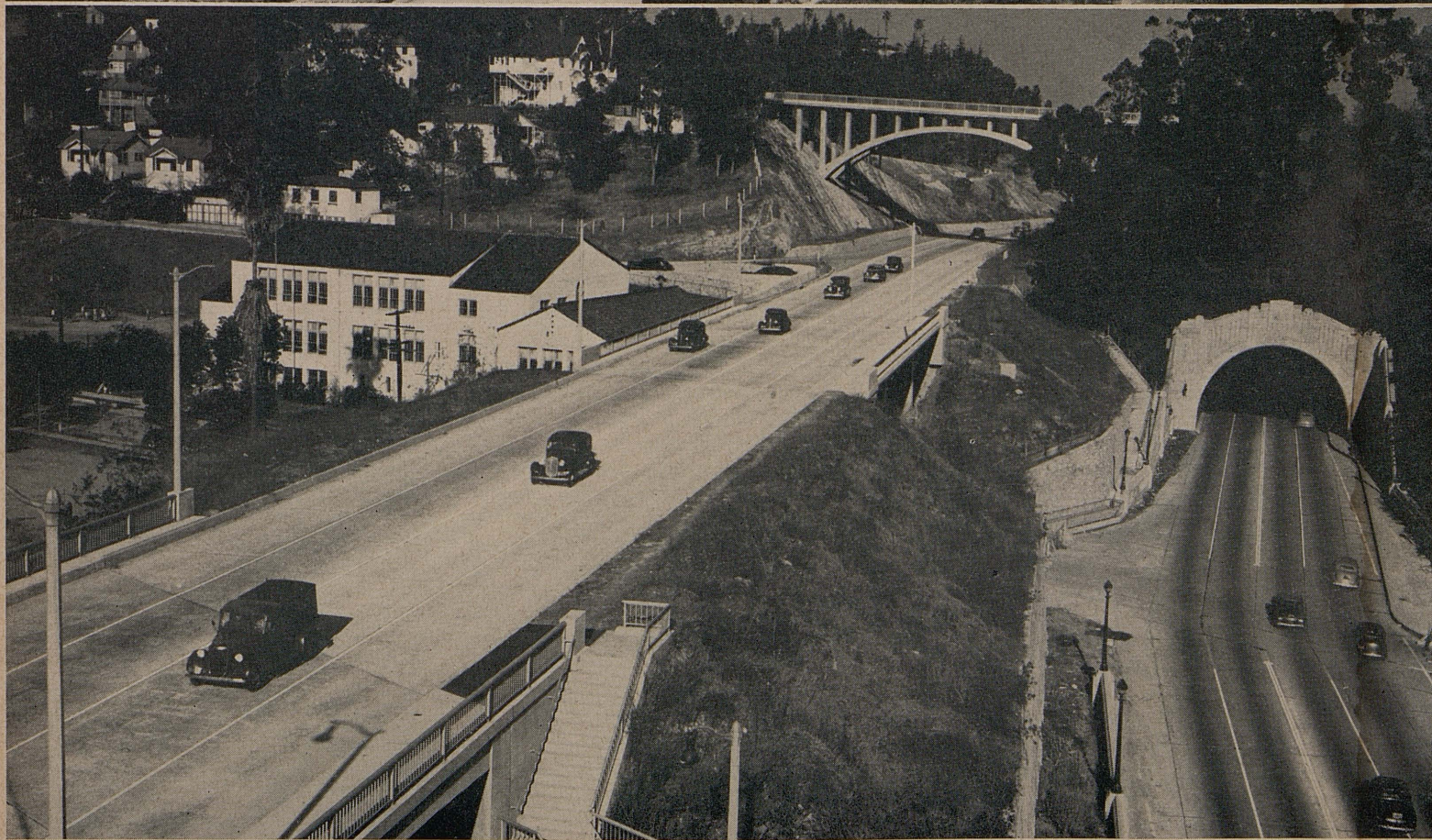
Under the WPA project the piers for the steel structure were constructed and the concrete approach spans, together with all other road work, including curbs and pavement, were completed to Adobe Street. Grade separations at Castelar, Bishops Road, Amador Street, Solano Street, and Park Row were constructed under Bridge Department contracts.

In June, 1943, the Bethlehem Steel Company, who had the contract for the steel superstructure of the Los Angeles River bridge, were able to make delivery and erect the girders. A contract was then awarded to A. S. Vinnell Company and Engineers Limited for the construction of the concrete deck and railing of the river bridge and certain work on the approaches.

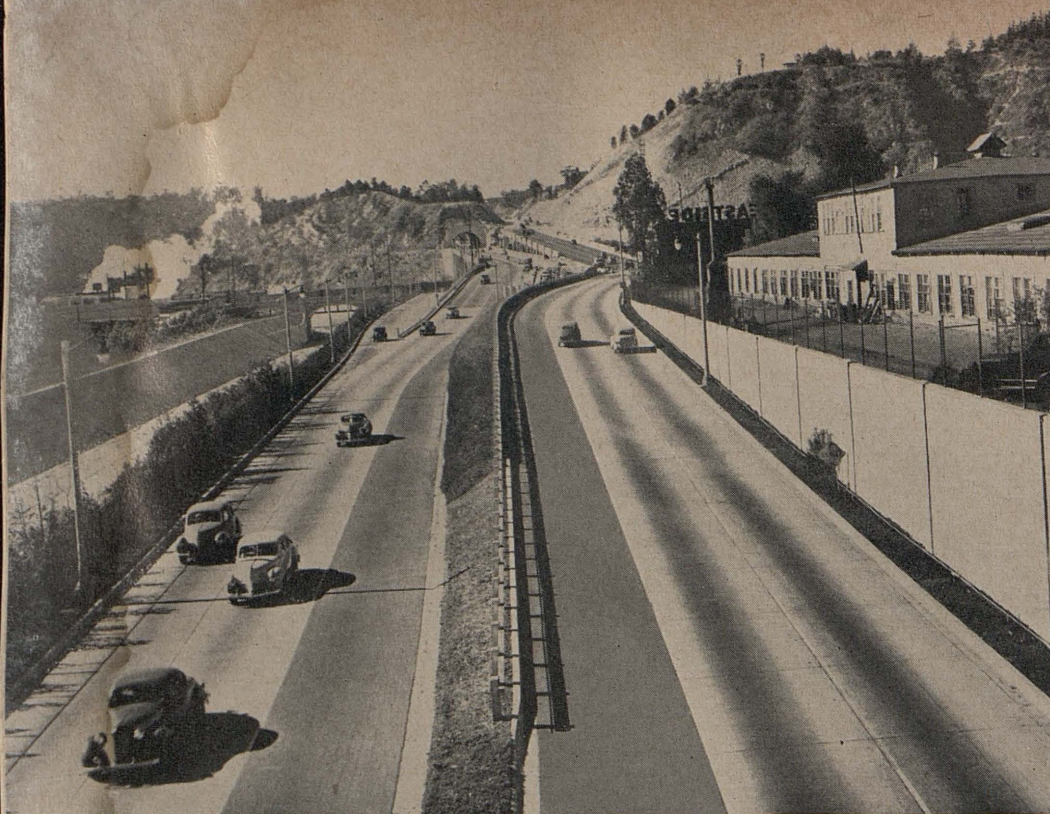
This work was completed to a degree that made it possible to open the south-

The newly completed Arroyo Seco Parkway Extension viaduct and bridge for southbound traffic only are shown at left of picture. Old viaduct and bridge over Los Angeles River for northbound traffic are seen at right.





At top southbound traffic is approaching Los Angeles on new Arroyo Seco Extension and through open cut in Elysian Park, City Hall in background. Old road at left. Below—Southbound traffic passing under Park Row Bridge and Northbound through park tunnel



On the above section of Arroyo Seco Parkway opposing traffic proceeds on different levels separated by railing and planted slope

bound highway on December 31, 1943, thus giving the heavy New Year's day traffic the benefit of the Parkway from Adobe Street in Los Angeles to Glenarm Street in Pasadena. Certain items of work under the A. S. Vinnell Company and Engineers Limited contract are not yet completed, but except for the periods when it will be necessary to divert traffic from the southbound roadway while certain of this work is being done, the public is having the use of the Parkway.

Another small contract has just been awarded to Vido Kovacevich for work in completing an accelerating lane near Bernard Street and some channelizing for inlets at Castelar and Solano streets. Even after this contract is completed, there will remain the landscaping of the highway through Elysian Park and surfacing of certain city streets which were disrupted by the Highway construction.

However, this work is deferred for the duration as not being of sufficient urgency to justify its being completed during the war.

The opening of this section of the Parkway marks another step in the completion of a freeway from the heart of Los Angeles to Pasadena. The construction of such a road has been under discussion at various times since as far back as the 1890's and has been mentioned in each major traffic survey that

was made of the Los Angeles District.

As early as 1922 the Los Angeles City Traffic Commission published a plan of major highways in Los Angeles which called for a roadway up the Arroyo Seco to Pasadena to be built as a double roadway, half on each side of the channel.

Although inviting the construction of a roadway by its freedom of expensive improvements along its banks the Seco presented a very real water hazard to any such highway project. In 1922, however, the cities of Los Angeles, and South Pasadena acquired a large part of the land which would be traversed by a Freeway in the Arroyo for park purposes.

At that time the State Highway Department was limited to the construction of highways outside of cities under bond issue funds. Later, with the advent of the gasoline tax and legislation liberalizing the highway policy, the State became actively interested in the construction of this freeway.

Still, the menace of flood water and the necessary heavy expenditure to protect against this menace was regarded a serious obstacle to construction of a highway along this location.

When the depression struck and it became necessary to find productive employment for a large number of men in the metropolitan area, the lining of

the channel with concrete as a protection against flood waters in the Arroyo presented itself as a desirable project.

CHANNEL LINED BY WPA

Work on this lining was started by various relief agencies and was taken over by the WPA when that agency was formed and the lining of the channel from the south boundary of Pasadena to the Los Angeles River was completed by that agency with a Federal expenditure of \$7,000,000, and an expenditure of \$880,000 by four sponsors: the State Division of Highways and the cities of Pasadena, South Pasadena, and Los Angeles.

This expense, however, can not properly be chargeable entirely against the Parkway as the channel lining has also provided protection to park lands and private residence property.

With the flood waters adequately provided for, the construction of the highway presented no serious difficulties, and from its very inception has been marked by very complete cooperation by all of the agencies involved, which included the cities of Pasadena, South Pasadena, and Los Angeles, and the Federal agencies of the WPA, PWA, and PRA, with special mention being given to the Los Angeles Park Department which donated the necessary park land.

This cooperation has not been passive, but has been most active, each agency taking an active part in various portions of the highway planning and construction.

TOTAL COST \$10,639,427

Without taking into consideration the original cost to the various cities of the park lands which were afterwards donated for highway purposes, the total cost of this improvement, including the purchase of rights of way outside the park lands, the moving of two railroads, sewers, the construction of four highway tunnels, etc., and one-half the cost of channel lining, is \$10,639,427.

The length of the Parkway from Adobe Street in Los Angeles to Glenarm Street in Pasadena is practically nine miles. When it is remembered that a portion of the WPA expenditure must be considered as relief expenditure, the net cost of this Parkway would be less than one million dollars per mile.

Although the first true freeway to be constructed in California, this road is serving as a model for the design of other freeways.

Relation Between Right of Way and Freeway Design in Metropolitan Areas

The following article is a paper delivered December 2, 1943, by Fred J. Grumm, Assistant State Highway Engineer, California Division of Highways, before the Road Design Committee of the American Association of State Highway Officials.

By FRED J. GRUMM, Assistant State Highway Engineer

FORTIFIED with the information available in the recommendations promulgated by the American Association of State Highway Officials, basic concepts for the general design of a freeway in a metropolitan area apparently should be readily formulated. With the benefit of these instructions, survey, plan and design problems should be happily solved.

The problem, however, is more than one of designing for multiple lanes of traffic, median strips of ample width, outer highways of acceptable standard, interchange and separation structures, marginal treatment for protection and esthetic satisfaction.

As the preliminary studies proceed, more and more does the designer feel the influence of rights of way. As he goes forward with the detail design, he finds instance after instance of the close relation between the two functions.

Unless conditions are more ideal and uniform than are invariably met in California, the problem of securing access rights and rights of way suitable for adequate design will prove to be a major concern.

Many new problems arise when land is sought for establishing freeways in metropolitan areas. The generally high values in the urban territory and the variety of improvements, actual and potential, to which the lands are adaptable compel a careful study of choice in location, design and the respective limitations in right of way. The best results are obtained through broad-minded dealings in rights of way when coupled with ingenious adjustment in location and design.

It is a fact that land owners and shrewd legal council are alive to the opportunity for capitalizing on rights of way necessities. There must be a close understanding and cooperation between the engineering and the right of way departments. There must be well organized team work throughout plan preparation.

The following briefly calls your attention to some of the right of way relations incidental to developing plans for economical and consistent costs without violating the principles of highway design to which we now subscribe.

GENERAL FACTORS OF DESIGN

Right of way width is one of our first concerns in setting up the requirements of a freeway proposal. In these urban areas, including highly developed industrial, commercial and residential establishments, arbitrary selection of right of way width is not the acceptable method. It is governed by design requirements and the widths of typical section which in turn are composed chiefly of the following:

1. Number and width of freeway lanes;
2. Outer highways;
3. Median strips;
4. Accelerating and decelerating lanes;
5. Intersection treatment;
6. Border treatment and slope requirement.

Our interest centers in how flexible these dimensions are if confronted with serious restrictions in right of way; to what extent can they be manipulated without detriment to traffic needs; how much can right of way provisions give and take on an economic basis to further the desirable and approved standards for the freeway.

1. Number and Widths of Lanes

The freeway lane widths and number of lanes obviously are not subject to much adjustments to meet right of way conditions, assuming that the preliminary determinations of the freeway requirements are correctly concluded. It will be 12-foot width for all of the 4, 6, or 8 freeway lanes on California State Highways.

What about shoulder widths? The shoulder is preferred to curbed edges

because it provides emergency parking ground; facilitates surface run-off. It *does* involve width additional to pavement dimensions. In tight right of way situations, the use of curbed edges can save 15 to 20 feet of width the shoulders ordinarily occupy.

That much right of way reduction can often avoid destruction or removal of expensive buildings or improvements. The minimum may also keep roadway slopes within bounds of reasonable property acquisition. It may be the means of salvaging a side street for use as an outer highway.

2. Outer Highways

On freeways there is the option of obtaining access rights from adjacent property or of furnishing outer highway facilities. Preservation of this distinctive characteristic of the freeway against the inevitable prejudice of the adjacent property owner brings out the genuine capabilities of the right of way departments. The designer can do much to facilitate procedure. The result is reflected in relative cost. Gain or loss of public good will can easily become an important issue.

Where outer highways must be provided we have adopted a minimum of two 12-foot lanes plus 8 feet for a single parking lane, a total width of 32 feet. That width may be saved if access rights are purchased. It is advantageous not to commit the department to construction and perpetual maintenance costs of outer highways where it can be avoided.

There are several methods whereby advantage can be taken of local conditions to minimize the problem of preserving limited access rights:

PURCHASE OF FRONTAGE

- (a) Locating parallel to a railroad so no access will be expected on that side. It is advisable to obtain an agreement to that effect. There are cases where it was more economical to relocate along such an

obstruction or along a natural barrier than to widen along an existing highway and provide outer highways.

(b) Purchase of a whole tier or strip of lots along an existing highway. Thereby all frontage on one side is removed from demands of severance or access and no outer highway is required on that side. The center line of freeway is adjusted accordingly.

(c) Use existing parallel streets or roads as outer highways when they are available for ingress to property disturbed by freeway acquisition. This recourse naturally requires proper loop extensions and reasonable freeway connections. It relieves the freeway agency of the maintenance of the outer facility.

(d) Locate the freeway in the middle of a block whereby original access or frontage on existing streets is undisturbed. Minimum widths will then suffice for the freeway. This procedure is advantageous where original frontage is highly developed and additional width there would cause excessive property damage. The midblock or even backstreet location lends to closure of many of the lateral streets that otherwise would cross the freeway, because existing parallel streets remain to form belt routing to selected cross-overs.

(e) In relatively undeveloped sections in large ownerships, limited access directly to the freeway can often be arranged. Points of access are designated but cross-over of the freeway median strip are reserved, subject to highway authority determination. These arrangements obviate outer highway construction unless the property owner desires to so develop his own property. Many subdivisions have been handled by such negotiation.

When access rights are purchased and no outer highway or parallel street provides connections to streets dead-ended at the freeway, the resultant cul-de-sac has occasioned considerable deliberation on how much contingent damage can run to property in the block containing the cul-de-sac. Accordingly it is safer practice to provide a loop street if that is cheaper than the estimated damage that might run to property affected. Of course, it is often probable that property owners may not bring up claims when not particularly inconvenienced by the street closure.

The cul-de-sac can be eliminated by connecting two or more dead end streets, as by outer highways, but not necessarily running continuously to reach every lateral. The bulb return in a dead end street is not sufficient to alter the status.

Construction economies are sometimes achieved and abutting property accommodated by constructing the outer highway at average ground level and not necessarily at elevation of the freeway. Contingent damages are eliminated and more ready property access is provided.

Experience has taught us not to attempt to save right of way width by restricting outer highways to one-way width along property that is enjoying frontage rights. In the higher courts are still pending appeals on adverse decisions that jeopardize some of the essential measures for maintaining freeway construction. At best, one way control is a police duty and even turning such streets over to a local agency under agreement to maintain one way control will not absolve of the initial responsibility.

Another consideration on outer highway width is the extent of the jurisdictional authority in restricting parking thereon to one side to eliminate the legal objections built up in the right of way acquisition. It is probable legislative action will be needed to give the department that authority. If parking is done on both sides of an outer highway designed for only one parking strip and two lanes of pavement, there will be difficulty in turning into and out of driveway entrances.

3. Median Strips

The width of median or dividing strips in freeways has a direct bearing on right of way width. When outer highways are included, three strips are required: the central freeway dividing strip and the two separations between freeway lanes and outer highway lanes.

These strips can be the minimum satisfactory for good design, and there is good reason to use for that purpose the A. A. S. H. O. standards. Often the utmost reduction in overall width of right of way is necessary to prevent unusual cost. The few feet width that can not well be gained by other means may be needed at critical controls as for walls to retain cut banks or fill slopes beyond which are set costly buildings or structures. The right of way appraisal dictates design in these cases.

For the central dividing strip, Cali-

fornia is adopting a 12-foot width for ultimate minimum wherever separation structures may need center pier supports in the median strip. That width is predicated on a clearance of 4 feet from the edge of each pavement to face of pier and 4 feet width of pier, if necessary. These dimensions are the desired minimum and should be reduced only in extreme circumstances.

If separation structures having center piers are widely spaced, there may be an advantage in making transition in the dividing strip widths, provided horizontal curvature occurs to facilitate a smooth transition without introducing reverses.

Temptation to reduce the separators between the freeway and outer highways is felt when right of way tells design that width is getting critical. These separators are essential to protect traffic against conflict and to eliminate headlight glare of opposing vehicles. Generous widths are useful to facilitate inlets and outlets to the freeway; to adjust adjacent road levels where grade levels are different or superelevation appreciable.

Speed change lanes may be introduced without requiring alignment changes if sufficient width is introduced in these dividing strips. These outer median strips are safety valves in possible future unexpected expansion requirements. They may incidentally be provided by the slopes between roadways.

4. Accelerating and Decelerating Lanes

The accelerating and decelerating lanes widen the cross-section at intersection points and can not be ignored as a factor in establishing proper right of way widths. Coming at intersection points, often at grade separations and at inlets and outlets, the additional width is often at sites where land values are high. It is a requirement too often overlooked and too unwillingly taken into account. It has caused more squeeze plays in adjusting typical sections to acquired right of way than many another item in freeway designs.

5. Intersection Provisions

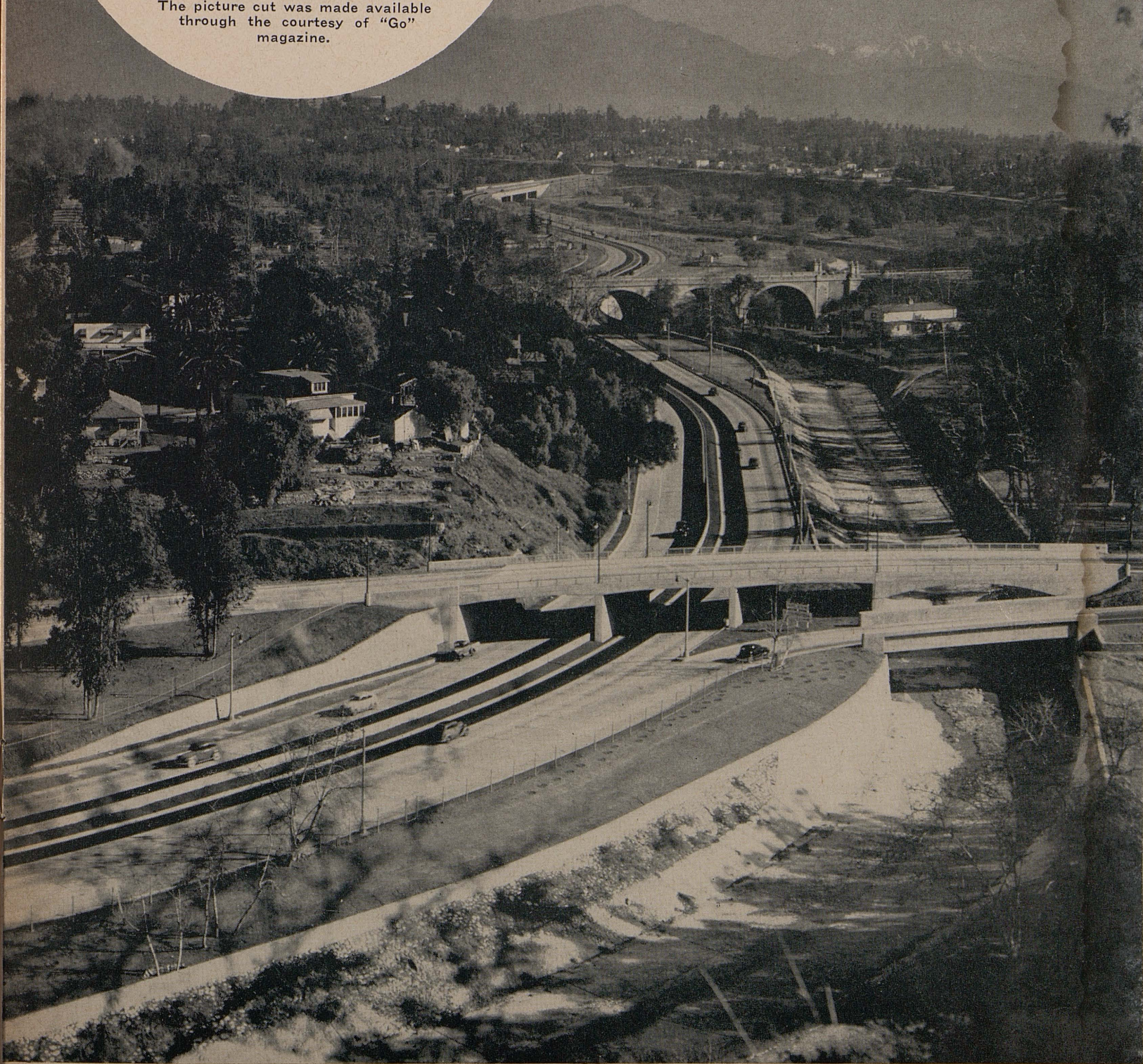
The intersection design can only be touched on in this paper. Intersections usually are already encumbered by improvements usually with high cost values, complicating determinations. If the intersection points can be picked as controls, where they can

(Continued on page 18)

Arroyo Seco Parkway

In this picture of the Arroyo Seco Parkway between Los Angeles and Pasadena may be seen many of the design and construction features essential to a true freeway as described by Assistant State Highway Engineer Fred J. Grumm in the accompanying article on the relation of right of way and freeway design in the metropolitan areas. In its entire length of 9.5 miles the Parkway has no street crossing intersection at grade nor any right or left turn across traffic. Instead there are 13 overhead bridge separation structures for street traffic, three pedestrian separation structures and five steam or electric railroad separation structures. Closely paralleling the Arroyo Seco Channel as it does through public park property, through much of the distance that natural barrier largely eliminates all problems of right of way acquisition and abutting property damages.

The picture cut was made available through the courtesy of "Go" magazine.



Building 29 Miles of Mountain Highway Increased War-needed Lumber Output

By C. E. BOVEY, District Maintenance Engineer, District X

At a public gathering in Sutter Creek on the night of January 31, the Army-Navy E was awarded to the Winton Lumber Company and McDonald Lumber Company for increased production during the year 1943. This award is the result of a most outstanding example of cooperation between private industry, landowners, county supervisors, and the State and Federal Governments in the building of 29 miles of new mountain highway that has resulted in increasing the output of over 8,000,000 feet of lumber a year.

Heretofore, owing to the bad condition of the narrow and curving old roadway, the logging production was practically abandoned during the winter months. Tom Mills of the Winton Lumber Company said that by reason of the improved highway the mills would get logs all winter and that the cut of 28,000,000 feet in 1942 would be increased from 35 to 36 million feet this winter.

At the beginning of this war lumber was thought to be very plentiful and in no sense a critical material. However, the huge building program soon created a critical shortage in lumber and timber products.

This material was particularly needed on the west coast and attention was soon focused upon the huge timber belt of the Sierra Nevada Mountains. Amador County, home of two of the world's deepest gold mines, contains vast quantities of white and red fir, cedar, ponderosa and sugar pine.

A number of small mills have operated here for many years, producing small quantities of lumber. Since 1941 a modern mill, constructed at Martell, has materially increased the lumber supply from that county.

The aggregate production during 1941 was approximately fifty million board feet. These various mills ordinarily operated less than 180 days per year and suspended operations entirely during the winter season.

After Pearl Harbor, War Production Board representatives demanded an all-out effort on the part of all lumber companies to increase their pro-

duction by working longer hours, a longer work week and year round production—conditions they could not meet on the existing roads.

During the year 1942, the heavy laden lumber trucks, many carrying a gross load of 45 tons, caused serious failures in the highway surfacing between Martell and Cook's Station on State Highway No. 88, the Carson Pass lateral. Failures were particularly serious during the early spring and late fall months. The narrow, twisting mountain road, constructed for light traffic only, was entirely inadequate for such heavy hauling. It was apparent that increased production on an all-year schedule was impossible unless the road was reconstructed to an adequate standard.

Acting upon the request of logging and lumber companies and appropriate county, State and Government agencies, the War Production Board approved a project and appropriated funds for the reconstruction, widening, straightening, and surfacing of 29 miles of county and State highway from railhead at Martell, elevation 1,500 feet, to Cook's Station, 5,000 feet, junction of private logging roads and the State highway.

LUMBER COMPANIES COOPERATED

The sum of \$300,000 was allocated from Federal Raw Materials Access Road funds to cover cost of surveys, engineering and construction. An additional \$40,000 was provided from State Division of Highway funds. The McDonald Logging Company, principal commercial user of this highway, agreed to finance the cost of clearing and grading a number of major line and grade changes not included in the originally approved project but necessary to increase speed and ease of hauling.

The Winton and Berry Lumber Companies also contributed the sum of \$6,000 toward grading costs on two of the major changes. Total contributions from the three companies amounted to approximately \$16,000, making a total of \$356,000 available for the entire project. This, an aver-

age of \$12,300 per mile, is admittedly a low cost for heavy duty mountain construction under war time conditions.

DAY LABOR EMPLOYED

Preliminary estimates were based on rough surveys made with speedometer, car compass and aneroid readings. Final approval for the construction was given by the Federal Government December 11, 1942. If the project was to be completed before the 1943 rainy season, it was apparent that time could not be spared to make detailed surveys and prepare plans which are required before a project may be placed under contract. It was also apparent that if the project was contracted, it would be impractical to utilize the offers of the county supervisors and McDonald Logging Company for the use of their equipment and crews to be furnished at actual cost. It was, therefore, decided to do the work by day labor.

In general, the construction of the 20 miles of State highway consisted of: (1) the grading of a new roadbed to the surveyed line and grade for a width of 24 feet exclusive of side ditches and berms; (2) base treatment with mineral aggregate over the full width and 12 to 18 inches in depth; (3) surfacing with bituminous mix 22 feet in width and 3 inches in thickness.

The nine miles of county highway had been widened and surfaced the previous year with combined county and logging company funds but required some base reinforcement and a bituminous mix blanket 2 inches in depth and 22 feet in width throughout its entire length.

GRADING WORK PUSHED

As the project was designed to expedite the flow of logs and lumber to the war projects, all work was planned toward that end. Surveys were begun January 7, 1943, and acquisition of rights of way, fence construction and clearing operations followed within a few days. Actual grading operations were started on January 19th. By April 19th, starting date of the lumber



Close-up views of heavily laden logging trucks on new Carson Pass Highway. At bottom loaded truck meets returning empty carrying logging dolly to save tires

hauling season, some seven miles of grading had been completed and surfacing of the base was under way.

Clearing, drilling, shooting, and fencing operations were usually continued regardless of weather, but grading work was frequently suspended due to both heavy rain and snow storms. Although considerable trouble was experienced during the winter season in the lower elevations where the clay soil became a sea of mud after every severe storm, good progress was made at the higher elevations as the road was located in solid lava formation workable even in snow and wet weather.

"BOTTLENECKS" ELIMINATED

All fence posts required for the entire project were manufactured by the State crews from cedar felled along the right of way during clearing operations. Mercantile timber was cut into the proper lengths and hauled to the mill by the logging company.

In addition to the widening and straightening of the State highway portion, a number of serious "bottle-necks" were eliminated by the construction of eight line and grade changes, totaling 3.33 miles in length. These sections of old highway consisted of steep adverse grades on very poor alignment, characterized by sharp curves with radii sometimes as short as 50 feet, all of which greatly retarded the speed of the trucks and exacted a heavy toll in truck maintenance.

Considerable clearing in dense timber was required on at least two of these changes. One 40,000 cubic yard cut, in rock and lava formation, required much drilling and shooting and created a sizeable problem in handling the truck traffic in conjunction with the grading operations.

WATER SUPPLY LIMITED

In order to complete 29 miles of road construction in one short season, it was necessary to have the various types of construction activities under way simultaneously throughout practically the entire length of the project. As the summer months arrived, dust became a real problem. Local springs went dry, leaving only a few streams for the water supply. Water trucks were severely taxed, working day and night, to supply the necessary moisture for subgrade and base compaction and to allay the dust sufficiently to keep the large fleet of logging and dump trucks moving safely through

construction areas and over the various auxiliary hauling roads.

The construction of the base and surface required the production, hauling and placing of 160,000 cubic yards of mineral aggregate. Creek gravel was used in the base construction on the westerly 15 miles, and lava and decomposed granite on the upper or easterly 14-mile portion. The latter required drilling and shooting and preliminary scarifying with heavy tractors and rippers to prepare for loading into the dump trucks. Power shovels were used for loading operations.

MATERIAL HAULING PROBLEM

The hauling of material constituted the main problem. Although a large fleet of dump trucks made possible the delivery of this quantity of material during a period of only five and one-half months, conditions were made difficult through the necessity of hauling the material over auxiliary roads containing a considerable amount of adverse grade, running as high as 16 per cent. Securing a sufficient number of rented trucks for economical operation proved a major difficulty. Trucks came and went, breakdowns were frequent, and it was extremely difficult to keep a full complement of trucks at work.

The 29 miles of bituminous surface required the producing, hauling, mixing, and placing of 55,000 tons of mix, the aggregate consisting chiefly of decomposed granite. The surfacing was laid in two courses: the entire lower or leveling course and the finish course on the easterly 12 miles were road-mixed with the use of a fleet of large motor graders.

MIX AT LOW COST

The mix for the finish course on the westerly 17 miles was produced at a central mixing plant at the low ready-for-hauling cost of \$1.50 per ton. Of this amount, \$1.15 was expended for the liquid asphalt in the mix. The balance of 35¢ per ton represented the cost of producing the aggregate, mixing in the plant, and loading into the trucks. Due to the fine grading of the material, an asphaltic content averaging 7.5 per cent of the weight of the aggregate was required. Thirty-one thousand seven hundred fifty tons of plant-mix were produced.

Two methods of spreading and finishing were used. One portion was placed with a finishing machine and the balance with a spreader box

and motor graders. Both pneumatic and power rollers were used for rolling and compacting the surfacing throughout the entire project.

No small part of the operations was the supplying, heating, hauling, and placing of the large quantity of liquid asphalt required in the road and plant-mix and surface treatment. A total of 5,000 tons (1,200,000 gallons) of MC-3 liquid asphalt was used. One hundred and nine carloads were shipped, the larger portion over the Southern Pacific Railroad to Ione, and thence over 12 miles of branch railroad (Amador Central) to Martell. The asphalt was heated at this point and hauled in tank trucks to the job site. An additional 800 tons, equivalent to 20 carloads, were delivered directly to the site of the work by commercial tank trucks from the bay area.

RIGHT OF WAY DONATED

All work performed in connection with this project was under the direction of the District X Maintenance Department. The construction work and crew were supervised by Superintendent L. H. Kahl. Assistant District Maintenance Engineer Bert Lund, and Assistant Engineer John S. Langenbach, were in charge of the engineering. R. H. Lapp and Frank Lucas were Resident Engineers. The task of securing additional rights of way was accomplished by Frank Walker of the Division of Highways and donated by the property owners in a spirit of complete cooperation.

Excellent cooperation was also received from the Amador County supervisors under chairman Dan Ramazzotti and from the officials of the various lumber companies, especially J. T. McDonald, of the McDonald Logging Company, and his superintendent, John Rukavina.

The completed highway, scarcely resembling the narrow, twisting road in existence at the beginning of the year, has accomplished the purpose for which it was built. It provides an all-year highway for the lumber industry, a road of sound base, modern bituminous surface, good alignment and grade, improved sight distance, and sufficient width for the safe passing of the heavy laden trucks.

INCREASED SPEED AND OUTPUT

The improvement has resulted in increased average speed of the trucks, and consequent greater daily output. This, together with the new all-year

(Continued on page 13)



At top—Easy going on 40,000 cubic yard cut. Bottom—Spreading and compacting surface with graders and rubber-tired roller

State Highway Commission Approves 61 Projects

(Continued from page 1)

plant-mixed bituminous material, 0.8 mile.

Madera County, Route 4, portions between 0.5 mile north of Madera and county line; repair base, place plant-mixed bituminous material and seal coat, 6.8 miles.

Solano County, Route 7, portions between Route 8 and Fairfield; place rock base and plant-mixed bituminous material, 0.8 mile.

San Joaquin County, Route 5, portions between Tracy and Grant Line Road; repair base and place plant-mixed bituminous material, 3.0 miles.

SECONDARY NORTH

Mendocino County, Route 48, portions between Olsen Hill and east of McDonalds; place base course and seal coat, 4.4 miles.

Mendocino County, Route 56, portions between Navarro River and one mile south of Casper; place base course and seal coat, 3.9 miles.

Humboldt County, Route 20, from Junction Route 85 to Blue Lake, repair base, place plant-mixed bituminous material and seal coat, 5.4 miles.

Tehama County, Route 83, from Morgan Summit to Route 29; repair base, place plant-mixed bituminous material, 3.8 miles.

Sutter County, Route 87, portions between Tudor and Oswald; repair base and place plant-mixed bituminous material, 5.8 miles.

Contra Costa County, Route 75, from Broadway Tunnel to Orinda; repair base, place plant-mixed bituminous material, 1.8 miles.

Santa Clara County, Route 32, from five miles west of San Felipe to San Felipe; repair base, place armor coat, 5.0 miles.

Santa Cruz County, Route 56, portions between Santa Cruz and Davenport; repair base, place plant-mixed bituminous material and seal coat, 6.2 miles.

Contra Costa County, Route 75, from Route 106 to east end Willow Pass near Pittsburg; repair base and shoulders, place plant-mixed bituminous material, 2.3 miles.

Contra Costa County, Route 75, from near Pittsburg to 2.5 miles east

and near Antioch to 2.5 miles east; place gravel base and plant-mixed bituminous material, 5.0 miles.

Fresno County, Route 10, portions between Oil King School and Huron Road; repair base, place borders, plant-mixed bituminous material and seal coat, 7.3 miles.

Fresno County, Route 125, portions between Kings County line and Caruthers; repair base, place borders, plant-mixed bituminous material and seal coat, 4.5 miles.

Stanislaus County, Route 110, portions between San Joaquin County line and Modesto; place rock base and plant-mixed bituminous material, 7.0 miles.

Stanislaus and Merced counties, Routes 41 and 32, portions between San Joaquin County line and Route 32 and between Los Banos and San Luis Creek; repair base and borders, place rock base and plant-mixed bituminous material, 23.5 miles.

San Joaquin County, Route 75, portions between Contra Costa County line and Stockton; place rock base and plant-mixed bituminous material, 5.0 miles.

Merced County, Route 123, portions between Route 32 and Merced; place rock base and plant-mixed bituminous material, 1.2 miles.

San Joaquin County, Route 53, portions between Potato Slough and Route 4; place rock base and seal coat, 1.9 miles.

PRIMARY SOUTH

San Luis Obispo County, Route 2, from 1.6 miles south of Cuesta to 1.7 miles north of Cuesta; repair base and place plant-mixed bituminous material, 3.3 miles.

Santa Barbara County, Route 2, portions between Alcatraz and Zaca; repair base and place plant-mixed bituminous material, 1.3 miles.

Santa Barbara County, Route 2, portions between Zaca and 1.5 miles south of Santa Maria; repair base and place plant-mixed bituminous material, 5.6 miles.

San Luis Obispo County, Route 2, portions between Santa Maria River and Arroyo Grande; repair base and place plant-mixed bituminous material, 1.5 miles.

Tulare County, Route 4, portions between Kern County line and Quail; repair base, place plant-mixed bitu-

minous material and seal coat, 6.7 miles.

Orange County, Route 2, portions between San Diego County line and Galivan; repair base and shoulders, place plant-mixed bituminous material, 4.4 miles.

Los Angeles County, Route 23, portions between Solamint and Acton Road; repair base and shoulders, place plant-mixed bituminous material, 7.7 miles.

San Bernardino County, Route 58, Newberry to Hector; repair base and place bituminous material, 8 miles.

Kern County, Route 23, portions between Mojave and Cinco; place road-mixed bituminous material, 4.0 miles.

Kern County, Route 23, portions between Cinco and Ricardo; place road-mixed bituminous material, 3.0 miles.

Imperial County, Routes 12 and 27, portions between Dixieland and Holtville; repair base and place road-mixed bituminous material, 11.6 miles.

SECONDARY SOUTH

San Luis Obispo County, Route 33, portions between Paso Robles and Kern County line; repair base, place cushion course and plant-mixed bituminous material, 6 miles.

San Luis Obispo County, Route 56, portions between 0.8 mile west of Pennington Creek and Toro Creek; repair base and place plant-mixed bituminous material, 5.6 miles.

Kern County, Route 57, portions between Maricopa and Route 4; repair base, place plant-mixed bituminous material and seal coat, 11 miles.

Kern County, Route 140, portions between Kern River and Greenfield; repair base, place plant-mixed bituminous material and seal coat, 6 miles.

Kern County, Route 33, portions between Pumping Station and 2 miles west of Wasco; repair base, place plant-mixed bituminous material and seal coat, 16.5 miles.

Los Angeles County, Route 168, portions between Route 174 and Fawcett Avenue; repair base and shoulders, place plant-mixed bituminous material, 2.8 miles.

Los Angeles County, Route 79, portions between Route 23 and Route 4; repair base and shoulders, place plant-mixed bituminous material, 4.6 miles.

San Bernardino County, Route 190, portions between Etiwanda Avenue

(Continued on page 15)

23 Counties Receive \$494,506.39 For Postwar Highway Construction

CALIFORNIA counties rapidly are taking advantage of the legislative act appropriating \$1,500,000 to be divided among the counties for surveys, plans and specifications for postwar county highway construction.

County budgets of proposed expenditures for these purposes aggregating \$466,094.24 already have been approved by Director of Public Works C. H. Purcell.

The budget of 23 counties submitted to the Department of Public Works according to law have been approved and checks to finance the planned work have been drawn by the State Controller.

The act under which the \$1,500,000 was appropriated provides that each county shall receive \$5,000 and additional funds allocated on a basis of each county's motor vehicle registration as compared with the total motor vehicle registration of the State.

Counties whose budgets have been approved and the amount of money each has received are as follows:

Plumas	\$6,537 65
Glenn	7,383 58
Stanislaus	19,650 00
Sacramento	36,411 79
Madera	2,600 00
San Mateo	25,853 82
Monterey	18,213 53
San Luis Obispo	11,940 00
Mendocino	8,732 34
Fresno	35,500 00
Tuolumne	6,505 10
Siskiyou	7,000 00
Alameda	67,520 28
San Bernardino	33,533 09
Merced	13,300 00
San Joaquin	28,873 00
Placer	8,807 00
Sonoma	18,567 32
Santa Cruz	12,534 07
San Diego	64,893 00
Sutter	8,396 11
Riverside	23 342 56
Kern County	28,412.15
	<hr/>
	\$494,506.39

The board of supervisors of Marin County has taken action to obtain \$3,000 of its share of postwar planning funds which will be used to help finance a county survey for the proposed Sausalito approach to the Golden Gate Bridge.

In Memoriam

Edward M. Muse

On January 3, 1944, Edward M. Muse, former employee of Division of Highways, Central Office, passed away at his home in Sacramento, just five days prior to his seventieth birthday.

Mr. Muse retired from active service because of failing health on June 1, 1942. He entered the employ of the California Highway Commission on August 19, 1918, and served the State for nearly twenty-four years.

Mr. Muse was a man of unusual talent and artistic skill, and much of his work for the State will live for many generations. Most prominent among his permanent contributions to the State of California are the official seals which he designed for seven of the State Departments and the official emblem of the California State Employees Association. The State Departments whose seals are the result of Mr. Muse's handiwork include: the Department of Public Works, Division of Highways; Division of Forestry; Department of Motor Vehicles; California Highway Patrol; California Toll Bridge Authority; and California State Water Authority.

Mr. Muse supervised many of the exhibits of the Department of Public Works at State Fairs during the past twenty years. He also planned and promoted several projects for the beautification of the Capitol properties in Sacramento. The most ambitious of these was a proposed monumental arch as a Pioneer Memorial to be erected as an entrance to the Capitol grounds.

Another project which Mr. Muse conceived was a proposed series of large oil paintings depicting wild life scenes and historical episodes of early California. He executed the first of this series, and it now hangs beside the north staircase of the Capitol. The painting shows a bewildered fawn standing beside the prostrate body of a doe killed by a careless hunter.

Mr. Muse was born in Greensburg, Louisiana, on January 8, 1874. He studied at the Art Students League and the Academy of Industrial Design in New York City. He came to California in 1904 and was employed in the commercial art field in San Francisco, Stockton and Sacramento prior to his employment by the State.

The sympathy of the Department is extended to Mrs. Muse and to his grandson, Edward Brock, now serving in the Army of the United States.

Lumber Output Increased By Rebuilding 29 Miles of Mountain Highway

(Continued from page 10)

program, will materially increase the lumber supply for the war effort. It will also prove of considerable value to the logging and lumber companies and the local communities, in that year-round work for experienced crews, rather than seasonal work, will be provided.

For many years, residents of Amador County and snow sports enthusiasts have pleaded for improvement of State Highway 88 over the scenic Kit Carson Pass. The new construction now provides the first modern link in this highway east of Pine Grove. The good grades and easy curves, the sharpest of which are safe for a speed of 35 m.p.h. by actual test, will surprise and delight the motorist on his first trip over this new highway.

LOCAL COMMUNITIES BENEFITED

The local communities of Amador County also received considerable financial help from this road construction through employment of local citizens previously made idle by the closing of the gold mines, by the expenditure of several hundred thousand dollars in these communities, by the shipment of the many carloads of oil over the locally-owned branch railroad, and indirectly by the aid rendered to its present chief industry—the lumbering business.

Thus the expenditure of \$356,000 has built in one season 29 miles of good road of permanent economic and recreational value at moderate cost, has assisted local communities, and has contributed materially to the war effort.

Regrettably, this project cost the life of Angelo Puccini, a popular citizen of Amador County. During the performance of his duty as a flagman, he fell under the wheels of a large motor grader.

Tunnel Through San Vicente Dam Used During Relocation of Highway

By L. H. WILLIAMS, Resident Engineer

ONE of the major problems of all the southern California cities has been that of securing adequate water supply. The civic-minded leaders of the early San Diego days, realizing this, made long range plans to care for the community's increase in population, by adding additional units of supply to the water system, as they became necessary.

The plans for San Diego have always incorporated a chain of separate and interlocking lakes and reservoirs, to be constructed, or added, as the need for them arose, together with the possibility of bringing in water from the Colorado River by one of several feasible routes.

The unprecedented increase in the population of San Diego and vicinity, due to war activities, advanced the need for adding additional supply and storage units far ahead of the time originally contemplated.

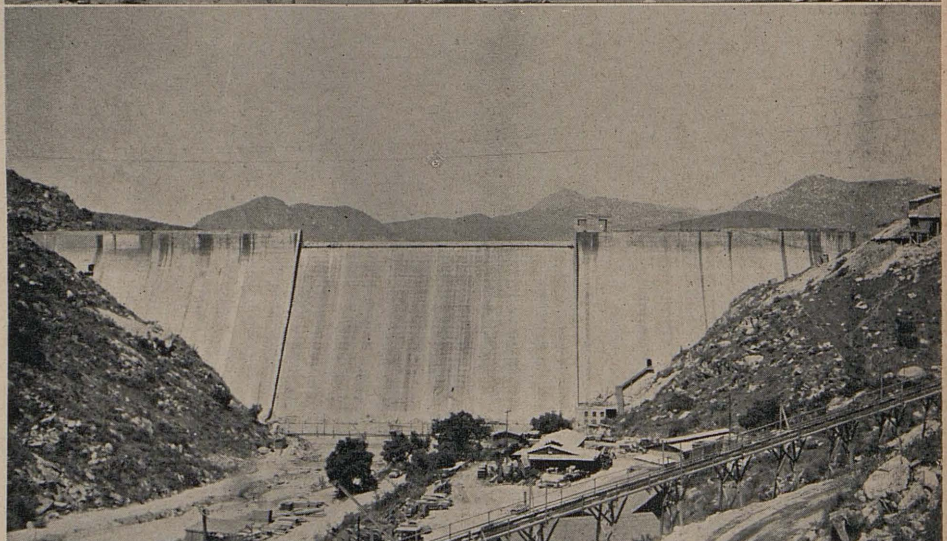
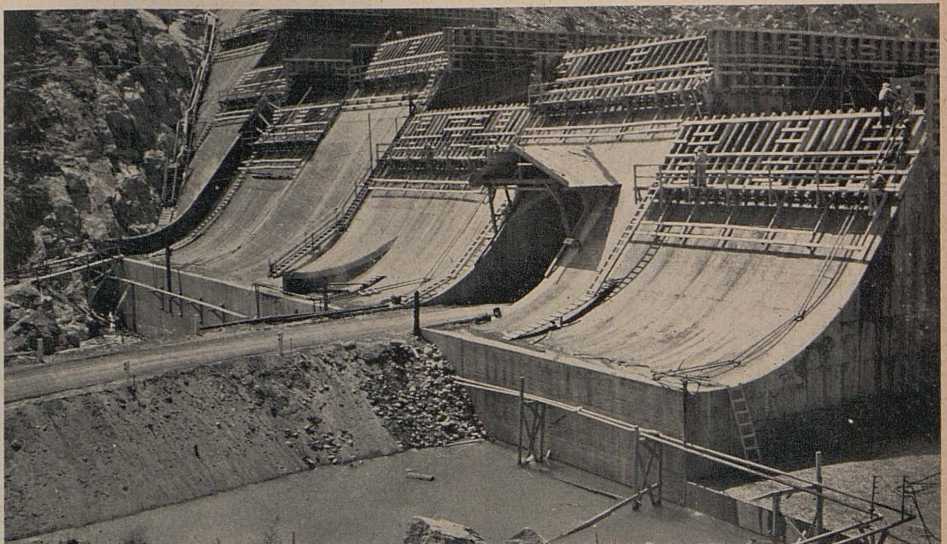
HIGHWAY RELOCATION NECESSARY

The next logical unit to be added, after the completion of the El Capitan Dam across the San Diego River near Lakeside, was the San Vicente Reservoir across San Vicente Creek north of Lakeside, which was designed to store run-off from its own watershed, and also to care for the surplus waters of the El Capitan Dam.

The utilization of the San Vicente unit involved the relocation of Highway 198, the Lakeside-Ramona road, a rather important link in the State Highway System of San Diego County. Satisfactory arrangements were made with all concerned, as to the financing of an alternate route to take the place of the one located within the area to be flooded by the construction of the dam.

As the plans for the dam began to materialize, the State started surveys and plans for the new highway location. Upon completion of several reconnaissance surveys, the most feasible route was found to be to the left, or west, of the dam and reservoir site.

From the bridge across the San Diego River, just north of Lakeside,



San Vicente dam under construction across highway showing hole left for traffic during road relocation. At bottom, the completed dam

the location follows closely an existing county road for about two miles. Thence it traverses new territory through rocky hills for about eight miles, to a connection with the Poway road.

It then follows the Poway road about one and two-thirds miles to a connection with an existing oiled road near the Mount Woodson State Ranger Station. This oiled road extends about three miles to a connection with

the pavement on Route 198, and has been taken over by the State as a portion of the new location. The total length of the new construction is 11.67 miles.

HOLE LEFT FOR TRAFFIC

A contract to Clyde W. Wood, of Los Angeles, was approved April 10, 1942, and work on the highway started on April 27, 1942. Owing to low priority and scarcity of repair parts,

it was difficult to keep equipment in repair, and also to keep a sufficient force of men on the job. For these reasons the work was not completed until December 29, 1943.

The contractor for the construction of the dam carried on his work in such a manner as to have the existing highway open to traffic as long as possible. An opening through the base was left to permit passage of traffic while the dam was being constructed across the highway. (See accompanying photograph) The handling of traffic in this manner was very successful, and accomplished with very little interference to the contractor's operations. The plugging of the tunnel presented some interesting problems. This was accomplished by means of a wooden patch placed over the upstream end and the filling of the tunnel itself with concrete by means of pressure methods.

Owing to a heavy rain storm, and the prospect of being able to store considerable water before the winter was over, the tunnel was closed on January 23, 1943, by order of Army authorities. From that time on, the major part of the traffic was routed either through Escondido, or over the Barona Indian Reservation road, until late in the summer, when it became possible to carry most of it on the new highway in its semi-completed condition.

SEVEN PER CENT GRADE

The present highway is slightly longer than the old one, but is considerably improved in alignment. There are two curves of 400-foot



Mile and a half stretch of 7 per cent grade on new highway through boulder covered hills

radius, and one of 500-foot. The balance are of (comparatively) large radii. The maximum grade is 7 per cent, and is $1\frac{1}{2}$ miles in length.

The roadway, from shoulder to shoulder, is 24 feet, and surfacing consists of 3 inches of road-mix, a portion of which is constructed on 1 foot of selected decomposed granite. Another portion is constructed on a $1\frac{1}{2}$ -foot depth of the same. On the balance, the native material of a granitic nature was used.

Drainage structures consist of metal and concrete pipes, there being included six 90-inch and one 105-inch multiplate pipes, as well as one 84-inch

concrete pipe. Five of these pipes were paved and fences tied into them, so they could be utilized for cattle passes.

A total of 2,120 feet of guard rail was placed, and 570 culvert markers and guide posts to safeguard traffic.

The last one and two-third miles of the project replaced a portion of the Poway road which was very narrow and precipitous, being practically a one-way road.

The entire cost of the job, including engineering amounted to approximately \$700,000.

State Highway Commission Approves 61 Projects

(Continued from page 12)

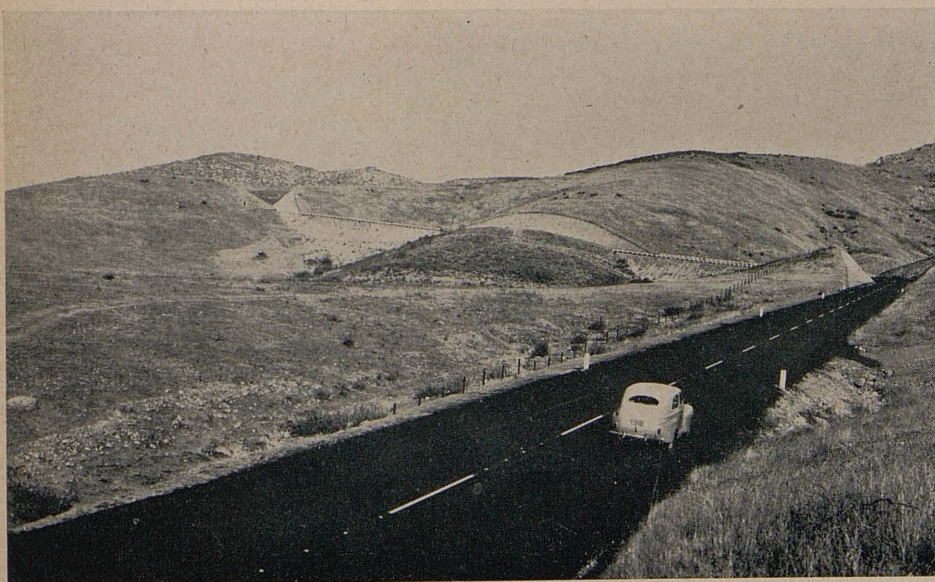
and San Bernardino; place road-mixed bituminous material, 1.3 miles.

San Diego County, Route 77, portions between Escondido and north county boundary; repair base and place plant-mixed bituminous material, 4.2 miles.

San Diego County, Route 195, from 6 miles east of Oceanside to Route 77; repair base and place plant-mixed bituminous material, 3.0 miles.

San Diego County, Route 2, portions between San Ysidro and Chula Vista; repair base and place plant-mixed bituminous material, 1.7 miles.

Riverside County, Routes 187 and 203, portions between Thermal and Route 26; place road-mixed bituminous material, 9.8 miles.



The 24-foot roadway has few curves, only 2 of 400-500 foot radii

New Spotting Wheel Device for Marking Pavement Traffic Lines

By MARTIN A. O'BRIEN, Maintenance Assistant

THE OLD adage that necessity is the mother of invention is again exemplified by a new pavement marking wheel developed by the Maintenance Department. Manpower shortage coupled with rising costs and decreasing revenue prompted trial uses of devices to reduce the high cost of spotting the pavement preparatory to traffic striping.

The device consists of a trailer wheel and paint container attached to the rear of a truck with two pointers mounted by adjustable clamps on the truck's front bumper. The spotting wheel is attached to the rear bumper while the paint container is affixed to the tail gate. Paint drips by gravity onto the wheel which runs along the pavement, leaving a trail of white paint.

The present device, copied from a machine used in District VI, was made at headquarters shop from the verbal suggestions of the author. Credit is due the shop mechanics for the improvements incorporated in the unit, particularly to E. C. LaTour, Shop Foreman, and his assistant, Wm. J. Millard.

IMPROVED ON MODEL

The clamps and wheel attachment are adjustable so as to fit any model truck or passenger car. After a few trial runs over a rough surface, it was found necessary to tie the pointers more rigidly to the bumpers to eliminate "wobble." The tie rods, adjusted by turn buckles, stiffen the boom and allow for perfect alignment of the pointers.

The idea for this method of marking was borrowed from the Los Angeles County Road Department which made up a wheel several years ago to mark mountain roads. Our Highway District VI improved on this early model and have used it successfully for spotting.

The device made up by District VI consists of a spotting wheel and pointer in one unit, and is attached to the front bumper of a truck. Its use on tangents requires an operator of con-

siderable skill and practice to obtain a straight line.

MARKING WHEEL AT REAR

With the marking wheel in front, each movement of the front wheels of the truck was indicated by the marking wheel. By placing the wheel in the rear, we found the painted line did not reflect the slight movements of the front wheels.

This also eliminated the necessity of having a workman ride on the fender to regulate the flow of paint. The rear attachment permits a workman to ride in the body of the truck as the paint control valve and wheel lifting lever can be operated from this position.

In installing the device, it is first necessary to line up the truck and driver's eyes along a painted line. The two pointers are then placed and carefully adjusted to this line. The marking wheel is then installed on the rear bumper directly over the center of the line.

PAINTS 3-INCH DOTS

At first a short trial run, using water instead of traffic lacquer, was made to test the adjustments. While the driving speed will vary with different operators and types of pavement, a speed of 10 to 12 miles per hour appears to give the best results.

In using the wheel device, guide points consisting of white painted dots (3 inches diameter) are placed at approximately 100-foot intervals.

When the guide line is to be followed by painting of the regular stripe within a short time (1 to 2 weeks), the lacquer may be thinned, using one-half paint and one-half thinner. If the line must serve for longer periods, a heavier application should be made. A satisfactory line was obtained by using one-third gallon of thinned lacquer per mile.

Cold water paint is not suitable for use with this device. It was found that it settled quickly and clogged up the valves and paint lines.

REPLACES ROPE METHOD

The method followed for many years consisted of stretching a rope between transit points set on a newly paved highway, and painting small marks on the rope at from 2- to 4-foot intervals. The resulting "cat-tracks" were used to guide the striping equipment.

In a normal working day approximately six miles of highway could be cat-tracked. The operation usually required three men, one at each end of the rope and one for marking, plus flagmen at each end of operations on heavily traveled routes. This method is hazardous as workmen are placed on the traveled way without any protection. As a matter of fact, the foreman of one of the traffic striping crews was recently struck by an automobile in an open desert area, and quite severely injured.

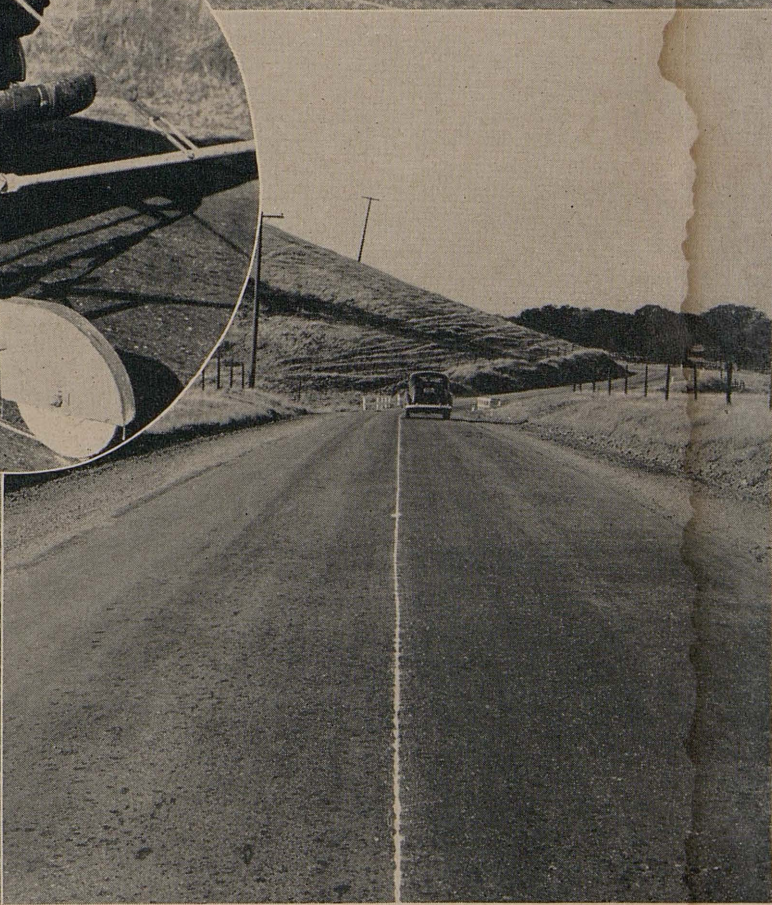
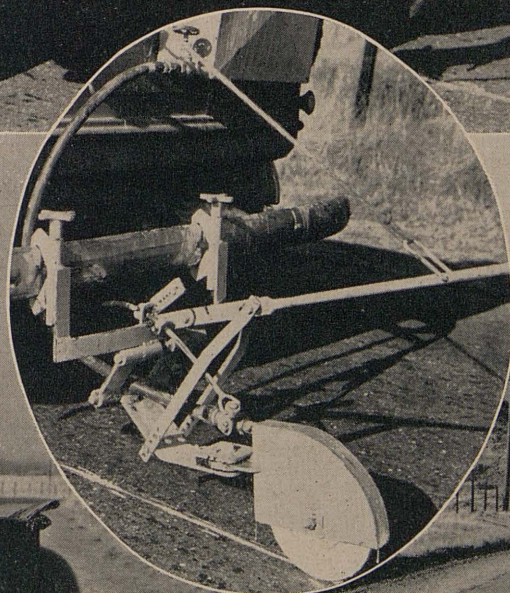
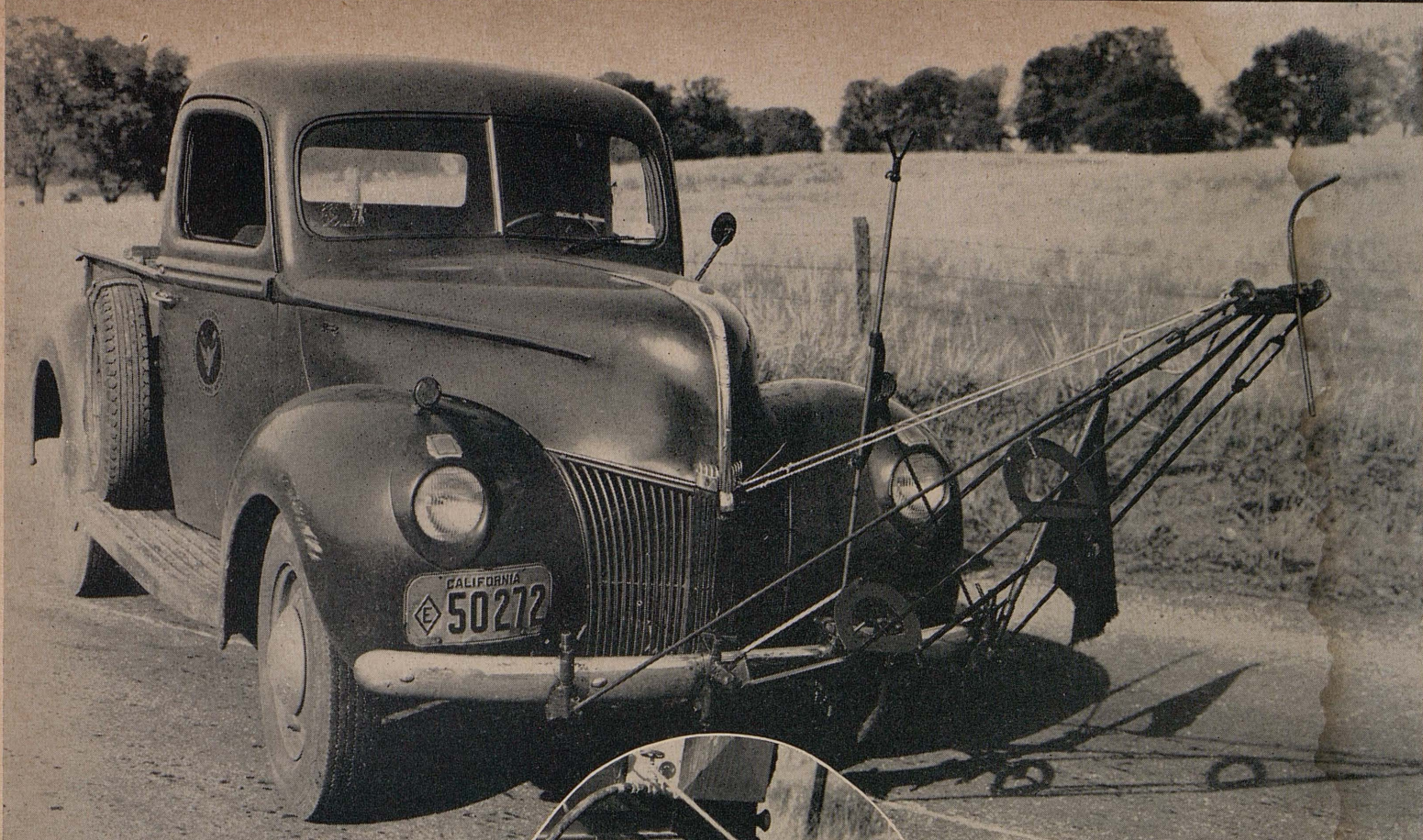
The new marking device makes a continuous white line, one-half inch wide, and if sufficient pavement is available, will spot 50 miles per day with a crew of two men. Frequently, on curves or winding roads, a pilot car precedes the truck doing the spotting to warn oncoming traffic.

LOW COST EFFICIENCY

By its low cost of operation, the new marking wheel permits the placing of a temporary traffic line on new pavements immediately after the surfacing is placed or is ready for traffic. Because of manpower shortage or distance involved in moving the paint crew, it was frequently necessary to defer the painting of traffic lines on new pavements.

This new device, easily mounted on any car or truck, makes it possible to mark all new blankets or seal coat jobs and give traffic the benefit of a temporary center line at a reasonable cost, particularly important on multiple lane highways.

Like all new devices, proficiency in its operation requires practice and a certain degree of skill in driving to insure a straight line. The results obtained are illustrated in the picture accompanying this article.



Top picture shows pointer assembly attached to front bumper of truck enabling operator to follow straight line. Center inset shows marking wheel attached to rear bumper and below workman controlling paint valves and wheel lifting lever

Relation Between Right of Way and Freeway Design

(Continued from page 6)

be favorably developed, the rest of the location usually can be fitted satisfactorily.

At important intersections careful right of way plans must be laid out on the basis of ultimate development, regardless of initial improvement. Purchase of an area that will allow future elimination of traffic stream conflict is usually cheaper now than later when improvement has increased values. Purchasing access rights from abutting property on ramp approaches or interchange roads over distances sufficiently long so that the freeway entrances will never be choked by local interference, is good insurance.

We should make an inflexible rule which forbids combining an outer highway connection with a direct freeway entrance or with accelerating and decelerating lanes. This requires extra right of way area; it requires some additional purchase of access rights. It forces bulb returns at a freeway entrance so the outer highway is carried independently of the direct and channelized freeway entrance. Expensive corner property may occupy the bulb return area. Sometimes the whole connection can be more economically deflected to miss the corner lots—be brought to a point where the necessary area will not destroy so much improved property.

Separations can often be offset parallel to the existing cross street, getting new right of way cheaper than to purchase access rights along the existing lateral. The latter can then be used for outer highway connection or for inlets and outlets. Cooperative study between engineer and right of way agent has resulted in avoiding considerable cost and much local criticism along one of our routes where this principle could be applied repeatedly.

6. Border Treatment

Public utility facilities are not desired on a freeway and should not be permitted on the freeway proper. Where an existing highway carrying public utilities is incorporated in the freeway development every effort should be made to remove the utilities, at least to the outer highway. On new right of way a positive attitude can be maintained. The cost of additional right of way to accommodate public utility facilities on freeways is too

Postwar Disposal of 50 Billions of War Equipment

The following resolution relative to the orderly disposal of surplus war equipment by the government after the war was passed by the American Association of State Highway Officials at its recent convention in Chicago.

Whereas, It has been estimated that the surplus of war equipment and supplies at the end of the war will have a cost value of at least fifty billions of dollars; and

Whereas, The disposal of this surplus should be made with the least possible loss to the Government and at the same time, the least disruption to our private enterprise system; and

Whereas, It will benefit the economy of the Nation if there be a distribution of road building and maintenance machinery on a "Lend Lease," "Direct Sale," or other suitable basis to those countries whose road programs have been slow in developing; and

Whereas, Such programs will create a market for United States made equipment as well as a market for United States Engineering talent; now, therefore, be it

Resolved, That this association favors the orderly disposal of surplus war equipment at the least loss to the Government and the greatest benefit to the National economy; and be it further

Resolved, That the Committee on Maintenance and Equipment of the American Association of State Highway Officials be requested to study the question and make recommendations to our Legislative Committee for its use before the Congress; and be it further

Resolved, That copies of this resolution be sent to the Roads Committee of the Senate and the House.

great for the highway department to assume.

Some provision must be made for transverse crossing of utility lines.

Telephone lines that may legally enjoy the privilege of using public right of way, can be required to go to underground installation. Power lines should be denied. There are usually parallel streets available for their use.

The appropriateness of treatment and the character of development will determine the area required for landscaping or border treatment. A freeway is not always a parkway. It may, however, still be appropriately treated to satisfy esthetic taste with a minimum amount of right of way required for that purpose.

Sidewalks should not be permitted on freeways; they belong on the outer highways or on parallel streets.

General Observations

Everyone realizes the advisability of acquiring enough overall area for ultimate purposes—for some provision that may not be foreseen.

Be careful right of way estimates are reliable when the analysis is made. Ultimate satisfaction is more assured by adequate right of way than by doubtful expedients design must employ to make too much saving in width.

Right of way negotiations should be carried out by the agent in a frank discussion of the proposed highway plan. Disadvantages to property as well as the good points of the design should be disclosed if occasion requires. To so act, the agent must have a correct layout plan and must understand it. The engineer must have those plans advanced far enough to be reliably presented by the time acquisition is begun.

Considering the many steps and factors whereby the working design takes form through joint investigation and recommendation, it is evident both right of way and engineering personnel will have a mutual understanding in order to efficiently function. The preparation of freeway projects unfolds relatively new angles that can not be turned to advantage without collaboration.

Centralized coordinating personnel of a well organized highway department play an important part in smooth progress. Reviews and approvals, step by step in stages of advancing project preparation are necessary to comb out defects, standardize results and expedite completion.

No freeway project succeeds without cooperation of the other interests outside the highway department. Local support is helpful and necessary from inception to completion. The engineer and the right of way man can work best with those interests cooperatively. Together they can accomplish wonders. It is one thing to submit to local authorities a freeway map and freeway agreement. It is another to get their approval to the scheme of a limited freeway established across the heart of their metropolitan area, closing streets here, interrupting arterials there.

Finally we are fortunate in being fortified with a thorough understanding of the principles of good design this association has been so active in making available.

Highway Bids and Awards for December 1943-January 1944

ALAMEDA COUNTY—On Washington Avenue, between San Leandro and San Lorenzo, about 1.3 miles, drainage pipe to be installed. District IV, Route 69, Section B. Radich & Brown, San Leandro, \$34,349; Louis L. Fitinghoff, San Jose, \$36,890; McQuire & Hester, Oakland, \$38,472; Oakland Sewer Construction Co., Oakland, \$42,233. Contract awarded to McDonald & Kahn, Inc., San Francisco, \$33,845.

IMPERIAL COUNTY—Between State Highway Route 12 at Seeley and Camp Seeley, about 1.4 miles to be graded, gravel base material to be furnished and placed, and road-mix surfacing to be placed thereon. District XI, R. E. Hazard & Sons Contracting Co., San Diego, \$26,115; Macco Construction Co., Clearwater, \$41,458. Contract awarded to Arthur A. Johnson, Laguna Beach, \$24,949.

KERN COUNTY—Across Rag Gulch, about 1.5 miles south of Tulare County line, a reinforced concrete box culvert to be constructed. District VI, Route 129, Section B. Griffith Co., Los Angeles, \$14,914; Kiss Crane Co., El Cerrito, \$16,620; Rexroth & Rexroth, Bakersfield, \$14,585; Vinnell-Engineers, Ltd., Alhambra, \$11,983; C. B. Tuttle, Wilmington, \$12,780; James B. Allen, San Carlos, \$12,380; Rand Construction Co., Bakersfield, \$11,733; Wm. E. Thomas Concrete Construction, Maricopa, \$9,804; J. E. Haddock, Ltd., Pasadena, \$11,433; Trewitt, Shields & Fisher, Fresno, \$10,769. Contract awarded to F. Fredenburg, South San Francisco, \$9,317.

LOS ANGELES COUNTY—Figueroa Street between Adobe Street and Riverside Drive to be surfaced with asphalt concrete and plant-mixed surfacing. District VII, Route 165, Section A. Griffith Co., Los Angeles, \$31,601. Contract awarded to Vido Kovacevich, South Gate, \$26,314.

MONTEREY COUNTY—Across Torre Canyon, Vicente and Limekiln Creeks between 38 and 56 miles south of Monterey, three bridges to be repaired. District V, Route 56, Sections C.E. A. A. Tieslau & Son, Berkeley, \$31,390; Earl W. Heple, San Jose, \$40,300; I. M. Sommer & Co., San Francisco, \$33,276; Fred D. Kyle, Los Angeles, \$34,610; James B. Allen, San Carlos, \$34,854; James H. McFarland, San Francisco, \$29,977. Contract awarded to Kiss Crane Co., El Cerrito, \$24,525.

RIVERSIDE COUNTY—On Arlington Avenue between Van Buren Street and Magnolia Avenue in the city of Riverside, about 3.0 miles, to be surfaced with plant-mixed surfacing. District VIII, Match Bros., Elsinore, \$82,368; Phoenix Construction Co., Bakersfield, \$89,448; J. E. Haddock, Ltd., Pasadena, \$93,801; Tomei Construction Co., Van Nuys, \$106,702. Contract awarded to George Herz & Co., San Bernardino, \$74,687.

SAN DIEGO COUNTY—In National City between Concrete Ship Constructors Yard and National Avenue (State Highway Route 2) via 19th Street, McKinley Avenue and 13th Street, about 1.4 miles, to be graded and surfaced with plant-mixed surfacing. District XI, R. E. Hazard & Sons Contracting Co., San Diego, \$48,860; Griffith Co., Los Angeles, \$50,131. Contract awarded to V. R. Dennis Construction Co., San Diego, \$46,347.

SAN FRANCISCO CITY AND COUNTY—On Donahue Street and Jerrold and Kirkwood Avenues, about 0.3 mile, to be graded and paved with portland concrete cement on crushed rock base and armor coat to be applied. District IV, Hunter's Point. Chas. L. Harney, San Francisco, \$17,802; M. J. Lynch, San Francisco, \$20,939; A. G. Raisch,

San Francisco, \$22,416; MacDonald & Kahn, Inc., San Francisco, \$22,840; Peter Sorensen, Redwood City, \$25,872. Contract awarded to Eaton & Smith, San Francisco, \$16,102.

SAN JOAQUIN COUNTY—Bridge to be constructed across south branch Main Canal, 1.7 miles west of Route 4, junction. District X, Route 53, Section C. Wm. E. Thomas Concrete Construction, Maricopa, \$6,390; F. Kaus, Stockton, \$6,600; Baty Rocca, Stockton, \$7,160. Contract awarded to James H. McFarland, San Francisco, \$5,042.

MARIN-SONOMA COUNTIES—Between 1.5 miles and 12.5 miles south of Petaluma, five existing timber cattle passes to be replaced with new reinforced concrete sections. District IV, Route 1, Sections A,C. Earl W. Heple, San Jose, \$25,958; Kiss Crane Co., El Cerrito, \$27,885; Mercer, Fraser Co., Eureka, \$28,376; Stolte Inc., Oakland, \$31,425; W. Lenkeit, San Francisco, \$31,954; James B. Allen, San Carlos, \$33,370; A. A. Tieslau & Son, Berkeley, \$33,461; Lord & Bishop, Sacramento, \$33,891; Helwig Construction Co., Sebastopol, \$36,500; Peter Sorensen, Redwood City, \$37,116; Trewitt, Shields & Fisher, Fresno, \$37,576; A. Soda & Son, Oakland, \$38,722; Stockton Construction Co., Stockton, \$39,760; Moore & Roberts, San Francisco, \$44,444; E. A. Forde, San Anselmo, \$51,135. Contract awarded to Wm. E. Thomas Concrete Construction, Maricopa, \$24,334.

SACRAMENTO COUNTY—At the intersection of 12th Street and 16th Street, a traffic signal system to be furnished and installed. District III, Route 3, Section B. C. D. Draucker Co., Los Angeles, \$7,379; Holdener Construction Co., Sacramento, \$6,508. Contract awarded to Luppen & Hawley, Inc., Sacramento, \$6,124.

SAN BERNARDINO COUNTY—At Blue Cut about five miles northwest of Devore, heavy stone riprap to be constructed. District VIII, Route 31, Section B. Shanahan Bros., Inc., Huntington Park, \$77,330; John Strona, Pomona, \$77,970; Geo. Herz & Co., San Bernardino, \$83,670. Contract awarded to Norman I. Fadel, North Hollywood, \$45,600.

Central Valley Project Scenes Shown in Technicolor

The motion picture in color "Central Valley Project" has recently been shown at meetings of the California State Grange at Woodland and Stockton and at a meeting of the Sacramento Printing House Craftsmen.

This picture depicts the various stages of construction of the project by showing Shasta, Keswick and Friant dams, relocation of the State highway and the railroad around Shasta Reservoir, and the Contra Costa and Madera canals. It likewise shows many irrigation works completed with scenes of some of the State's agricultural crops.

This film was prepared and was shown under the auspices of the Water Project Authority of the State of California.

In Memoriam John James Stockard

The sudden passing of John J. Stockard, Associate Highway Engineer, on November 4, 1943, came with a sense of real and personal loss to his many friends in District IV and throughout the entire department, where he was so well known for over a quarter of a century.

Born in Springfield, Missouri, on October 30, 1875, he received his early education in the public schools and Cotley College of that State and Vanderbilt University at Nashville, Tennessee.

He married Edna M. Busby in August, 1903, and taught in Cotley College (founded by his mother) until 1907, when his urge for the outdoor life of an engineer became too strong to resist. From 1907 to 1913, he was employed in the construction and maintenance of various railroads in Utah, Missouri, and Oregon. He and his wife came to San Francisco from Salt Lake City on a projected vacation back to the old home in Missouri. Upon their first view of San Francisco, on September 2, 1913, from the deck of a ferryboat, he remarked, "This is it!", and the vacation plans were changed! Only a month later, on October 3, 1913, he was appointed an Assistant Resident Engineer in District IV. Since then he was promoted several times and filled many responsible and varied positions, in District I and District IV, throughout his thirty years of service.

Stanton and Harris Win Engineering Awards

THOMAS E. STANTON, Chief of the Materials and Research Department of the Division of Highways, has been awarded the Norman Medal, the highest award of the American Society of Civil Engineers, in recognition of an original paper on "The Expansion of Concrete," as an especially notable contribution to the Engineering profession, it was announced by George T. Seabury, secretary of the society.

Mr. Stanton has been with the Division of Highways for 31 years. He was one of the founders and first State President of the California State Employees Association. He is president of the Board of Administration of the State Employees' Retirement System.

Major Milton Harris, a member of Sacramento Section and an employee of the Division of Highways before entering the service, was awarded the Arthur M. Wellington prize for his paper on "Traffic Engineering as Applied to Rural Highways."

Traffic Counts Show 16.5 Per Cent Decrease for 1943

COMPILATION of 1943 traffic counts following the December check reveal a decrease in traffic last year of 16.5 per cent under 1942 according to Director of Public Works C. H. Purcell.

Regularly monthly traffic counts for December, 1943, show an increase of 25.7 per cent over December, 1942, and a decrease of 3.6 per cent under November of last year. Based on a five-year average, December counts normally show a decrease of 9.7 per cent under November. Traffic in 1943 decreased 29 per cent under that of 1941.

Comparing December, 1943, with December, 1942, passenger vehicles show an increase of 33.2 per cent and freight vehicles an increase of 10.5 per cent. Freight vehicles represented 22 per cent of the total traffic. Military vehicles accounted for 4.76 of the 1943 total traffic.

"The large percentage increase shown for last December over December 1942," Purcell said, "is accounted for by the unprecedented drop in December, 1942, traffic which occurred at the outset of gasoline rationing. The comparison of the full 12-months' periods of 1942 and 1943 is much more representative of the traffic trend. Our monthly counts indicate this decrease to have been approximately 16.5 per cent. A further comparison with the peak year of 1941 shows 1943 traffic to have decreased approximately 29 per cent under that of 1941.

Two Highway Employees On War Casualty List

The impact of war casualty lists has been felt in District VII and District IX.

Mrs. Catherine Miller of Lawndale, California, has notified District Highway Engineer S. V. Cortelyou of Los Angeles of the death of her son, Lt. Carl T. Miller, bombardier, in the crash of an Army plane at Hutchinson, Kansas. Lt. Miller was employed by District VII from March, 1938, until February, 1941, when he was granted military leave. Lt. Miller was born July 16, 1916.

District IX has been informed by Edward Clayton Davis of Bishop,

In Memoriam

Joseph Felix O'Hara

JOSEPH FELIX O'HARA, Associate Engineer in District III of the Division of Highways, at Marysville, passed away on November 26, 1943, in the Yuba City General Hospital, after an illness of several months. He was 51 years of age.

Born in St. Paul, Minnesota, May 12, 1892, he received his early education in the elementary and high schools of St. Paul and Aitkin, Minnesota, and then attended the Chicago Technical College where he studied civil engineering. He later completed the short course in highway engineering at the New Mexico State College.

In 1914 he entered the service of Minnesota State Highway Department, at Aitkin, where his father was district engineer. He remained in this service four years and later was employed by the Union Pacific Railroad, New Mexico State Highway, the County of San Miguel, New Mexico, and Oregon State Highway at Pendleton.

Mr. O'Hara entered the service of the State of California in September, 1920, with the State Engineer's Office at Sacramento, where he worked until February, 1923, when he went with the E. M. Lynch Engineering Company, Los Angeles, and from August, 1923, to April, 1924, he was employed by the Los Angeles Investment Co. During the remainder of 1924 and until September, 1925, his employment was short term work with the California Division of Highways, the Los Angeles City Engineer's Office, and the Fitzgerald Construction Co.

In September, 1925, he again entered the service of the California Division of Highways, and shortly thereafter was made Assistant Right of Way Agent at Sacramento. In December, 1933, he was transferred to District III at Marysville, where he remained until his death. His services with the State of California approximate 21 years.

Mr. O'Hara was a congenial and friendly person and was held in high esteem by all who knew him. His passing marks the loss of a capable and loyal employee.

He is survived by his wife, Margaret Nora O'Hara, a daughter Eileen, three sons, Brian, of the United States Coast Guard Academy, New London, Conn., Francis R., and Thomas E., of Marysville, two sisters, and two brothers.

Funeral services were held in St. Joseph's Catholic Church, in Marysville, November 29, 1943, where a Solemn Requiem High Mass was celebrated.

Inyo County, that his brother, Private George R. Davis, Coast Artillery Corps, died last November in New Caledonia from an attack of pneumonia.

He was granted military leave on September 11, 1942. He was born September 3, 1905.

Three More Public Works Men Depart For War Duty

Over 750 employees of the California Division of Highways have joined the armed forces. Included in this group are men and women from most of the various classifications, with the greater number naturally coming from the younger employees. Among the engineering personnel, however, quite a number over the 38-year draft age have joined the service.

From the Bridge Department alone, 64 engineers are now with the Army, Navy, or Marine Corps; from Central Office 21 are in uniform.

The most recent departures from Central Office include Lieutenant John G. Meyer, Assistant Office Engineer, who joined the Sea Bees, Lieutenant Richard R. Norton, Associate Engineer, who went into the Naval Reserve and Captain Sam Leedom, public relations executive of the Department of Water Resources, who is a Civil Affairs Officer in the U. S. Army.

A. S. H. O. Urges Aid By Federal Works Agency

The following resolution was adopted by the American Association of State Highway Officials at their annual meeting.

WHEREAS, It is of the utmost importance that plans be made now for the creation and sustaining of employment following the cessation of hostilities and demobilization of the armed forces; and

WHEREAS, The construction of public works by the Federal Government and by State and local agencies will be an important factor in meeting the employment problem; and

WHEREAS, The Federal Works Agency has had many years of experience in planning and providing for Federal and non-Federal construction, and by reason of its experience is qualified to undertake and aid State and local governments in advanced planning of public works; now, therefore, be it

Resolved by the American Association of State Highway Officials assembled in annual meeting at Chicago, Illinois, December 3, 1943, that the Association express its confidence in the Federal Works Agency and its hope that the Federal Works Agency will be granted authority by the Congress to undertake, and to aid State and local governments in the preparation of detailed plans for postwar construction and copies be sent to Federal Works Agency and each member of the Roads Committee of the House and Senate.

State of California
EARL WARREN, Governor

Department of Public Works

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

CHARLES H. PURCELL, Director of Public Works

A. H. HENDERSON, Assistant Director

HIGHWAY COMMISSION

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HARRISON R. BAKER, Pasadena
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FRED J. GRUMM, Assistant State Highway Engineer
J. G. STANDLEY, Principal Assistant Engineer
RICHARD H. WILSON, Office Engineer
T. E. STANTON, Materials and Research Engineer
R. M. GILLIS, Construction Engineer
T. H. DENNIS, Maintenance Engineer
F. W. PANHORST, Bridge Engineer
L. V. CAMPBELL, Engineer of City and Cooperative Projects
R. H. STALNAKER, Equipment Engineer
J. W. VICKREY, Traffic and Safety Engineer
E. R. HIGGINS, Comptroller
FRANK C. BALFOUR, Chief Right of Way Agent

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JNO. H. SKEGGS, District IV, San Francisco
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S. V. CORTELYOU, District VII, Los Angeles
E. Q. SULLIVAN, District VIII, San Bernardino
S. W. LOWDEN (Acting), District IX, Bishop
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E. E. WALLACE, District XI, San Diego
HOWARD C. WOOD, Acting Bridge Engineer, San Francisco-Oakland Bay, Carquinez, and Antioch Bridges

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P. T. POAGE, Assistant State Architect, Design and Planning

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H. W. DEHAVEN, Supervising Architectural Draftsman
D. C. WILLETT, Supervising Structural Engineer
CARLETON PIERSON, Supervising Specification Writer
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W. H. ROCKINGHAM, Principal Mechanical and Electrical Engineer
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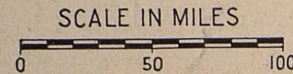
DIVISION OF CONTRACTS AND RIGHTS OF WAY

C. C. CARLETON, Chief
FRANK B. DURKEE, Attorney
C. R. MONTGOMERY, Attorney
ROBERT E. REED, Attorney



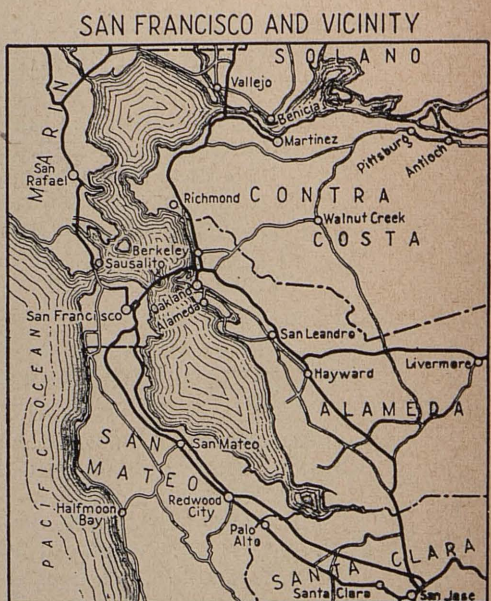
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~ LEGEND ~

- Primary Routes
- Secondary Routes
- Proposed Routes



D50 Illuminant, 2 degree observer

L*	39.12	65.43	49.87	44.26	55.56	70.82	63.51	39.92	52.24	97.06	92.02	87.34	82.14	72.06	62.15
a*	13.24	18.11	-4.34	-13.80	9.82	-33.43	34.26	11.81	48.25	-0.40	0.90	0.27	0.75	1.19	0.07
b*	15.07	18.12	-22.29	22.85	-24.49	0.39	59.99	48.09	1.13	0.23	0.23	0.23	0.23	0.23	0.19
Density										0.04	0.09	0.15	0.22	0.38	0.51

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