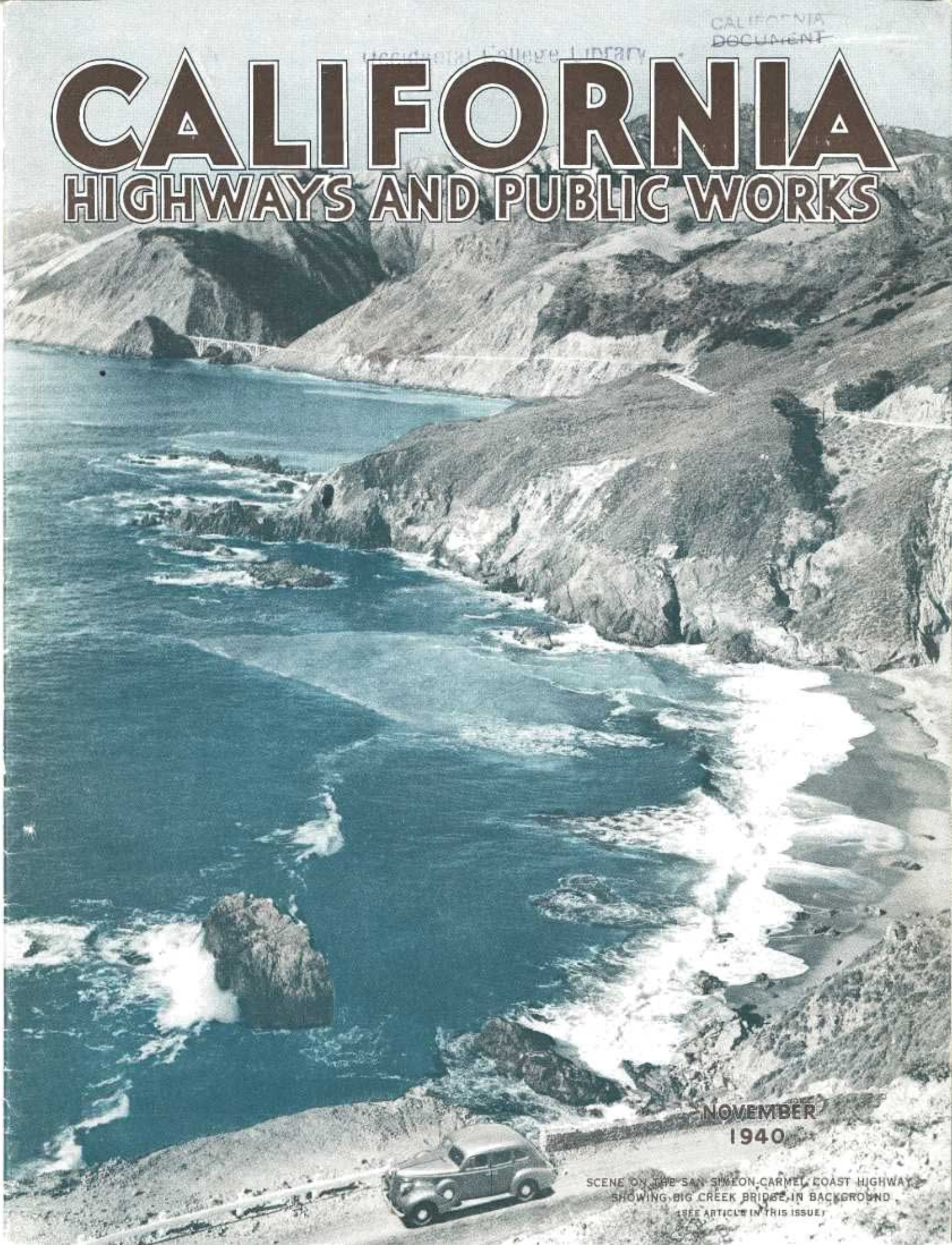
CALIFORNIA
HIGHWAYS AND PUBLIC WORKS



NOVEMBER
1940

SCENE ON THE SAN SIMEON-CARMEL COAST HIGHWAY SHOWING BIG CREEK BRIDGE IN BACKGROUND
(SEE ARTICLE IN THIS ISSUE)

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

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

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Vol. 18 NOVEMBER, 1940 No. 11

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Photo by U. S. Signal Corps

Such roads as this one hamper rapid movement of mechanized units of the Army and must be widened and realigned for National Defense

Highways for National Defense

By C. H. PURCELL, State Highway Engineer

WITHIN the past two years the mind of the American public has become focused on the urgent necessity of more complete preparedness for national defense. There has been a great deal of discussion both in Congress and elsewhere relative to the measures to be taken. Demands for increased production of planes, automotive equipment, and munitions have held the center of public thought.

Within the past year, however, national sentiment has been crystallized to the realization that one of the most important weapons of defense is a well articulated system of highways which provides adequate connection with all parts of the nation.

The effect upon highway construction in California by the necessary readjustment in the financing of projects to meet the demands of the proposed defense system will be far reaching. The results of surveys made in this State for proposed improvements which would be required for the strategic road system indicate that approximately $150,000,000 will be required in California. In addition to this amount, a sum of some $11,000,000 will be necessary for construction of access roads to the several cantonments, naval and military reservations planned for this State.

INADEQUACY OF FUNDS

The appalling inadequacy of funds which will be available for highway improvement is clearly seen when these figures are compared with anticipated Federal Aid to be apportioned to California during the next two years and the total expected State revenue.

California's regular Federal Aid appropriations for the next biennial budget have been reduced 25 per cent which places an additional burden on this State in meeting defense demands.

It has long been known that the success of the Caesars during the four centuries when the Roman Empire held the world in subjugation was largely due to the substantial road system over which the legions could move quickly from front to front.

FOR MECHANIZED ARMIES

In the present conquest of continental Europe by the mechanized armies of the Hitler regime the outstanding feature has been the rapid mobility of large numbers of troops and vast trains of heavy motorized equipment. Germany, by reason of her network of superhighways, was capable of throwing her military to the borders of Czecho-Slovakia, and Poland, then to Denmark and its position for the invasion of Norway, back through Holland and Belgium, on to Paris and the channel ports. The perfection of the Nazi military organization would have been useless without the interlocking system of German highways which were turned into arterials for the armed forces and their supplies.

In the United States, with 3000 miles from the Atlantic seaboard to the Pacific Coast and 2000 miles from Canada to Mexico and the Gulf, any program for national defense must give first consideration to the vital necessity of a complete network of military highways. This network must provide routes over which the National army and thousands of pieces of heavy motor equipment may be moved at high speeds and without congestion. It must tap the sources of raw materials and agricultural products and connect them with the centers of manufacture and industry. It must lead from the hubs of distribution to the points of

Photo by U. S. Signal Corps

Some highways and narrow bridges on roads of military importance in California will not accommodate these heavy tanks

strategic importance. It must have the strength in its weakest link to bear the burden which a nation prepared for defense will place upon it. It must be the base upon which may be built the entire program for National Defense.

FOUNDATION NETWORK EXISTS

To American highway engineers and officials, knowledge of these facts is not new. Highway development throughout the country has been advancing at an ever increasing pace during the last three decades. It is true that the standards used in building American roads have been governed largely by the needs of commercial traffic, nevertheless, development of the automotive equipment of commerce has been such that it parallels in size, weight and speed, equipment necessary for modern military operations.

The result is that, while there remains an enormous task of road building to be immediately accomplished, this nation has in the several State highway systems the foundation for the national network required by a complete defense program. The work ahead will be to push forward from where we are, with the gratifying knowledge that investments made up to this time will not be lost but will become an integral part of the complete network.

Trained organizations for taking the necessary steps are now functioning in the Public Roads Administration and the several State highway departments. The need is for immediate finances.

MUST STEP UP PROGRAM

We can not, however, sit back and complacently expect the rate of progress which has been normal for the past ten years to be adequate for the task which now confronts us. Highway construction programs in recent years have been based upon peace time plans for development over long periods. The urgent necessity for providing an adequate national highway system demands that road construction programs in all States must be tuned to the same tempo as other phases of defense preparedness. Trained armies with the most modern equipment and munitions are of no avail if adequate highways are not available for their transportation to any destination.

With full realization of these facts, the American Association of State Highway Officials, State highway departments, and Public Roads Administration, the Congressional Road Committee, American Road Builders Association, and others have worked to impress upon the public mind and upon the Congress the urgency of the situation and the necessity for immediate action and the stepping up of road and bridge construction to assembly-line speed.

Working together, the War Department and the Public Roads Administration estimated the highway needs of the nation for adequate defense purposes.

As result of this collaboration it was definitely determined that "military requirements would impose no standards for roads or bridges superior to those that would be required for the accommodation of normal commercial traffic." The estimate of construction needs showed further that "in greater part, the roads recommended by the War Department have been included in the Federal-Aid system and that with few exceptions they are the roads most needed in normal peace time life."

NEEDS OF NETWORK

The War Department, as a result of the conferences with the Public Roads Administration has stated that there are approximately 75,000 miles of highways on existing road systems which have special military and strategic value. Many miles of this strategic system, however, are in need of immediate widening, straightening and strengthening.

Figures issued by Federal Works Administrator Carmody give the following statistical data with reference to the strategic system.

Total mileage in the network	75,000	miles
Total number of rural bridges	16,000	
Number of bridges with load capacity less than 30,000 pounds	1,800	
Number of rural bridges with vertical clearance less than 12½ feet	150	
Number of rural bridges with horizontal clearance less than 18 feet	1,700	
Mileage of road surface less than 18 feet wide	5,500	miles
Mileage of road surface needing to be strengthened	14,000	miles

The Public Roads Administration, with the cooperation of the various State highway departments is now conducting an exhaustive engineering survey to determine the cost of improving the roads and bridges in the strategic system. The results of this survey will be available shortly.

In addition to the roads which are on existing highway systems, the War Department estimates that there will be needed construction of some 3,100 miles of highway to give access and connection with 120 cantonments and military reservations.

Standards to which the improvements are to be made will conform to the best practice now in use in State highway construction.

CONSTRUCTION OF BY-PASSES

It is not to be understood, however, that the program will require superhighways throughout the entire strategic system. Similar to highways for peace time activities certain military roads will serve as arterials and others as secondary routes feeding into the arterials. Requirements for standards of improvement form definite patterns on the basis of traffic volumes.

One of the most vital problems, however, will be construction of necessary by-passes around metropolitan areas. Troop and supply movements can not be jeopardized by meeting congested traffic in urban bottlenecks and ample provisions must be made to eliminate any such possibilities.

Immediate financing of this program for development of the military system is the problem which now confronts the nation and it must be realized that in accomplishing the development certain local highway programs now planned may of necessity be deferred.

Naturally, any defense system of highways will supplement the service the railroads will be able to furnish the army and navy. I believe it to be important that all highway officials work in cooperation with the railroads in the ultimate working out of defense transportation problems. It is proper that highway departments work closely with army and navy officials in selecting the routes most needed for national defense.

From preliminary estimates of proposed apportionments to the State of Federal Aid funds it appears that California will receive during the fiscal years ending June 30, 1942 and '43 only about $10,400,000 for regular Federal Aid, Federal Aid Sec-

Photo by U. S. Signal Corps

Narrow and structurally inadequate bridges such as the one shown in this photograph offer problems of troop movements.

Photo by U. S. Signal Corps

Surfacing on numerous highways of strategic value will not long stand up under the pounding of heavy mechanized army equipment

ondary and Federal Aid Grade Crossing funds. California must match the regular Federal Aid and Secondary funds with some $8,900,000 which will make a total of only $19,300,000 for the first two years of the $150,000,000 program for strategic roads in California.

It is most apparent, therefore, that the Federal government must provide additional money for the strategic roads and for the access roads in greatly increased amounts if the program for national defense is to be accomplished.

On the basis of the evidence presented to the Congressional Road Committee Congress passed and the President signed a new Federal Aid Highway Act which appropriated and authorized expenditures of $327,000,000 for the fiscal years ending June 30, 1942 and 1943. This means a total of $163,000,000 for each year will be provided by the Federal government for road construction projects throughout the nation. Official apportionment to the States has not as yet been made but the Federal Works Administrator has announced an approximate apportionment for each year of $97,500,000 for Regular Federal Aid, $17,063,000 for Secondary or feeder roads and $19,500,000 for grade crossing elimination. The Regular Federal Aid and Secondary funds must be matched by the States.

Photo by U. S. Signal Corps

This road to be of any importance to the military forces must be widened

For the construction of the 3,100 miles of special access roads to cantonments and military locations it is estimated about $202,000,000 will be required. These funds must be supplied in addition to those provided in the Federal Aid Act.

Provisions of the new Federal Aid Act provide that the Commissioner of Public Roads may give approval to and expedite the construction of projects recommended as important to national defense with any unobligated funds apportioned to any State as Federal Aid. Thus in addition to the $327,000,000 provided for the fiscal years ending in 1942 and 1943 there remains some $181,000,000 in 1940-41 authorizations which are still unobligated and are therefore available for defense priority construction.

These sums together with State money which must match Federal Aid will provide more than $800,000,000 for use in the building of the strategic system.

The problem of defense highways is known, funds for a considerable portion of the work are authorized or appropriated, State highway departments and the Public Roads Administration have the organizations to accomplish the task and the program will soon be rolling towards completion.

RESOLUTIONS ON NATIONAL DEFENSE

Adopted by The American Association of State Highway Officials at Seattle, Washington, September 19, 1940, as follows:

Whereas, Our country is at the present time definitely committed to the adoption of adequate defense measures; and

Whereas, Any adequate plan for national defense requires a comprehensive system of improved highways for the rapid and efficient transportation of men, equipment and supplies; and

Whereas, Large expenditures of public funds will be required, to insure the early construction and reconstruction of strategic highways selected by the War Department for national defense purposes; and

Whereas, The expense of providing such a system of defense highways is definitely beyond the financial capacity of the individual states; and

Whereas, This Association believes that the expense of providing an adequate system of national defense highways is primarily the obligation of the Federal Government, representing as it does all the interests of our people, and that expenditures for such a highway system are proper charges in a defense program; therefore, be it

Resolved, That this Association recommends that the Federal Government provide and make available separate and sufficient funds on such basis as will insure the early completion of an adequate system of strategic highways necessary for proper defense; and be it further

Resolved, That this Association again tenders its services to the President and the Congress and respectfully suggests that the technical and other organizational services of the Public Roads Administration, and the Highway Departments of the several states—constituting as they do, agencies which have amply demonstrated their ability to readily and efficiently initiate and carry to completion the extensive highway programs heretofore undertaken in our country—are at their disposal for carrying out any highway improvement program, essential to our national defense.

Defense Highways Demand More Funds

Make the Highways Safe for the Army might well have been the motto of the more than 550 delegates who attended the twenty-sixth annual national convention of the American Association of State Highway Officials in Seattle September 16-19 where the problem of making the nation's roads adequate to meet military demands was the principal topic. And paramount among resolutions adopted was one calling upon the Federal Government to make sufficient funds available as will insure early completion of an adequate system of strategic highways necessary for proper defense. The same resolution pledged the services of the Association in carrying out the program.

Indicating the magnitude of the defense highway program, Congressman James W. Mott of Oregon in his address to delegates recommended Congress pass a special bill to make possible a 1,000,000,000 schedule of construction and improvement. Mott is a member of the House roads committee.

Consensus of delegates and speakers at the conclave was that reconstruction and not construction of new super-highways is the primary problem. Widening, straightening and strengthening of highways, construction of by-passes to route traffic around large population centers, and reconstruction of bridges to bring them at least up to the minimum loading standard of H-15 were listed by engineers as first steps in improving the highway system.

Enlarging upon his proposal for a billion-dollar appropriation from Congress, Congressman Mott said he believed the new defense program should be in addition to the regular Federal Aid work, with the government contributing the major portion of it. Said he:

"I should say not less than 75% of the cost, and perhaps as much as 80 or 85% shoud be borne by the Federal government, instead of the 50-50 contribution which now prevails."

Declaring the main highways are ideally located for defense purposes, in the opinion of the War Department, Congressman Mott expressed confidence in the ability of road builders to continue their efforts toward national defense objectives without the confusion and uncertainty which marks other phases of the defense program.

T. H. MacDonald, Federal Commissioner of Public Roads, said statewide surveys form a secure foundation for sound policies, and provide detailed information for effective and immediate action toward making the highways suitable for military and defense purposes.—*Western Construction News.*

Public Agencies and Publicly-owned Electric Facilities

IN LESS than five years, electric energy from the Shasta Power Plant of the Central Valley Project will be flowing over transmission lines to serve the project itself and the domestic and commercial users in northern California.

With an initial capacity of 300,000 kilowatts the hydro-electric plant will generate an average of 1,500,000,000 kilowatt hours annually. Combined with a steam-electric power plant tentatively proposed at Antioch, it will be capable of serving a general power load of 2,000,000,000 kilowatt hours or about one-third of the present power load in northern California.

The accompanying artist's sketch shows the power facilities of the project, the various public agencies now distributing their own power and others organized which will be in a position to negotiate for the purchase and use of Central Valley Project power. It also shows other major publicly-owned power systems in the State, namely the Hetch Hetchy and Boulder Dam developments which could be interconnected with the Central Valley Project.

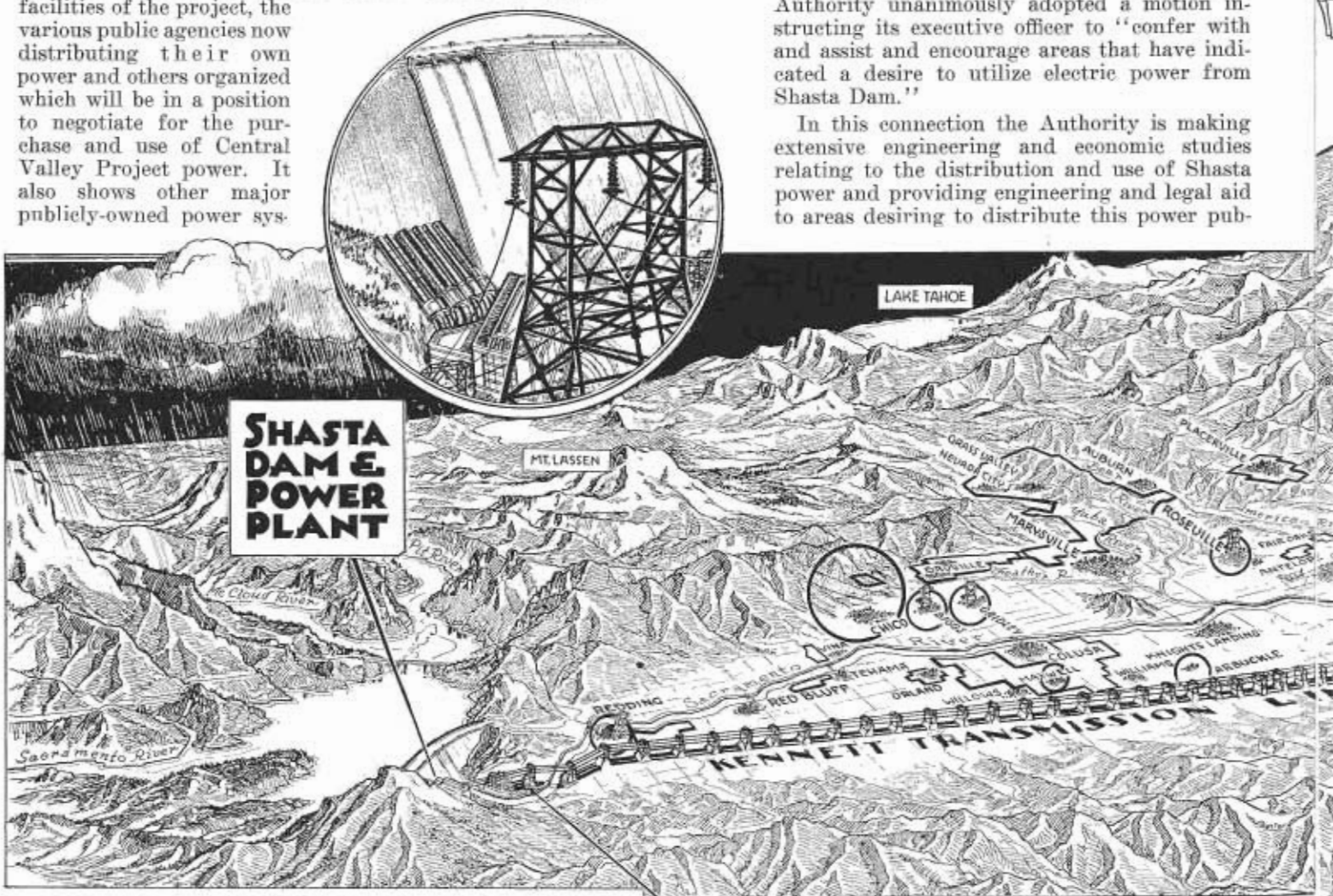
Under State and Federal laws public agencies will be given preference in the sale of Central Valley Project power. These agencies as indicated on the map are: public agencies already distributing electric energy through publicly-owned systems; municipal utility districts and existing irrigation districts legally constituted to own and operate electric power distribution systems.

Within the general market area for Shasta Dam power these cities are now distributing power through publicly-owned systems: Redding, Biggs, Gridley, Roseville, Lodi, Ukiah, Healdsburg, Alameda, Palo Alto and Santa Clara. The Modesto and Turlock Irrigation Districts generate and distribute their own power.

The Sacramento Municipal Utility District is in the process of acquiring its own distributing system. Assistance in acquiring Central Valley Project power for public distribution has been sought through the Water Project Authority of California by the Glenn-Colusa Irrigation District, Bidwell Municipal Utility District, East Contra Costa Irrigation District, Banta-Carbona Irrigation District, West Stanislaus Irrigation District, Byron-Bethany Irrigation District, Waukena-Packwood Canal Area.

At its meeting on September 24th, the Water Project Authority unanimously adopted a motion instructing its executive officer to "confer with and assist and encourage areas that have indicated a desire to utilize electric power from Shasta Dam."

In this connection the Authority is making extensive engineering and economic studies relating to the distribution and use of Shasta power and providing engineering and legal aid to areas desiring to distribute this power pub-

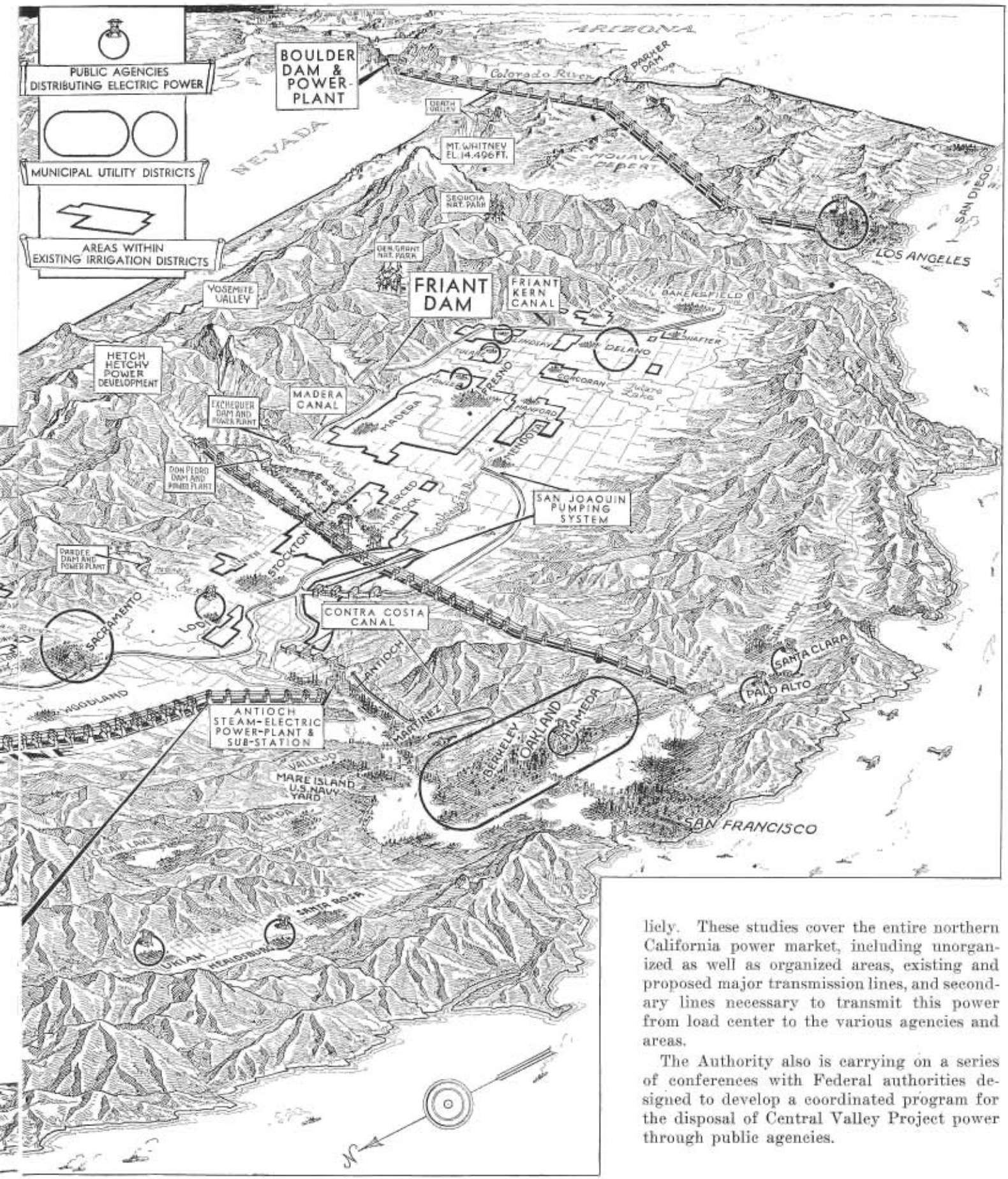


Central Valley Power Facilities

Shasta Dam hydro-electric plant will accommodate five 75,000-kilowatt generators, each driven by a 103,000-horsepower turbine. Initial installation is four units. The plant will generate an average of 1,500,000,000 kilowatt hours of electric energy annually.

Kennett transmission lines will be 200 miles long, extending from Shasta Dam to a sub-station near Antioch. The proposed capacity is 300,000 kilowatts.

s Which Can Be Linked to Central Valley Project Power



licly. These studies cover the entire northern California power market, including unorganized as well as organized areas, existing and proposed major transmission lines, and secondary lines necessary to transmit this power from load center to the various agencies and areas.

The Authority also is carrying on a series of conferences with Federal authorities designed to develop a coordinated program for the disposal of Central Valley Project power through public agencies.

View of Niles Canyon showing new highway around relocated stream bed and one of two bridges eliminated by new alignment

River Bed Moved to Make Room For Niles Canyon Road Relocation

By J. J. STOCKARD, Associate Highway Engineer

IN 1937 a major highway construction project at the lower end of Niles Canyon was completed, whereby six modern grade separation structures and a bridge over Alameda Creek removed the menace of the old railroad grade crossings and an obsolete inadequate bridge—all in vicinity of Niles in Alameda County about half way between Oakland and San Jose at the junction of State Sign Routes Nos. 17 and 21.

And now another noteworthy contribution is made to the highway facilities of the Niles neighborhood by reconstructing one mile of the Niles Canyon road, on Sign Route 21, eastward from its junction with Route 17 whereby alignment is greatly improved and two inadequate and dangerous bridges are eliminated.

Niles Canyon is one of Nature's outstanding contributions to the convenience and economic well being of the bay region. It was cut through the mountain chain by the small river called Alameda Creek. Early in the bay region settlement, pioneer highway builders and the railroad companies began to encroach upon the river's valley floor until now there are two railroads and a highway contending with the river for living space.

The mile of construction here referred to is the most pronounced of these acts of benign usurpation, in that the entire river bed for this mile of relocation was moved over to make room for the new highway. The construction was designed to utilize materials from new channel excavation to build the highway roadbed, and to furnish boulders for riprap bank protection against attack by the river in flood stages.

An alternative to this plan of reconstruction was to build two new bridges over Alameda Creek and

straighten out the existing road as much as bridge controls would permit. This alternative would have entailed a first cost equal to or more than that of the work as actually done. In addition there would have been the cost of perpetual maintenance of the two bridges.

TRAFFIC SERVICE AND BENEFITS

Traffic over this canyon road has summer counts of around 4300 cars on Sundays and holidays, and about 1500 on week days. The road affords a low level grade between bay points and the Livermore Valley. The heavily loaded trucks with trailers using this highway, in spite of the two obsolete and ancient bridges along the way, have made this improvement imperative, and it is with a sense of great relief that the Division of Highways has been able to furnish traffic this fine new stretch of highway and at the same time provide the river with a better channel bed than the one we have taken it from.

The upper bridge of the two displaced has been demolished and removed, but the lower bridge was returned to Alameda County as a provision to serve a few home sites and summer camp grounds.

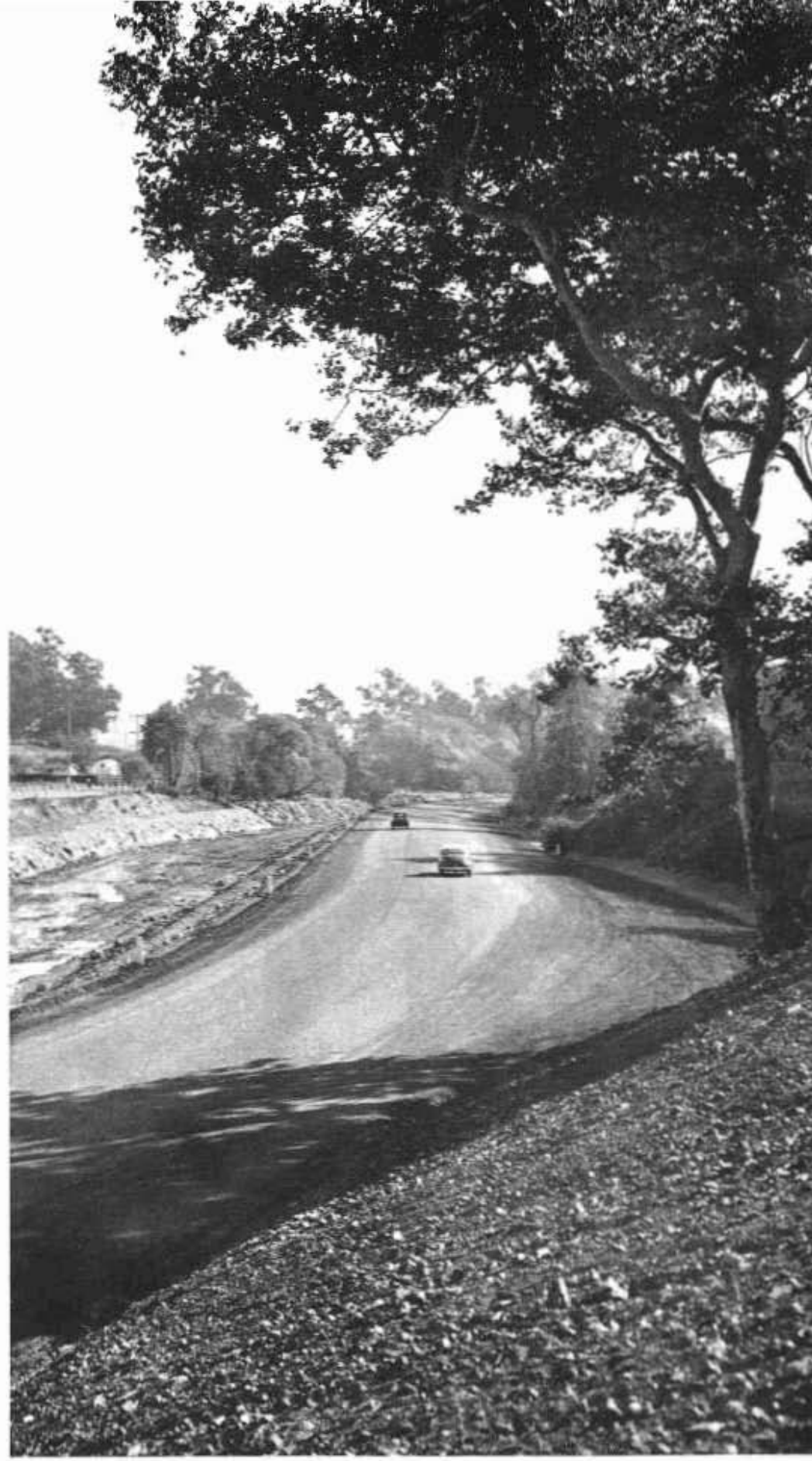
TYPE OF CONSTRUCTION AND COST

The new road has four curves with a total of less than one-half circle, as against eight curves with very nearly one complete circle of curvature in the section of old road displaced. Also on the new road the shortest radius curve is 700 feet as against a 60-foot radius on the old road.

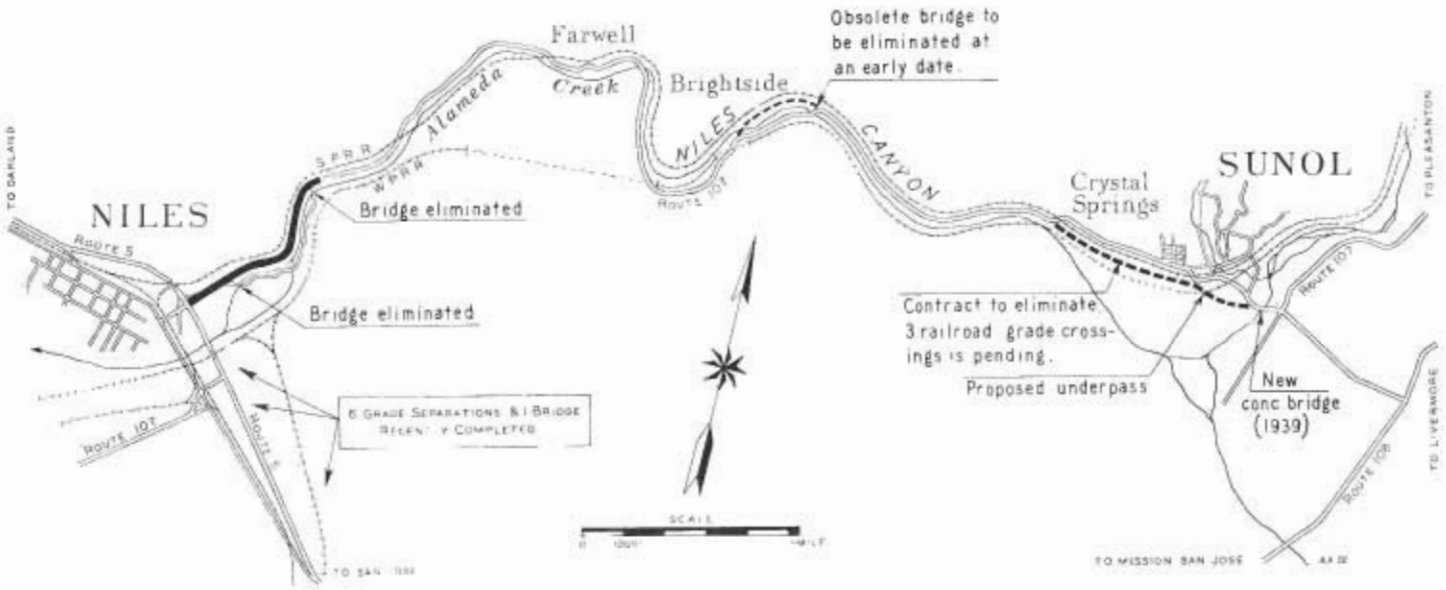
The new location shortens the distance nearly one-tenth of a mile as compared with the old road or any other feasible line of construction.

The new roadway is thirty-six feet wide exclusive of dikes and gutters. A top course of selected gravelly material blankets the entire roadbed to a minimum depth of one foot and upon this base is placed a 0.21 by 22-foot plant-mix surfacing with 7-foot penetration oil treated shoulders.

Coarse rock and boulders encountered in excavating the new river channel were grouted in place along embankment slopes exposed to flood waters, and where necessary toe trenches were dug and this protection was extended below flow line to prevent undercutting the roadbed.



Another view of Niles Canyon showing channel change and new highway. Railroad adjacent on the right is screened from view



Detail of the boulder facing set in Portland cement for slope protection

The boulder facing was dragged to place by mechanical means, washed clean of dirt and fines before placing the portland cement grout which was flushed into voids to a depth of about eighteen inches.

Practically throughout the length of this project the railroad right of way joins the highway on one side and the river channel on the other, so that the greatest possible use is made of available space of the valley floor.

Nearly all the right of way required was included in the old Spring Valley holdings now belonging to the City of San Francisco.

Cost of construction was a little less than $75,000.

As related to this improvement a project is now being advertised for contract whereby three railroad grade crossings at the easterly end of Niles Canyon, in the vicinity of Sunol, will be eliminated. Also at Sunol a new bridge over Arroyo De La Laguna was recently completed and it is planned to eliminate, at an early date, the only remaining obsolete structure in Niles Canyon.

This latest completed improvement is directly integrated with the scheme of high standard reconstruction in the Niles vicinity, and is a very attractive part of that system.

Motor vehicles traveled 287 billion miles in 1939 and carried passengers ten times farther than all other forms of transportation combined.

Add dictator definitions: An iron man on a steal job.

Central American Official Visitors Amazed By Our Highways

Left to right:—Juan Jose Martinez-Lacayo, Consul General of Nicaragua at San Francisco; Madame Julia Cortes; Leo J. Smith, Department of Public Works; Dr. Leon Cortes, former President of Costa Rica; Arturo Fernandez-Ardon, Consul General of Costa Rica at San Francisco

"CALIFORNIA'S highways have delighted and amazed me."

This tribute to the State highway system was paid by Dr. Leon Cortés, former president of Costa Rica, following a tour throughout California last month.

Dr. Cortés, who served as chief executive of the Central American Republic from 1936 to 1940, was accompanied on his trip by Madame Cortés Arturo Fernandez-Ardon, Consul-General of Costa Rica at San Francisco, and Juan Jose Martinez-Lacayo, Consul-General of Nicaragua at San Francisco and former Governor of Granada, Nicaragua.

The party motored north from San Diego through the San Joaquin Valley to Yosemite and thence to Sacramento, where the members visited with Governor Culbert L. Olson and Director of Public Works Frank W. Clark. From Sacramento the distinguished visitors toured the Sacramento Valley and the Redwood Empire.

Dr. Cortés was greatly impressed by California's 14,000 miles of State highway. His own country has approximately 700 miles of highway, mostly asphalt concrete roadways, largely located in mountainous areas.

These highways are maintained by government tax on petroleum products which the government of Costa Rica controls.

"One of my most vivid impressions of the California highway system," Dr. Cortés told Director Clark, "is your excellent system of highway maintenance. California highways are among the most beautiful in the world and the manner in which they are maintained arouses admiration."

Dr. Cortés complimented the Department of Public Works on the publication of its monthly magazine, CALIFORNIA HIGHWAYS AND PUBLIC WORKS.

"The magazine, which we receive in Costa Rica and also in Nicaragua, has been of great help to our highway engineers," Dr. Cortés said.

The former president of Costa Rica was minister of public works of his country from 1929 to 1936, in which year he was elevated to the presidency.

While in Sacramento, Dr. Cortés and party were escorted through the Division of Highways shops, and the Testing and Research Laboratory by Leo J. Smith of the Department of Public Works, who assisted the visitors in arranging their itinerary in northern California.

3,618,818 Miles of Highways In the America Republics

THE total road mileage in the 21 American Republics is 3,618,818 miles. Argentina leads outside the United States with 253,115 miles of highways and 275,300 automobiles. Brazil is second with 129,057 miles and Mexico third with 56,923 miles. The United States has six times the combined road mileage of the other 20 Republics with 3,056,000 miles.

Argentina is making the most progress of any of the South American Republics in road building since the government in 1933 passed the Highway Act which provided for the National Highway Bureau and Federal Aid, patterned in many respects after the Federal Highway Act of the United States.

Road construction in Central America is progressing slowly. Guatemala and El Salvador may now be crossed by automobile. This year Nicaragua planned to build 125 miles of main road.

Cuba, with 43,852 automobiles, leads with a ratio of 19.1 automobiles to 1 mile of road. Panama and the Canal Zone are second with 9.7. Argentina, with the greatest road mileage outside of the United States, has 1.1 automobiles to a mile of road.

Some idea of the condition of roads in South America is shown in a report of the United States Department of Commerce which indicates that Paraguay, with only 3,759 miles in its present highway system, has 30 miles of roads improved with gravel surface, the remaining mileage coming under the heading of unimproved earth roads, and yet Paraguay has 1,526 automobiles.

—*Highway Highlights.*

Steel Guard Rail Installed Along 46 Miles of Monterey Coast Road

By L. H. GIBSON, District Engineer

A CONTRACT was entered into with the Union Paving Company in July of this year for what is perhaps the largest installation of guard rail ever placed on a California State highway under one contract. This installation on the Roosevelt Highway (State Sign Route 1), between San Luis Obispo and Monterey, is now practically complete. The new guard rail presents a very pleasing appearance as well as high visibility and affords unusual protection.

The contract extends from the San Luis Obispo County line northerly 46.6 miles to the Big Sur River, about 27 miles south of Carmel. The total cost of the contract will be in the neighborhood of $80,000, which sum was set up in the current budget to be paid out of State Highway Funds. The northerly ¾ of a mile is within the boundaries of the Big Sur State Park.

In addition to the guard rail installation, points of less hazard have been protected by installation of guide posts. The total mileage of guard rail and guide post protection covers 30.2 roadside miles.

During the summer months the traffic will average between 700 and 1100 cars in a 16-hour day, and the estimated traffic in 1965 will be 1410 cars per day. This is mostly passenger car traffic with only one to two per cent of truck traffic, which percentage is very much lower than on the general main traveled arteries. Traffic during winter months is considerably less.

Because of the nature of the terrain which on this portion of the Roosevelt Highway is very precipitous, a car leaving the road at some places may fall hundreds of feet. Consequently, the necessity for guard rail is very evident and further consideration was given to the selection of a type of rail which would give the greatest protection possible. A beam type of metal rail was finally selected as best adapted to the conditions.

The rail is supported only through steel brackets attached near the bottom of the wooden posts. This gives a great resiliency to the railing which tends to absorb the impact of a car hitting the rail without the usual breakage that occurs with more rigid types. This spring action also tends to throw the car back into the road without upset or other than minor damage.

A description of the guard rail as installed is as follows: Redwood or cedar posts 8 by 8 inches in section and 6 feet long were set into the ground 3 feet 6 inches and to this post was bolted a steel spring bracket 7/16 inch in thickness and 4 inches wide and curved to fit the rail section and to hold it approximately 5 inches away from the post at the top. This bracket which has a tensile strength in excess of 100,000 pounds per square inch is fastened to the post with two galvanized bolts near the ground surface. The railing which is 12 inches wide after forming and is a minimum of 5/32 of an inch in thickness has a tensile strength in excess of 80,000 pounds per square inch. The edges of the railing are rolled to remove any sharp edges which might be dangerous to car or passenger in case of accident. These rails are 10 feet long and are bolted together at each end and the railing bolted to the steel bracket with two galvanized bolts.

The steel brackets and steel rail are given a shop coat of red lead before reaching the job and after installation are given another coat of red lead and two coats of white paint. The paint is particularly selected for its protective qualities, as steel in this ocean area deteriorates very rapidly unless properly protected. The redwood or cedar posts are given three coats of white paint.

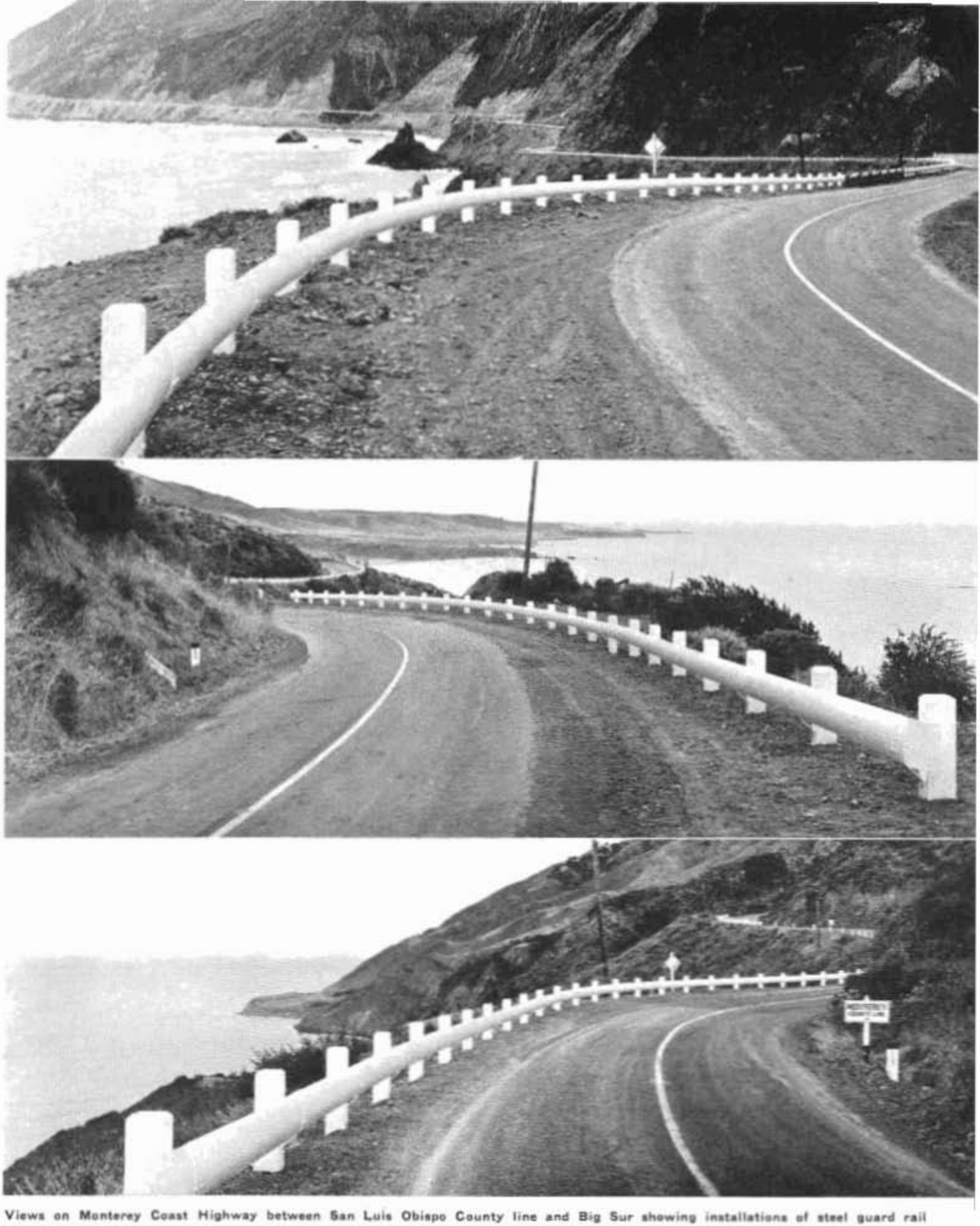
In addition to the protection afforded by the guard rail, guide posts 3 by 8 inches by 5 feet 4 inches long were placed in areas which were considered less hazardous but where, on account of occasional fog conditions, marking of the roadside edge was quite essential. These guide posts were also given three coats of white paint and were spaced approximately 50 feet apart measured along the centerline of the highway.

The State obtained very satisfactory bid prices for rail and guide posts considering the rocky material encountered in digging post holes and the location of the work. The guard rail contract price is $1.09 per lineal foot of rail and the guide posts are $1.75 each, in place. 63,662 lineal feet, or approximately 12 miles, of guard rail are being installed on the 46.6 miles in 294 different locations; 3,649 guide posts are being placed in 289 locations and cover about 18 roadside miles. In the contract additional guard rail, complete with posts, brackets and railing, and a quantity of guide posts were furnished and stored at the two Maintenance Stations within the limits of this contract so that quick repairs or replacements could be made on any section damaged by motor vehicles or other causes.

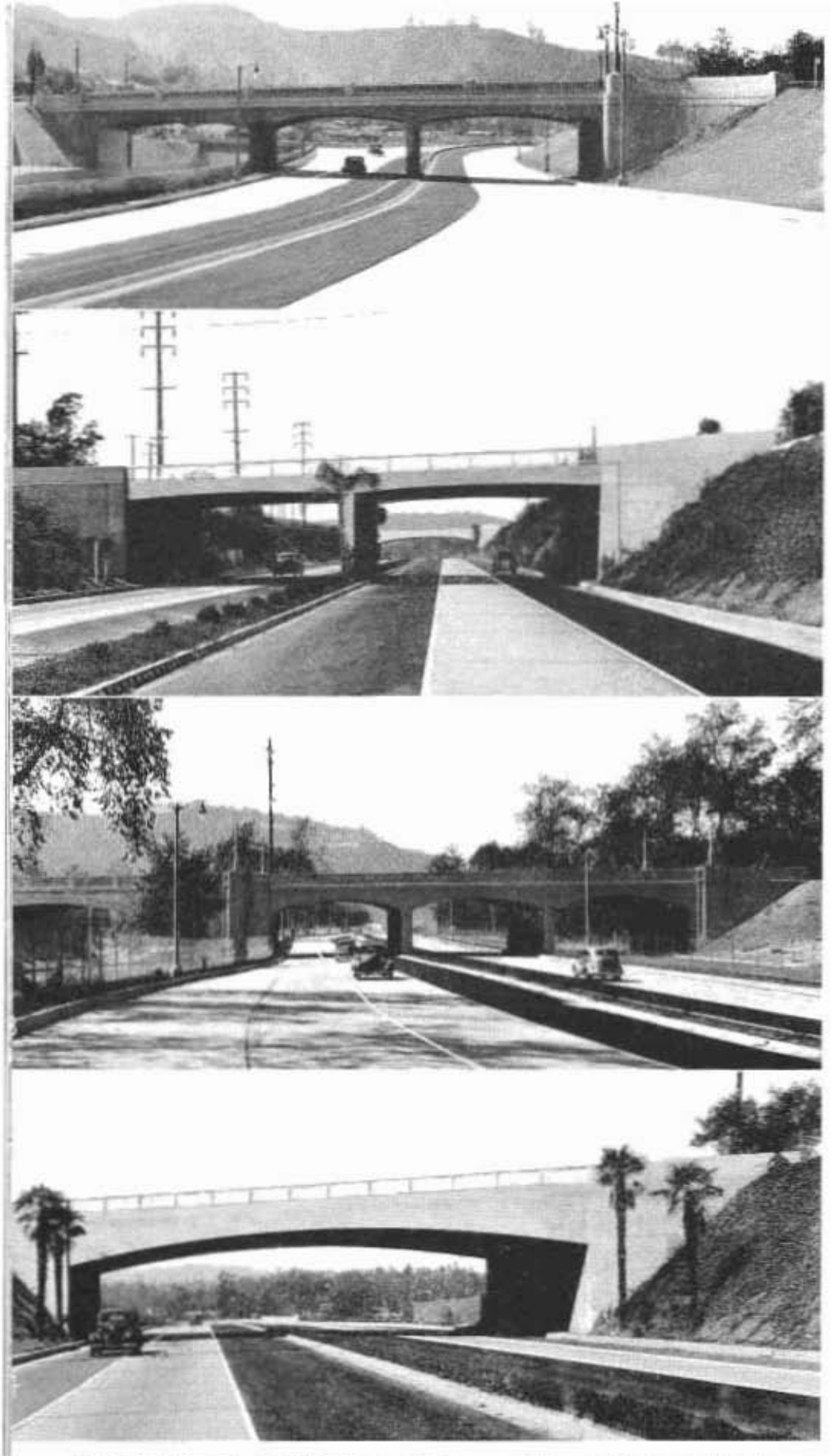
Of the above length of guard railing, 1000 feet were left unpainted by the contractor according to the terms of the contract to permit investigations and experiments by the Division of Highways laboratory to determine the types of paint considered best suited to the protection of steel work adjacent to the ocean where fog and salt spray tend to rust and deteriorate any type of steel work. The experimental painting was performed by State forces.

The section of road on which this protection is being placed was graded 20 to 24 feet wide, generally by convict labor, from 1922 until 1937 when the road was finally opened to traffic.

(Continued on page 28)



Views on Monterey Coast Highway between San Luis Obispo County line and Big Sur showing installations of steel guard rail



From top to bottom—Ave. 43 bridge over Freeway and channel. Service road bridge over channel in left background. Grand Ave. bridge, Arroyo Dr. bridge in background. Ave. 40 bridge over Freeway and channel. Arroyo Dr. bridge over Freeway in S. Pasadena

Arroyo Seco Fr
Required 26 Bri

CONSTITUTING the third unit of the Arroyo Seco Parkway connecting Los Angeles and the city of Pasadena, an additional mile of this famous freeway was opened to traffic on November 1.

The completion of this section from Avenue 22 to Avenue 40 opens up 5½ miles of the six-mile project which starts at the east end of the Figueroa Street Bridge across the Los Angeles River in Los Angeles and ends at Glenarm Street in Pasadena.

Since Figueroa Street is the major origin of north-bound traffic using the Parkway, its present condition constitutes a bottleneck and restricts the free and uninterrupted flow of traffic from the Los Angeles downtown area through the Parkway. At the present time surveys and studies are being made for an additional roadway northwest of and roughly parallel to the existing North Figueroa Street.

This project, which was described in the last issue of California Highways and Public Works, will extend southwest from Avenue 22, on the east side of the Los Angeles River, cross the river, and continue through Elysian Park to Castelar Street, a distance of about one mile. The new road will carry south-bound traffic only, while the existing road will carry only north-bound traffic.

FOR RAPID TRAFFIC MOVEMENT

Tentative plans require the construction of five bridges on this Figueroa Street extension project: a bridge across the Los Angeles River parallel to the present structure approximately 850 feet long; one to carry a park road situated within Elysian Park over the proposed new roadway approximately 200 feet long; another 200-foot bridge to carry the new roadway over Solano Street; an 80-foot structure to carry the new roadway over Bishop Road, and a bridge approximately 230 feet long to carry a new road connected to Castelar Street over existing Figueroa Street.

In the construction of the Arroyo Seco freeway every consideration was

Freeway Project Bridge Structures

given to providing means of facilitating rapid movement of traffic. All highway, pedestrian, and railroad cross traffic at grade has been eliminated. The motorist will not encounter a boulevard stop sign or an automatic traffic signal in the entire length of the freeway. To accomplish this required the construction of 26 grade separation structures of various types at the following locations:

PROJECTS AND COST

In Los Angeles

Projects	Cost
Avenue 22 Bridge	**$165,000
Avenue 26 Bridge	42,300
Cypress Avenue (Abutments and Foundations for Future Bridge)	164,000
Avenue 35 Railroad Bridge	120,000
Pasadena Avenue Bridge	190,000
Avenue 43 Bridge	45,100
Avenue 43 Ramp Bridge	5,700
Sycamore Grove Pedestrian Bridge	30,400
Avenue 52 Parkway Bridge, Avenue 52 Channel Bridge, Hermon Avenue Parkway Bridge, Hermon Avenue Channel Bridge	**195,400
Avenue 60 Service Road Bridge	18,400
Avenue 60 Bridge	58,900
Marmion Way Bridge, Marmion Way Service Road Bridge	58,000

South Pasadena

Hough Street Bridge	135,000
Arroyo Drive Bridge, Equestrian and Pedestrian Underpass, Grand Avenue Bridge	**111,100
Orange Grove Avenue Bridge, Prospect Avenue Bridge	20,200
Meridian Avenue Bridge	23,600
Fremont Avenue Underpass, Fremont Avenue Bridge	154,500
Fair Oaks Avenue Bridge	50,400
	$1,588,300

** *Includes Roadwork.*

The detailed plans of these structures were designed cooperatively by the Los Angeles City Engineering Department and the State Division of Highways, and the structures themselves were built under the supervision of the Bridge Department of the Division of Highways of the State of California.

Several of the projects include extensions to former structures over the

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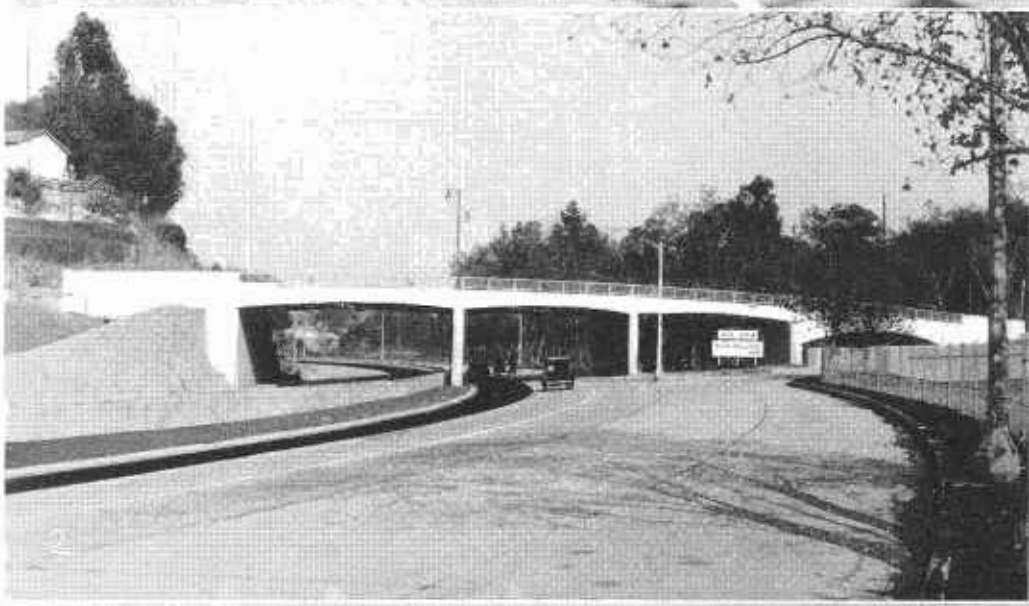
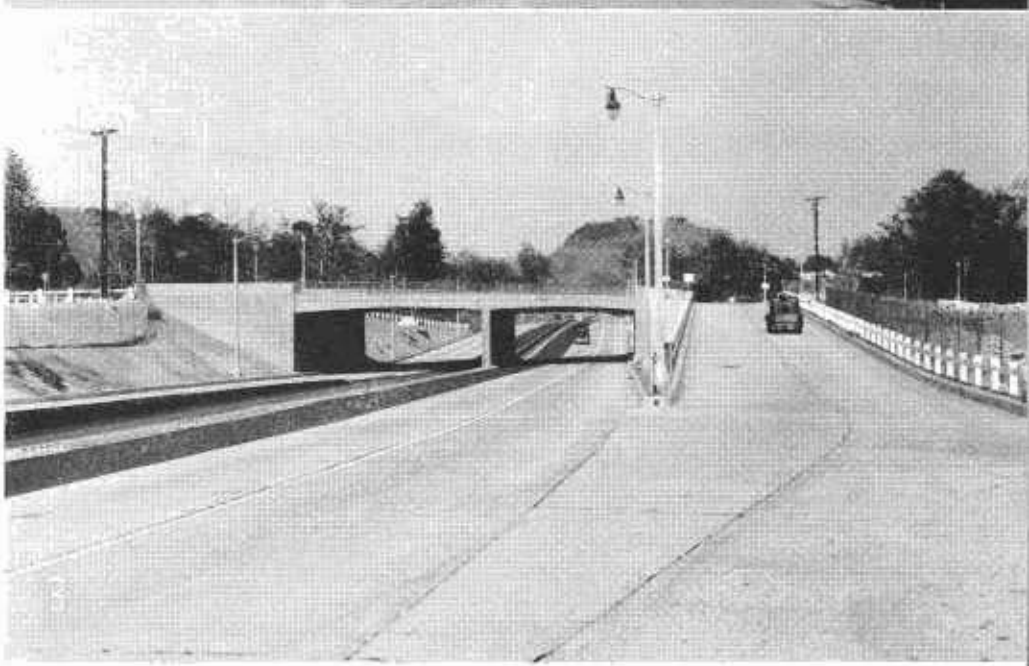




Top—View of Ave. 52 bridge over Freeway and Arroyo Seco channel. Center—View of Marmion Way bridge crossing over Freeway and channel. Lower—Hermon Ave. bridge over Freeway. Bridge over channel is shown on right side of picture behind fence!

Reconstruction of 19th Avenue In San Francisco By Gas Tax Funds

By GEORGE MATTIS, Engineer, City and Cooperative Projects, District IV

STATE Highway Route 56, which is California Sign Route No. 1, will become, in the ordinary course of events, one of the major routes of recreational travel throughout the length of the State, traversing as it does the Pacific Ocean shore line from Santa Barbara County to Humboldt County.

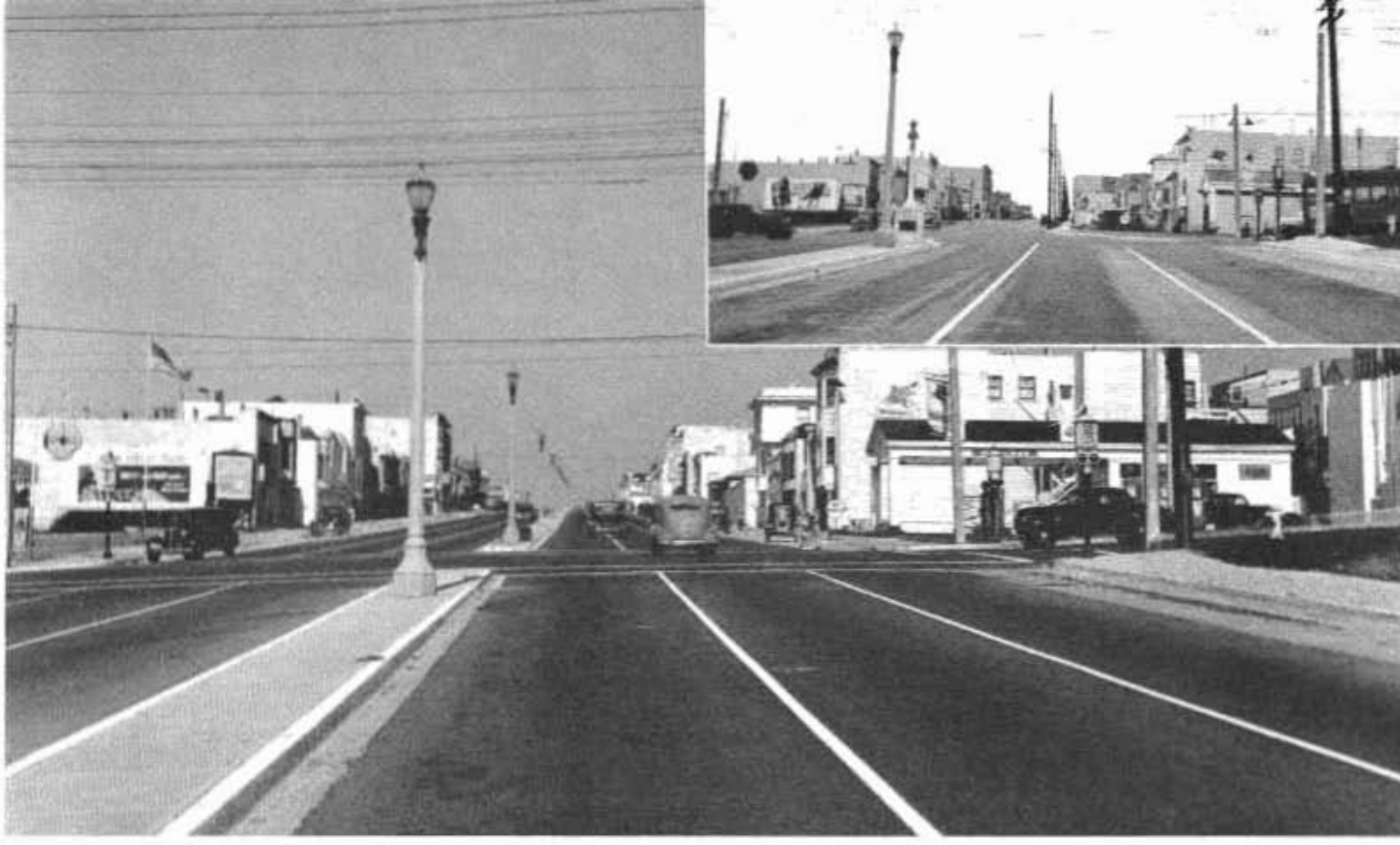
While this route will be used more for its recreational features than for through travel, it will greatly contribute to the development in a commercial way of the country along its route. The Division of Highways in cooperation with Santa Cruz County, San Mateo County, and the City and County of San Francisco, have been reconstructing State Highway Route 56 between San Francisco and Monterey Bay during the past several years as funds became available. The entire length of this route within the City of San Francisco has been reconstructed and widened to modern standards.

This route enters the City of San Francisco on Junipero Serra Boulevard, at the city limit line between San Francisco and Daly City. It follows Junipero Serra Boulevard to its intersection with the Nineteenth Avenue Extension, and thence over the Nineteenth Avenue Extension and Nineteenth Avenue to the Golden Gate Park.

Through the Park, no street has been officially designated by the Division of Highways as State Highway Route 56; however, the Golden Gate Park authorities, in cooperation with the W.P.A. authorities, constructed a divided roadway through the Park, from Nineteenth Avenue at Lincoln Way to Fulton Street at Park-Presidio Boulevard.

From this point, this route uses Park-Presidio Boulevard to the south-

Views on Nineteenth Avenue, San Francisco, before (upper) and after (lower) widening of pavement and setting back of residences



Looking north on Nineteenth Ave. across Taraval St. in San Francisco before (upper) and after (lower) thoroughfare was widened

erly line of the Presidio Military Reservation near Lake Street, and thence over the newly constructed Funston Avenue Approach to the Golden Gate Bridge, described in the March and May 1940 issues of this publication.

The territory in San Francisco traversed by State Highway Route 56 is through the westerly portion of the city and is through a highly developed residential district. Southerly of Sloat Boulevard a large territory is rapidly being developed for a residential district, and for the past several years new homes have been under construction at all times. This development will, of course, increase the local traffic desiring to use State Highway Route 56 to reach not only the outlying districts but also to reach the business section of San Francisco by way of the Portola-Market Street arterial, or by way of the newly constructed Golden Gate Bridge approach and Lombard Street.

NINETEENTH AVENUE WIDENED

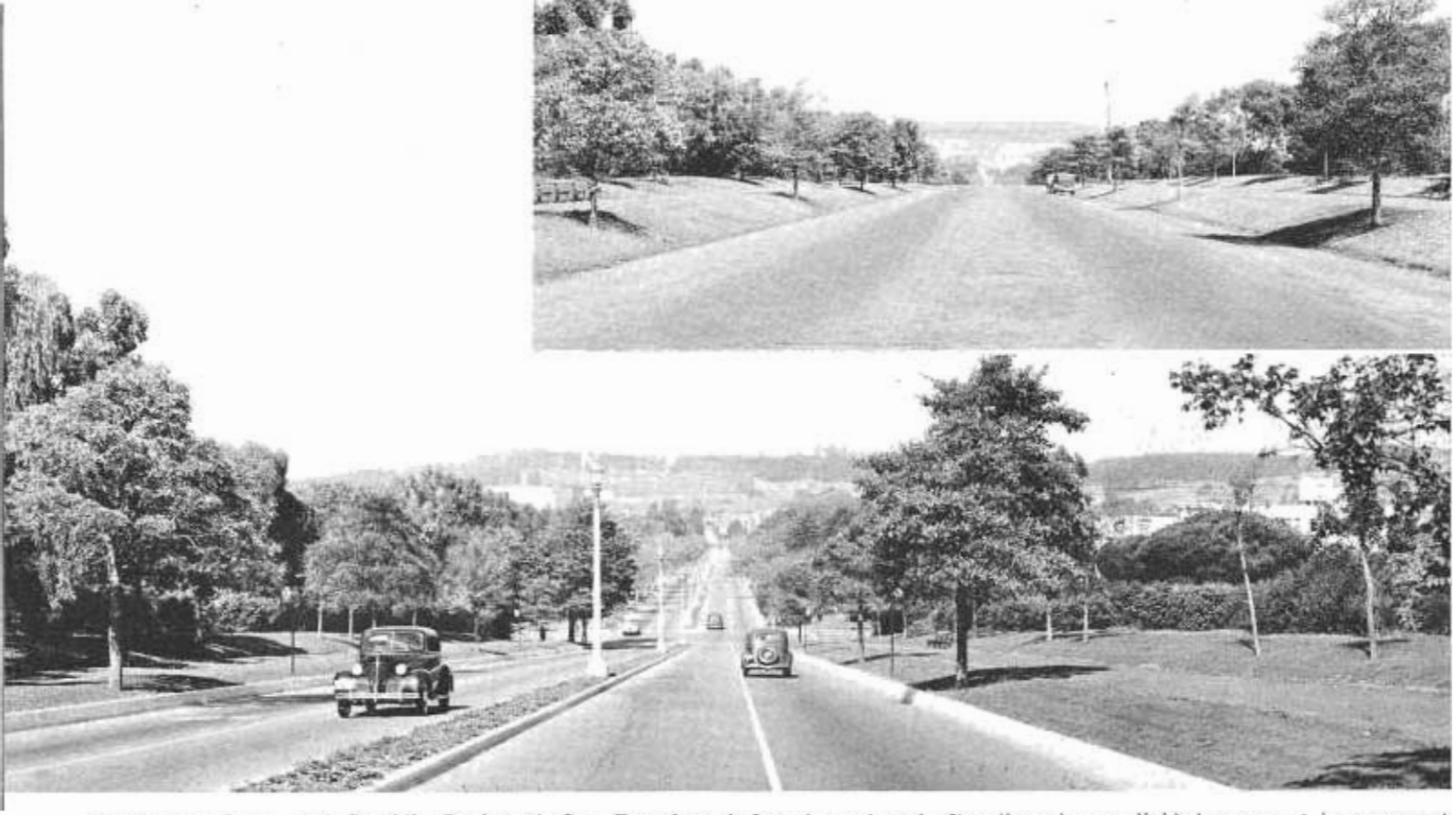
The reconstruction of State Highway Route 56 on Nineteenth Avenue, between Sloat Boulevard and the Golden Gate Park at Lincoln Way and on Park-Presidio Boulevard from Fulton Street to the Presidio, was financed entirely from the ½¢ allocation for State Highways in the City of San Francisco. The entire project was designed by the Engineering Department of the Department of Public Works of the City of San Francisco, under the supervision of City Engineer John J. Casey, and was approved by the State Division of Highways.

The alignment followed the lines of Nineteenth Avenue from Sloat Boulevard to Golden Gate Park, but the widening was done in such a manner as to avoid the destruction or moving of the larger buildings. The method of alternately widening on opposite sides would ordinarily have caused an irregularity in the alignment, but at the suggestion of District Engineer Jno. H. Skeggs, full advantage was taken of the high summits and of the topography of the district traversed, and no one driving along this highway is conscious of any irregularity in the alignment of the roadway. This deviation in direct alignment, however, did permit of a great saving in the total cost of this project by avoiding the destruction of expensive apartment houses and other important structures.

Nineteenth Avenue was widened from a width of 70 feet to a width of 100 feet between property lines. On this right of way there were constructed two roadways having a total width of 38 feet each between curbs; a center dividing strip 5 feet in width; and portland cement concrete sidewalks 9½ feet wide on each side of the street. Roadways were paved with a portland cement concrete pavement 8 inches in thickness. The traveled way was surfaced with an asphaltic pavement 31 feet in width and 2 inches in thickness. This section is 2.18 miles in length.

The additional right of way required to provide for the widened section cost $764,355. The work was done under public contract at a total cost, including engineering, of $534,-865. The total cost of the Nineteenth Avenue portion is therefore $1,299,-220. This project was divided into four contracts of approximately one-half mile in length each. The Fay Improvement Company was the contractor on one section and Charles L. Harney on the other three sections.

On Park-Presidio Boulevard, the alignment followed the lines of the then existing roadway from Fulton Street to the Presidio. This boulevard passes through the center of a planted city park, parallel to and between Funston Avenue and Fourteenth Avenue.



Looking north on Park-Presidio Boulevard, San Francisco, before (upper) and after (lower) new divided pavement improvement

WIDE ROADWAY

Originally this section was paved with an oil macadam pavement 50 feet in width. The new pavement was extended 2½ feet on each side into the Park area, and two portland cement concrete roadways were constructed 24 feet in width each and 8 inches in thickness. No parking is permitted on these roadways. They were surfaced with 2 inches of asphaltic concrete pavement. A dividing strip 5 feet in width was constructed on the center line.

The total width from the westerly property line on Funston Avenue to the easterly property line on Fourteenth Avenue is 240 feet. The Park-Presidio Boulevard is constructed in the center of this 240 foot wide park. The footpaths on each side of the roadway were not disturbed by the new construction. There is a bridle path between the new roadway and Funston Avenue, which also was not disturbed by the new construction. The length of the improvement from Fulton Street to Lake Street is just one mile. The total cost of this improvement, including engineering, was $147,890. Charles L. Harney was the contractor on this section.

The total cost of the reconstruction of State Highway Route 56, financed from the ¼¢ State Highway Fund, for these two projects is $1,447,110.

The officials of the Division of Highways are well pleased with the hearty cooperation of the Engineering Department of the city in the preparation of the plans and specifications, and in the construction standards prescribed for this project, which were in conformity with the standards maintained by the State.

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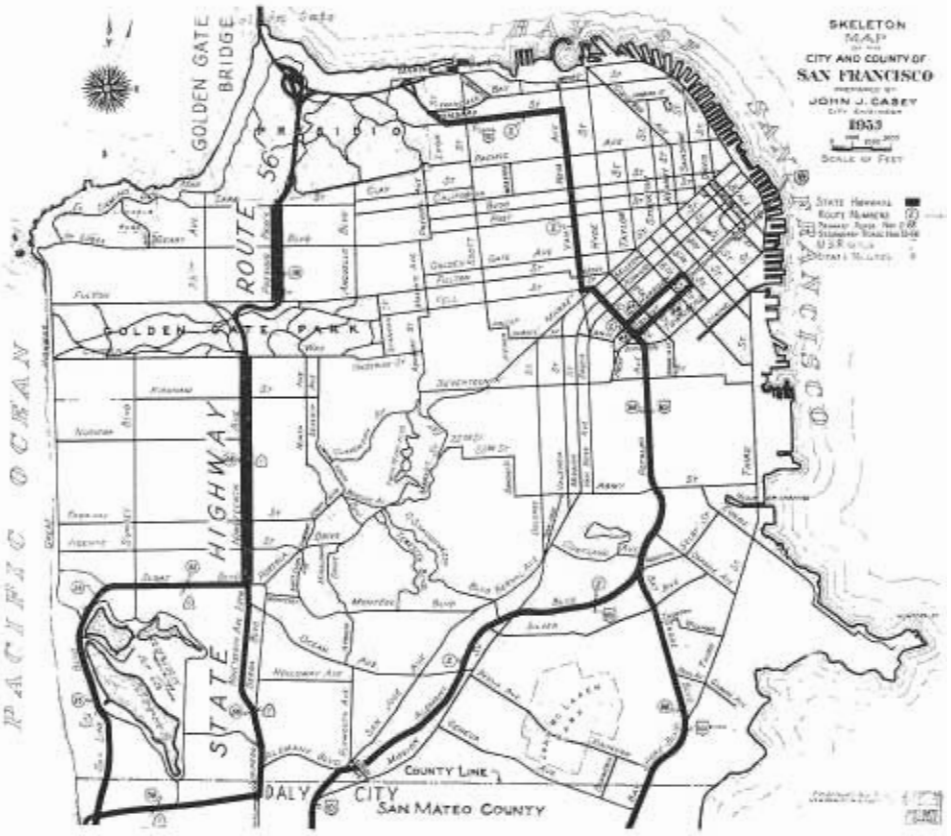

Arroyo Seco Project Required 26 Structures

(Continued from page 15)

Arroyo Seco Channel to provide crossings over the adjacent Parkway. A similar type of construction was used in making an extension or addition to these structures so that the whole system would provide a uniform and pleasing appearance.

Completely new structures incorporate the latest methods of modern design standards. Many of these are of the rigid frame concrete type which allows for the construction of longer spans and provides a maximum of under-clearance with a comparatively smaller variation in grades of the separated roadways. Aesthetics and economy were given foremost consideration in the design of all the structures. Simplicity and grace in line result in harmony throughout.

RAILROAD CROSSINGS

There are two locations on the Parkway which will be crossed by the Union Pacific and Santa Fe Railroads. At Avenue 35 there is a double track railroad structure 260 feet in length with a 113-foot channel span and roadway spans of 75 feet and 68 feet. The superstructure is a continuous steel girder design. During construction the Union Pacific and Santa Fe railroads operated over a 300-foot timber shoofly trestle.

At Fremont Avenue another railroad structure is provided for both the Santa Fe and Union Pacific tracks across the Parkway. It is a double track structure with a steel girder span of 140 feet. The girders for this structure, a total of three, were assembled completely in the shop and hauled to the job at night by truck and trailer while traffic density was at a minimum. These girders are 140 feet long, 10 feet deep, and weigh 67 tons each.

At Fair Oaks Avenue a double track bridge over the Freeway is being provided for the Pacific Electric Railway in conjunction with the vehicular structure.

Included in the Arroyo Drive and Grand Avenue project was the construction of an equestrian and pedestrian tunnel. This structure is 168 feet long with an inside width of 16 feet and a clear height of 10 feet, 7 inches. Automatic lighting facilities are provided.

Of the 26 structures on the Parkway, 17 of them carry traffic of one form or another over the Freeway, 13 are for vehicular traffic only, two for railroad traffic only, one for pedestrian traffic only, and one carries both vehicular traffic and two tracks of the Pacific Electric railroad. The equestrian and pedestrian tunnel is the only structure under the Freeway.

There are 12 new structures over the Arroyo Seco Channel, five of them contiguous with the aforementioned bridges over the Freeway. The other seven structures are entirely independent and only span the channel.

Avenue 26 and Avenue 60 Bridges over the Freeway are extensions to bridges which spanned the Arroyo Seco Channel prior to construction of the Freeway.

The Cypress Avenue project consists of abutments and foundation construction only for a future bridge consisting of two 35-foot lanes to carry traffic over the Freeway.

Out of the total cost of approximately $12,000,000 for the entire Arroyo Seco Parkway project, the structures will cost about $1,600,000. This figure includes some incidental road work included in three of the bridge contracts.

Obviously a project of this magnitude, however desirable, could not be financed by a single agency. The State's 1½ cent gas tax fund must be used in the maintenance and construction of approximately fifteen thousand miles of primary and secondary roads. Nor could the city or county of Los Angeles shoulder the entire fiscal responsibility. The project therefore was financed by joint contributions from funds of the city of Los Angeles, the city of South Pasadena, and the State and Federal Governments. The financing, planning, preliminary investigation, design, and construction of a project combining so many units and involving so many operations required complete coordination of all the interested agencies.

The utmost cooperation was required among the various cities and the State to plan and coordinate work so that each grade separation structure would tie in with ultimate plans favorable to all concerned. The problem of moving the many facilities owned by public utility companies is one example of the details involved. Provision had to be made for moving these facilities to other locations or for installing conduits, etc., for carrying them on or through the structures.

October Traffic on State-Owned Bridges Maintains High Level

TRAFFIC on the San Francisco-Oakland Bay Bridge during October continued to be very high even though the Golden Gate International Exposition is no longer operating.

During the month 1,424,822 vehicles used the span.

Coincident with the acquisition of the Carquinez and Antioch bridges by the State on September 16, tolls on these structures were reduced on most vehicle classifications. While it is too early yet to determine definitely the effect of these reductions on traffic, it is quite clear that there has been a substantial increase in volume.

October traffic 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	1,302,766	251,192	15,539
Motorcycles and tricars	4,769	870	125
Buses	19,362	4,555	193
Trucks and truck trailers	74,501	23,325	4,151
Others	23,424	106	16
Total Vehicles	1,424,822	280,048	20,024

San Jose Subway Eliminates 9-Track Railroad Grade Crossing

By J. E. BURKE, Resident Engineer

IN the city of San Jose, Polhemus Street has long been one of the most heavily traveled arterials in the northern part of that Santa Clara County city, due to the fact that it is the only street which provides a direct cross-town connection between El Camino Real (U. S. Route 101) and the Bayshore Highway (Route 101 Alternate). All other streets north of Santa Clara Street either stop at the Southern Pacific tracks or at Guadalupe Creek and traffic using these streets is required to make numerous right angled turns in order to find existing grade crossings over the tracks or bridges over Guadalupe Creek.

Polhemus Street, however, crossed nine tracks of the railroad at the north end of the San Jose yards. Over these tracks, daily, pass eighty-odd scheduled passenger trains—about half of which cross Polhemus during the peak vehicle traffic hours of 6 to 8 a.m. and 4.30 to 7.00 p.m.

In addition there are numerous freight schedules per day and many switching operations. Thus, delays to Polhemus Street traffic were frequent and lengthy and made the grade crossing a dangerous one.

RAILROAD COOPERATES

In 1924 the officials of the city of San Jose instigated the construction of a grade separation on this arterial. By 1927, negotiations had progressed to the point of active cooperation with the Southern Pacific Company. However, a few years later, the tentative plans which had been formulated were shelved.

With the advent of the Federal Aid Grade Separation Funds for Feeder Roads, the city of San Jose again proposed Polhemus Street as worthy of consideration. Federal funds were advanced for the work and plans and specifications were drawn by the Bridge Department of the State Division of Highways. On January 17, 1940, Contractor Earl W. Heple of San Jose submitted a low bid of $130,497.40 for the construction of a subway at this location and was awarded the contract.

Work embraced under this contract provided for carrying the nine tracks of the railroad on an overhead structure consisting of 24-inch steel beams, supported by reinforced concrete abutments on spread footings on cast-in-place concrete piles. During construction operations, two of the nine tracks were removed but the other

View of Polhemus Street Crossing in San Jose before improvement where highway crossed nine tracks used by eighty trains daily

New Polhemus Street underpass in San Jose eliminating dangerous railroad grade crossing on heavy traffic highway arterial

seven were kept available to the movement of railroad traffic at all times except during the construction of the temporary timber railroad trestle.

ONLY SHORT INTERRUPTIONS

While driving the temporary trestle piles and setting the caps, stringers and decking and while setting the structural steel, one track at a time was removed from service for short periods. The work of erecting and removing the trestle, of setting structural steel and of arranging tracks, switches and signal facilities was done by the railroad company equipment and forces under an agreement with the State at an estimated cost of about $48,000.

Included in the railroad's estimate was a figure of approximately $6,000 for the driving of 161 steel shells for foundation piles under the seven tracks in operation. As the temporary trestle construction progressed, it became apparent to the engineers that, considering the volume of train operations per day and the design of the trestle, it would be impossible for the railroad crews to drive these shells either within a reasonable length of time or within the amount of money estimated by them for the work.

In order that the railroad crews and equipment might perform this work, it would have been necessary to shift or remove the ties, rails and timber stringers to allow driving each shell in the position shown for it on the plans. A follower would also have been necessary to secure proper penetration and bearing of shells and, as these shells were not the type which uses a mandrel, it was feared the process would be slow and awkward. Peak driving under these conditions was estimated to be not over seven shells per eight-hour shift.

SHORT PILE HAMMER LEADS

After numerous suggested methods had been advanced, it was decided to drive the shells from under the trestle, by constructing a special set of short leads for the pile hammer. An extra work order of approximately $4,800 was issued in favor of Contractor Heple. The special set of short leads was made and attached to a one and a half yard rig with a short crane boom. As vertical clearance between footing and the bottom of the trestle stringers was only about 22 feet, and as the double acting steam hammer used took up about nine and a half feet, it was necessary to drill eight to ten feet with post hole augers, set the shell into the hole and spot the leads and hammer over it. With this method an average of 40 shells per eight hour shift were driven. Approximately $1,200 and 19 eight-hour shifts of labor were known to have been saved.

The completed structure provides a 26-foot clear roadway through the abutments, flanked by 4-foot sidewalks on each side. An additional 11-foot lane for vehicular traffic is provided on either side of the structure proper for traffic ascending from the depressed portion. At the Stockton Avenue intersection, two triangular-shaped traffic islands were constructed, providing one 11-foot lane each way for traffic either entering or leaving Stockton Avenue.

Four-inch-thick concrete slope paving slabs were constructed on all cut slopes. Perforated pipe underdrains under the portland cement concrete pavement and slope paving provide for stable subgrade conditions. Adequate catch basins and other drainage facilities take care of the roadway drainage. All drainage flows into a sump at the southeast corner of the structure, whence it is pumped by either of two alternating centrifugal pumps into a 24-inch storm sewer of the city's system.

The steel beams supporting the nine tracks of the railroad are hidden from view by reinforced concrete facia beams which span the abutments at each end. On the inner side of the facia beams shelves are provided which carry one side of a "multigrip" walkway plate that spans the space between the steel and facia beams.

Stockton Avenue, at its intersection with Polhemus Street, was lowered approximately two feet. This necessitated the resurfacing with asphalt

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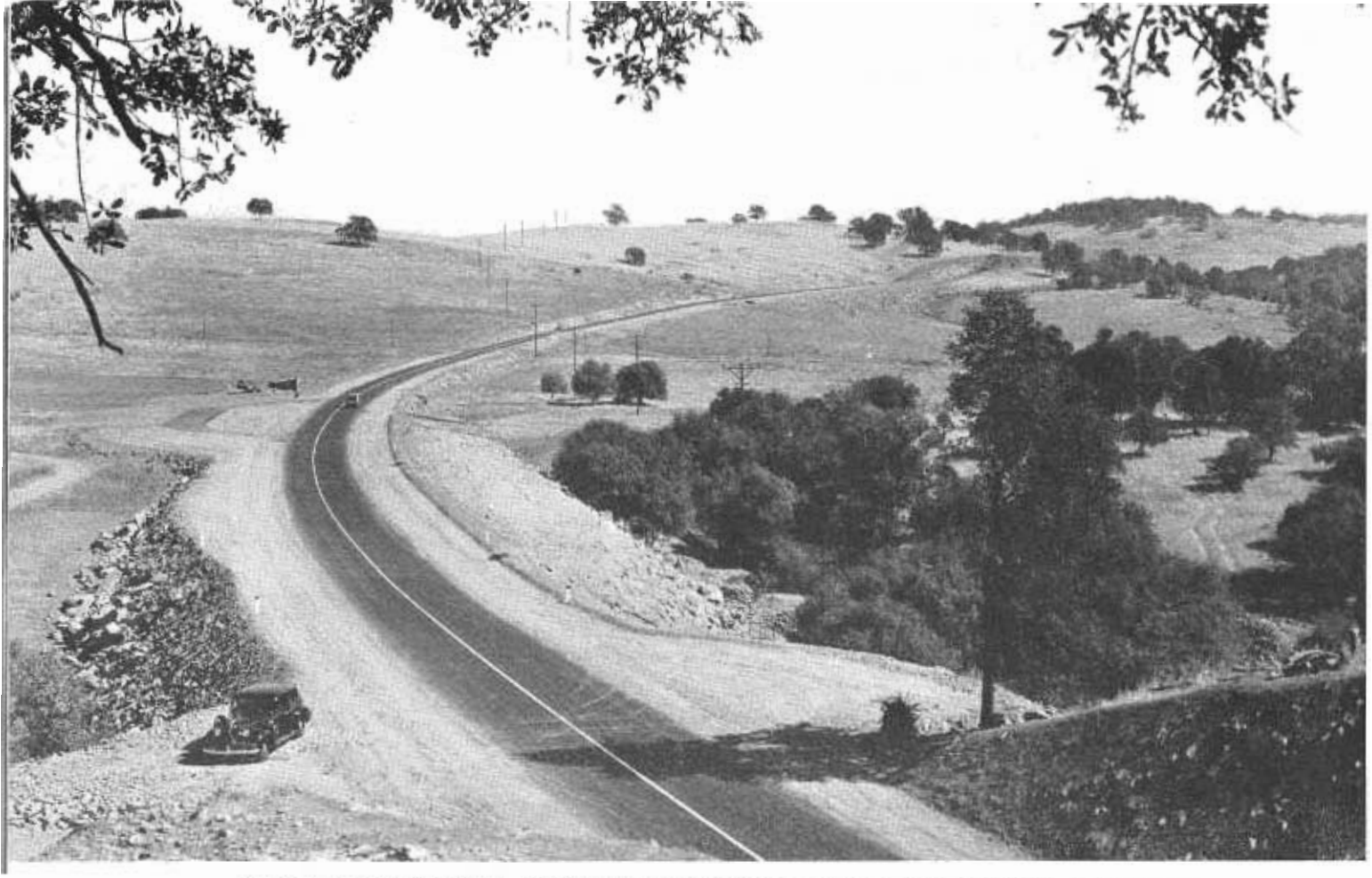


Looking up new Clarksville grade on the realignment of U. S. 50 between Folsom and Placerville

Realignment of U.S. 50 Reduces Curves and Miles East of Folsom

By H. F. SHERWOOD, Assistant District Office Engineer

THE new section of U. S. 50 highway between three and three-fourths miles east of Folsom and two and one-fourth miles east of Clarksville which has been under construction during recent months, was opened to traffic late in October. The new unit is a portion of State highway Route XI and a link in the connection between the populous San Francisco Bay and Sacramento Valley regions and the Lake Tahoe and American River Canyon recreational areas.

The old road between Sacramento and Placerville was constructed between 1915 and 1920 and was naturally designed to serve travelers who considered 35 miles per hour to be a high speed. The short radius curves, which were not particularly objectionable at these lower speeds, constituted definite hazards when higher speeds became usual and this road is being reconstructed to modern standards as fast as money becomes available.

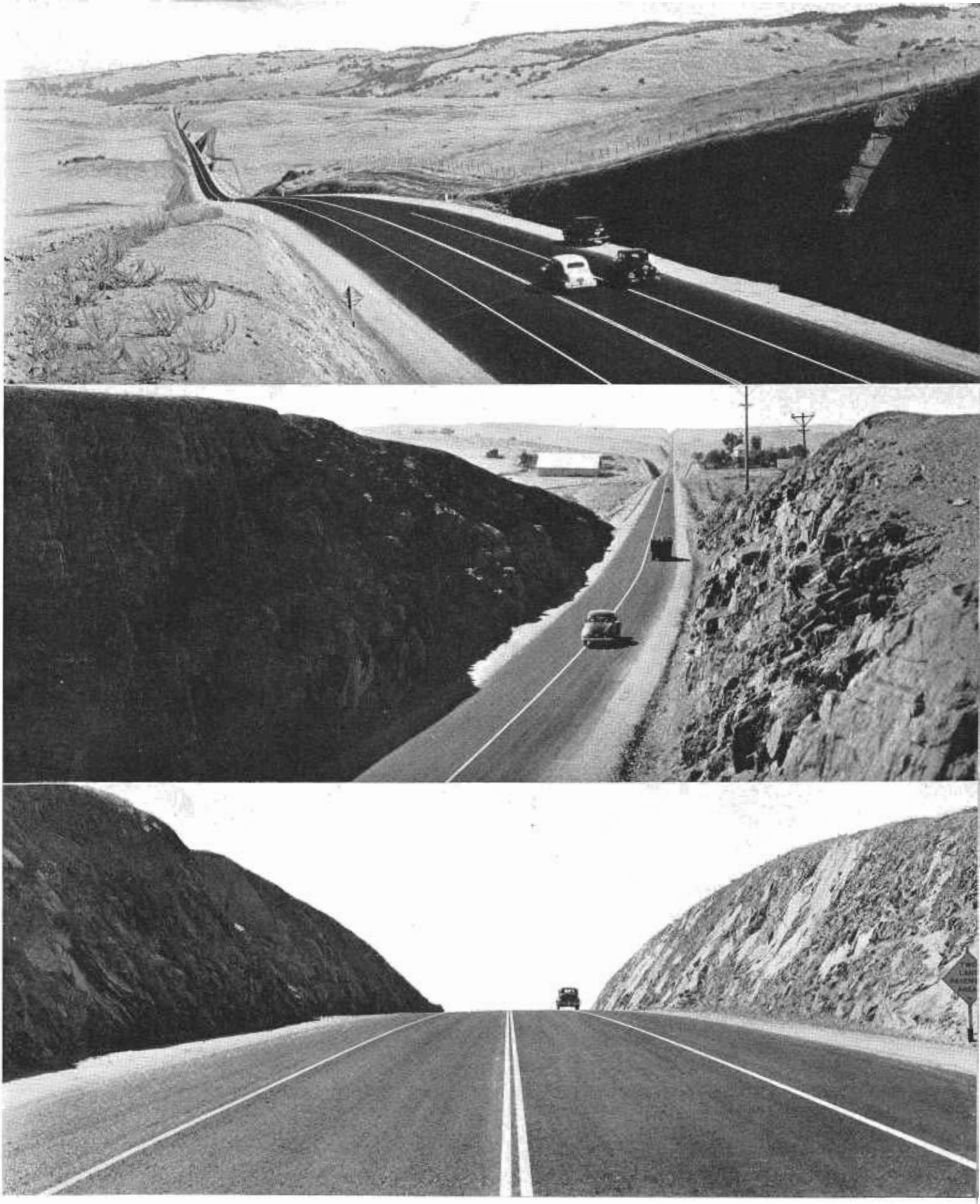
The new road throughout this section consists of a plant-mixed surfacing 22 feet wide by 0.21 of a foot thick on a crusher run base 23 feet by 0.4 of a foot. The project was designed on the basis of a minimum passing sight distance of 1600 feet, except at a few locations where the character of the terrain made modifications necessary.

In order to enhance the safety of the project at the vertical curve near Station 350 where one such modification was required, four traffic lanes were provided. Four lanes were also constructed at the one grade crossing on the project. This grade crossing is protected by flashing light signals.

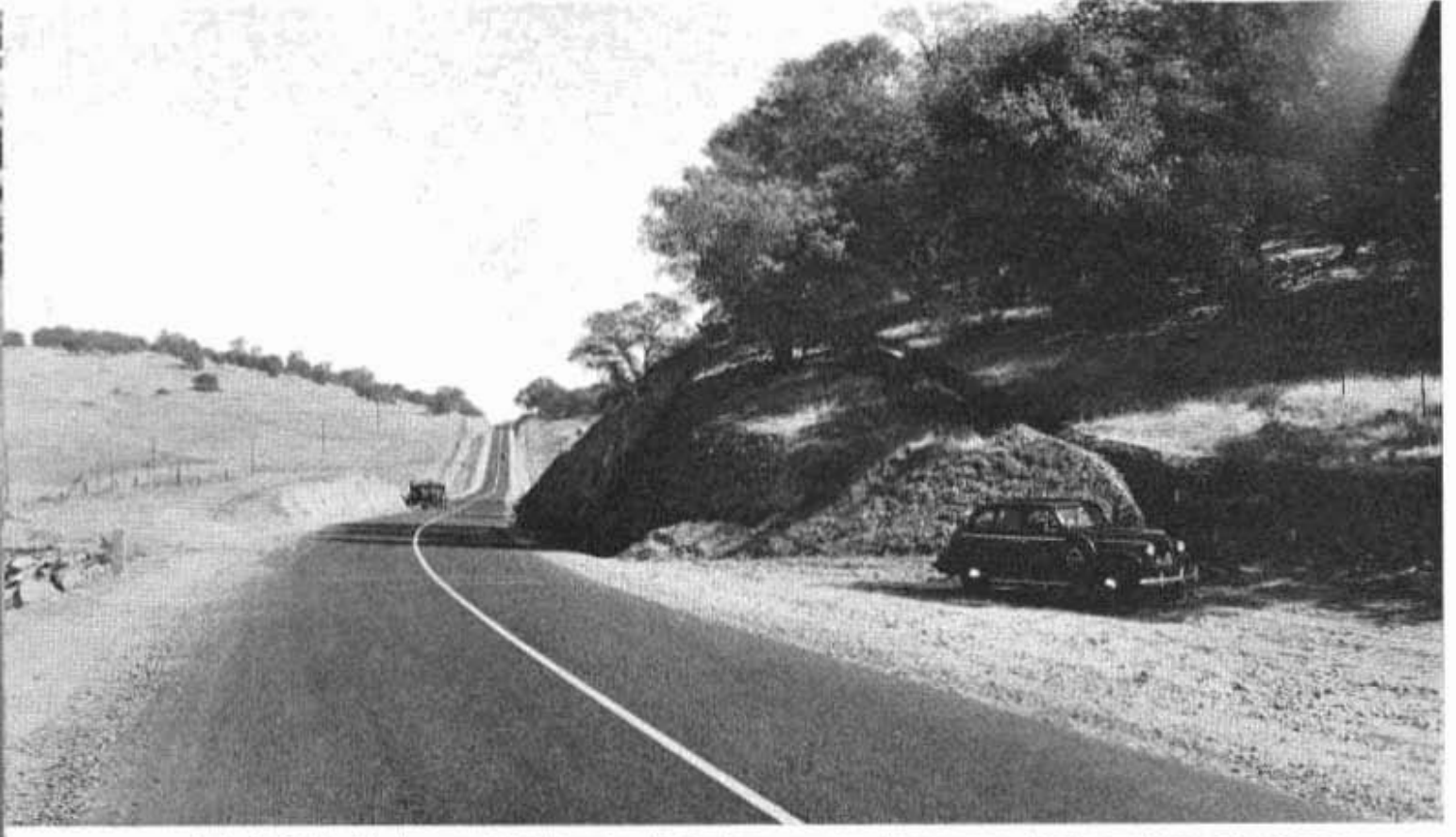
There were many short radius horizontal curves, some with radii as short as 100 feet, and many sharp vertical curves with very limited sight distance.

The narrow width and poor alignment and grades made the old road entirely inadequate to meet the traffic requirements of the larger number of cars and the higher speeds which now prevail.

During the summer months the ordinary commercial and passenger traffic between Sacramento and Placerville is greatly augmented by



Top and bottom pictures of U. S. 50 realignment east of Folsom show where 4 lanes were provided to enhance safety on vertical curves. Center picture is view of a cut through solid rock where blasting was necessary



East of Clarksville the new straight route, eliminating numerous sharp curves, affords excellent sight distance

an increasing amount of travel to the American River and Lake Tahoe recreational areas. Due to the increasing popularity of snow sports during the past few years the winter traffic has also increased.

The minimum radius of curvature is 1,500 feet except at the connections to the old road and the maximum grade rate is 7 per cent. The new alignment is much more direct than the old, resulting in a distance saving of about 1.9 miles. The total length of the new project is 5.84 miles.

The contrast in standards used on the old road and new road is brought out both in the table below and the map showing the location of the project.

	Length	Minimum Rad. of Curvature	Total Curvature	Maximum Grade
Old Road	7.75 mi.	100 ft.	1653° 21'	7%
New Road	5.84 mi.	1,500 ft.	304° 02'	7%

The construction of this project required the moving of about 400,000 cubic yards of material, part of which was solid rock. Wherever possible excavation was done by tractors and large carryalls. In rock cuts, blasting was done where necessary, the material being excavated by power shovels and hauled by five-cubic yard dumpsters. These dumpsters were close coupled for easy handling and the body so balanced that when a catch was tripped the load was dumped by gravity. They were capable of comparatively high speeds over short distances and

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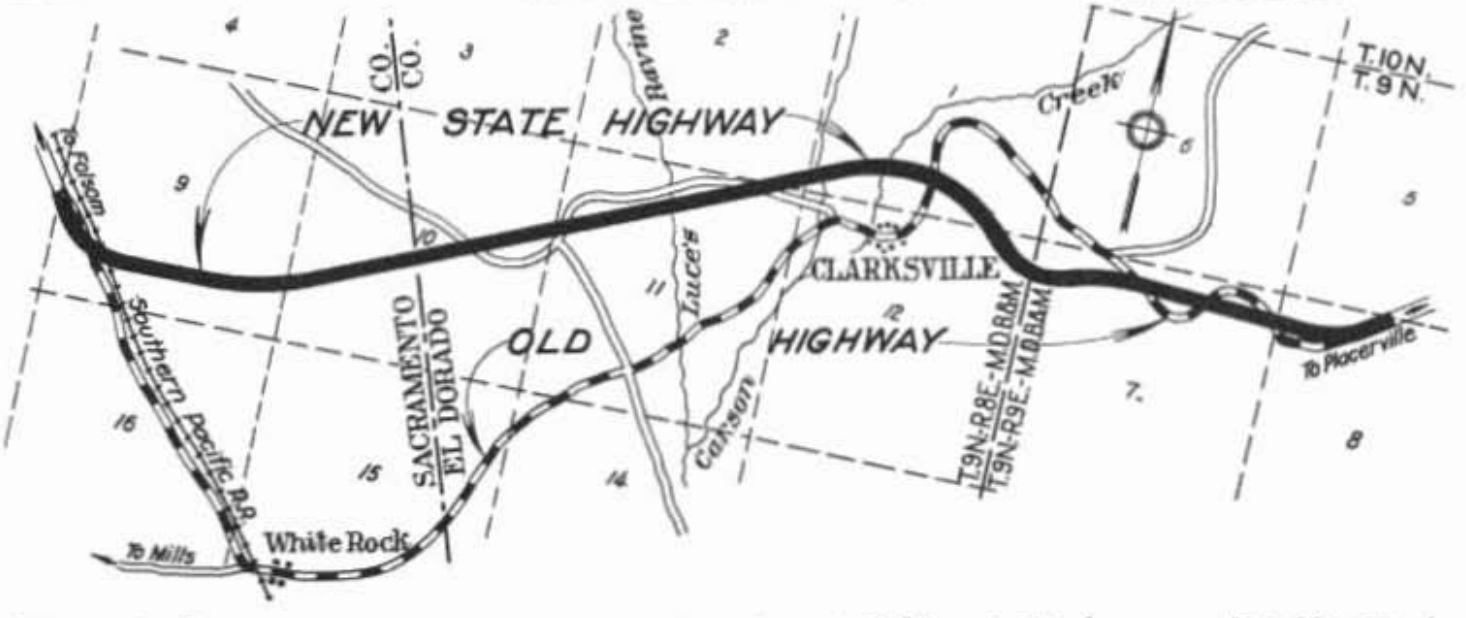

Operation of State Toll Bridges

By RALPH TUDOR, Principal Bridge Engineer

ON September 16, 1940, the California Toll Bridge Authority purchased the Carquinez and Antioch toll bridges, and the responsibility for operating and maintaining the two structures was given to the San Francisco-Oakland Bay Bridge organization of the Division of Highways. By thus consolidating the work, it will be possible to realize many economies and at the same time gain the advantage of uniform public relations on these State owned and operated bridges.

While the general supervision and much of the detail work will be carried on at the Administration Building of the Bay Bridge, the detailed residence supervision of these two structures will be handled from the office of the Carquinez Bridge. This assignment has been given to Mr. C. R. Davis, Associate Bridge Engineer. A force of toll collectors, an office personnel, and a small maintenance organization are under his immediate control. The heads of the various departments of the San Francisco-Oakland Bay Bridge have been assigned the supervision of the corresponding departments on the other bridges; however, in all cases this supervision is exercised through Mr. Davis. In this manner the immediate administration is reinforced with adequate and proper authority. The toll collection forces for these bridges are now being finally organized. This has involved the training of new collectors and the school work involved has been carried on at the Bay Bridge under the observation of the experienced staff on that structure. As the new collectors have become familiar with handling toll registers, scales, and other equipment, and have learned to work efficiently and courteously with the heavy volume of traffic that crosses these bridges, they have been given their permanent assignments.

Only the very minimum of accounting is done outside the Bay Bridge office. At each bridge the cash is counted and deposited and the traffic records compiled. All billings for credit charges are made up and mailed from the Bay Bridge. All requisitioning of supplies, preparation of payrolls, and bookkeeping is likewise conducted here.

There will be a minimum of maintenance personnel kept continuously on the Carquinez and Antioch bridges. For the present this will be sufficient to handle emergencies only but a small regular paint force will be organized later. All other work that is not handled by contract or service agreement will be accomplished either by temporary assignment of men from the Bay Bridge or by sending the work to the Bay Bridge shops.

A physical inspection of the bridges at the time of acquisition showed them to be in generally good condition. The Carquinez Bridge is in an especially good state of repair and, outside of a nominal amount of spot painting and a few repairs around the toll plaza, there is little that needs to be done. At the Antioch Bridge some repairs will be necessary in connection with the reinforced concrete approaches. Also, many of the piles in the dolphins and pier fenders must be replaced. The most important change planned at this structure is a new toll plaza. Heretofore there has been a small booth located on the lift span. The bridge is so narrow that this booth must be shifted from side to side to accommodate loaded trucks. Furthermore, although the toll schedule has been and is still based upon weights, there have been no scales. The tolls for trucks have generally been arrived at by guess and by compromise. This method is quite unsatisfactory and to correct it a small toll plaza with scales is planned to be placed on the highway adjacent to the south end of the bridge.

Realignment of U. S. 50

(Continued from page 24)

were found to be very satisfactory on the type of work for which they were used.

Compaction in addition to that secured by the usual watering and rolling was secured by routing the heavy carryalls over all portions of fills on which they were working.

Hemstreet and Bell, the contractors on this project, made good progress and were able to complete the work about a month before the specified completion date, at a total cost of approximately $241,000. The resident engineer for the State was Mr. J. W. Corvin.

Drainage facilities required were mostly of standard types. There were several springy areas within the limits of the project where perforated metal pipe underdrains were provided to care for the drainage. During construction several more areas of this type were encountered and it has been necessary to increase the amount of underdrain construction considerably.

At the crossing of Carson Creek, after a comparative study of several types of structures, it was decided that the most economical installation would be a triple 10-foot by 10-foot reinforced concrete box culvert, 103 feet in length. Due to the excellent foundation conditions, it was possible to eliminate the customary bottom slab in designing this structure.

Reconstruction of 19 Ave. in San Francisco

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The travel on State Highway Route 56 in San Francisco since it was reconstructed has increased to such an extent that the city authorities, in cooperation with the Division of Highways, have found it necessary to develop plans for facilities to provide relief for the congestion now experienced at pivotal points. A comparison of the traffic now passing through intersections on this route with that of 3½ years ago indicates the increasing use of this route and development and occupancy of the western portion of the city.

The grade descends by easy curves to the Coachella Valley desert floor between Palm Springs and Indio

Highway From Palms to Pines

By A. EVERETT SMITH, Assistant Highway Engineer

THE scenic Palms to Pines Highway (State Route 64) was for years a vision in the minds of progressive citizens of Riverside County. Due to their efforts it is now a reality of the most vivid sort. It branches from the Palm Springs-Indio Highway at a location adjacent to the precisely groomed date palm gardens of the upper Coachella Valley. From an elevation of 230 feet above sea level it bears southerly on a straight line for about three and one-half miles across alluvial plains rising to the foot of the mountains at Dead Indian Creek. Meeting the mountains, the highway winds its way over the steep rocky and cactus covered slopes, by means of sweeping curves that admit of comfortable riding.

Along this portion of the highway from the turn-outs provided at vantage points are vivid panoramic views of the distant broken mountain ranges, the deserts and farms and the Salton Sea in the Coachella Valley below.

Still ascending, but on a less severe alignment, it parallels Deep Canyon, passes through Pinon Flats, swings past the Santa Rosa Mountains, through the Santa Rosa Indian Reservation and over a summit at an elevation of 4980 feet. This summit divides the water sheds of the Salton Sea and the Pacific Ocean.

From here the highway leads through the Hemet Valley, past Lake Hemet and on until it meets the Idylwild National Forest Highway at the Idylwild Resort Junction.

This end of the highway is through forests studded with large pines and completes the name "Palms to Pines."

Varied is the scenery and numerous are the attractions along this drive. San Jacinto Mountain to the north, at an elevation of 10,800 feet, precipitously slopes to the floor of the desert at Palm Springs. Fine cattle range on adjacent pastures. A side road leads to Ramona's grave. Hunting areas annually attract numerous sportsmen. Tree covered mountains, rugged ranges, deep canyons and the desert all offer attractions to this route.

Unlike many a road that began as a trail and grew up to be a highway, this one was originally located and constructed under engineering supervision through relatively undeveloped

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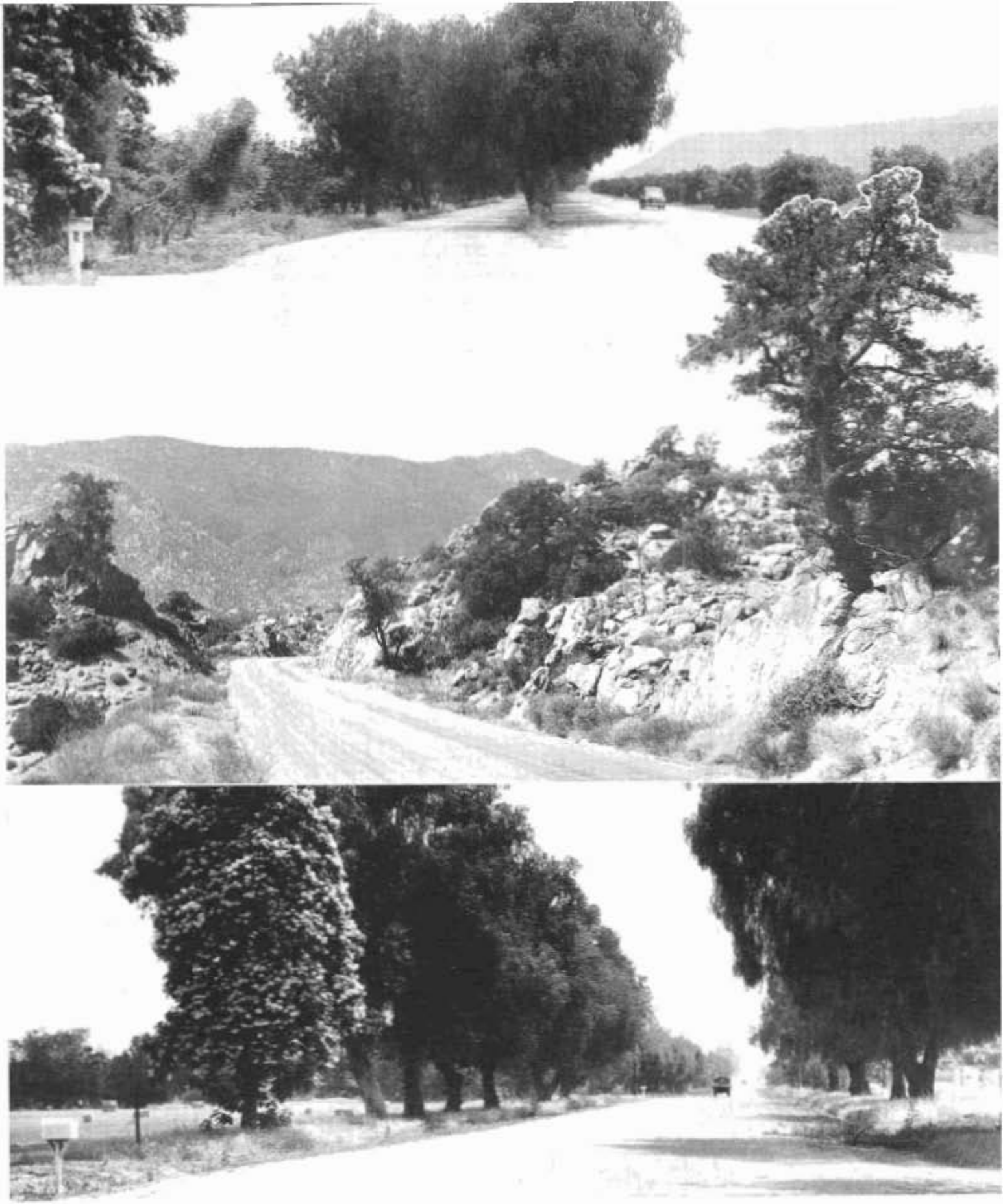

Scenes on route of Palms to Pines Highway from mountains to desert. At top, a beautiful piece of divided highway out of Hemet. Center—Picturesque rock formations on grade. Bottom—Flowering trees border road

October Highway Bids and Awards

AMADOR COUNTY—Between Ione and 2.0 miles southerly, about 1.6 miles to be widened and surfaced with plant-mixed surfacing over gravel base. District X, Route 97, Section A. Contract awarded to Fredericksen & Westbrook, Sacramento, $10,376.

BUTTE COUNTY—At Campbell Creek Overflow, about 5½ miles northwest of Oroville, a reinforced concrete bridge to be constructed and about 0.5 mile of approaches to be graded and surfaced with crusher run base and seal coat. District III, Route 87, Section B. F. Kaus & W. Younie, Stockton, $16,594; Engineer's Ltd., Sacramento, $19,800; M. A. Jenkins, Sacramento, $16,682. Contract awarded to Frank J. Reilly, San Francisco, $16,116.

BUTTE COUNTY—At Butte Creek about four miles southeast of Chico, about 0.3 mile in length, constructing a graded roadbed and constructing plant-mixed surfacing on crusher run base. District III, Route 87, Section B. Hemstreet & Bell, Marysville, $13,146; Claude C. Wood, Lodi, $12,597; Johnston Rock Co., Inc., Stockton, $17,178. Contract awarded to Wayne Younie, Chico, $12,042.

FRESNO COUNTY—Three bridges across Jacalitos Creek and overflows, about four miles southeast of Coalinga, to be constructed, District VI, Route 138, Section A. Trewhitt-Shields-Fisher, Fresno, $18,281; Jourdan Concrete Pipe Co., Fresno, $20,997; L. D. Tonn, Lodi, $21,995; Albert H. Siemer & John Carcano, San Anselmo, $22,806. Contract awarded to F. Kaus, Stockton, $18,243.

GLENN COUNTY—At Butte City, existing bridge across Sacramento River to be removed. District III, Route 45, Section B. Wixson & Crowe, Shasta Dam, $24,500; Kiss Crane Service, Berkeley, $15,939; J. S. Metzger & Son, Los Angeles, $20,000; Frank J. Reilly, San Francisco, $13,951; M. A. Jenkins, Sacramento, $10,838. Contract awarded to Lee J. Immel, Berkeley, $7,750.

KERN COUNTY—Between Famoso-Woody Road and Deepwell Ranch, about 5.6 miles to be graded and road-mix surface treatment applied. District VI, Route 129, Section B. Fredericksen & Westbrook, Sacramento, $89,477; Basich Brothers, Torrance, $90,239; Macco Construction Co., Clearwater, $90,645; J. E. Haddock, Ltd., Pasadena, $94,673; Rexroth & Rexroth, Bakersfield, $95,473; A. Teichert & Son, Inc., Sacramento, $96,462; Louis Biasotti & Son, Stockton, $98,630; Gibbons & Reed Co., Burbank, $104,620; Heafey-Moore Co. & Fredrickson & Watson Construction Co., Oakland, $107,168; A. S. Vinnell Co., Alhambra, $116,502; Lang Transportation Corp., Los Angeles, $116,913; Brown Materials Co., Ltd., Avenal, $118,296; Johnston Rock Co., Inc., Stockton, $122,972; Rhoades Bros., Los Angeles, $133,595. Contract awarded to Griffith Co., Los Angeles, $89,432.

LOS ANGELES AND ORANGE COUNTIES—Six miles east of Long Beach, a reinforced concrete bridge across San Gabriel River to be constructed and about 0.2 mile of roadway to be graded and surfaced with plant-mixed surfacing. District VII, Route 179, Sections A,A. Byerts & Dunn, Los Angeles, $47,409; Martin & Schmidt, Contractors, Long Beach, $47,505; Carlo Bongiovanni, Los Angeles, $48,343; Oscar Oberg, Los Angeles, $52,360; J. S. Metzger & Son, Los Angeles, $53,942; Oberg Bros., Los Angeles, $55,693; R. R. Bishop, Long Beach, $55,883; Dimmitt & Taylor, Los Angeles, $56,125; Griffith Co., Los Angeles, $60,817. Contract awarded to J. E. Haddock, Ltd., Pasadena, $42,403.

MONTEREY COUNTY—Between Peachtree Valley and Mustang Ridge, about 4.6 miles to be graded, surfaced with imported borrow and road-mixed surface treatment to be applied. District V, Route 10, Section B,C. Fredericksen and Westbrook, Sacramento, $197,117; Louis Biasotti & Son, Stockton, $197,939; N. M. Ball Sons, Berkeley, $198,851; Heafey-Moore Co. & Fredrickson & Watson Construction Co., Oakland, $201,487; Macco Construction Co., Clearwater, $223,760; Clarence Crow, Los Angeles, $229,073; A. Teichert & Son, Inc., Sacramento, $242,341. Contract awarded to Harms Bros., Sacramento, $187,013.

RIVERSIDE COUNTY—Between Elsinore and Corona, from 8 to 10 miles northwest of Elsinore, about 1.7 miles to be graded and road-mix surface treatment to be applied. District VIII, Route 77, Sections C, D. A. S. Vinnell Co., Alhambra, $58,809; J. E. Haddock, Ltd., Pasadena, $61,313; Rexroth & Rexroth, Bakersfield, $64,722; Matich Bros., Elsinore, $64,736; Griffith Co., Los Angeles, $67,478; Dimmitt & Taylor, Los Angeles, $68,220; Daley Corp., San Diego, $73,928; Chas. H. Johnston, Los Angeles, $75,653. Contract awarded to Oswald Bros., Los Angeles, $57,140.

SAN BERNARDINO COUNTY—At Malaga Underpass near Fontana, widening with portland cement concrete and plant-mixed surfacing. District VIII, Route 9, Section A. George Herz & Co., San Bernardino, $7,047; Matich Bros., Elsinore, $6,631. Contract awarded to Vido Kovacevich, South Gate, $4,987.

Guard Rail Installed

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A 20 foot oil mix surfacing using local materials has now been completed throughout this entire section which provides a very rideable surface. Because of the precipitous nature of the terrain, construction necessarily involved a great deal of curvature some of which is quite sharp with limited sight distance, but the grades generally throughout this section are very reasonable.

This section of the Roosevelt Highway (sometimes known as the Carmel-San Simeon Highway) lies entirely along the ocean at the foot of the Santa Lucia Range of mountains. It is one of the most scenic highways in California, and that it is nationally so recognized is evidenced by the large number of cars from eastern states which annually pass over it.

The Union Paving Company, contractor on this work, has made very satisfactory progress and it appears at this writing as though the project will be completed within the 100 working days allotted. Mr. Paul I. Wagner was Inspection Engineer for the Division of Highways.

Highway from Palms to Pines

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areas. Reconnaissance surveys were made on several alternates by the county of Riverside, the present routing being chosen from a cost and use standpoint.

Construction was started in 1929 by the county of Riverside using prison labor and by 1931 approximately twenty-three miles of graded roadway was completed. From 1931 to 1932 the U. S. Forest Service, under a contract, constructed a ten mile section and during the same period the Riverside County Road Department built the easterly four-mile portion. Surfacing was placed in 1933 by cooperative effort of the U. S. Forest Service and the Riverside County Road Department, under attention of the U. S. Bureau of Public Roads.

The road was built in general to a twenty-two to twenty-four foot roadbed width, and about seventeen and one-half miles of rock subgrade stabilizer was placed before the surfacing was applied.

This route was adopted by the State as a State highway in 1933. Since coming into the State Highway System, the entire length of surfacing, which is of the oil-mix type, has been covered with seal coat, and about seventy-five hundred feet of guard rail has been placed along the most winding of the grades.

San Jose Underpass

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concrete of almost one-half block either side of Polhemus Street as well as about one-half block back on Polhemus. New curbs, gutters and sidewalks were also constructed on Stockton Avenue where the existing facilities of a like type had to be removed due to line or grade changes.

The new subway was opened to the public at 11.30 a.m. on Saturday, October 19, 1940, after ribbon-cutting ceremonies which were unique inasmuch as not a single speech was made, or, as a San Jose newspaper put it: "The new subway 'left them speechless.'"

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