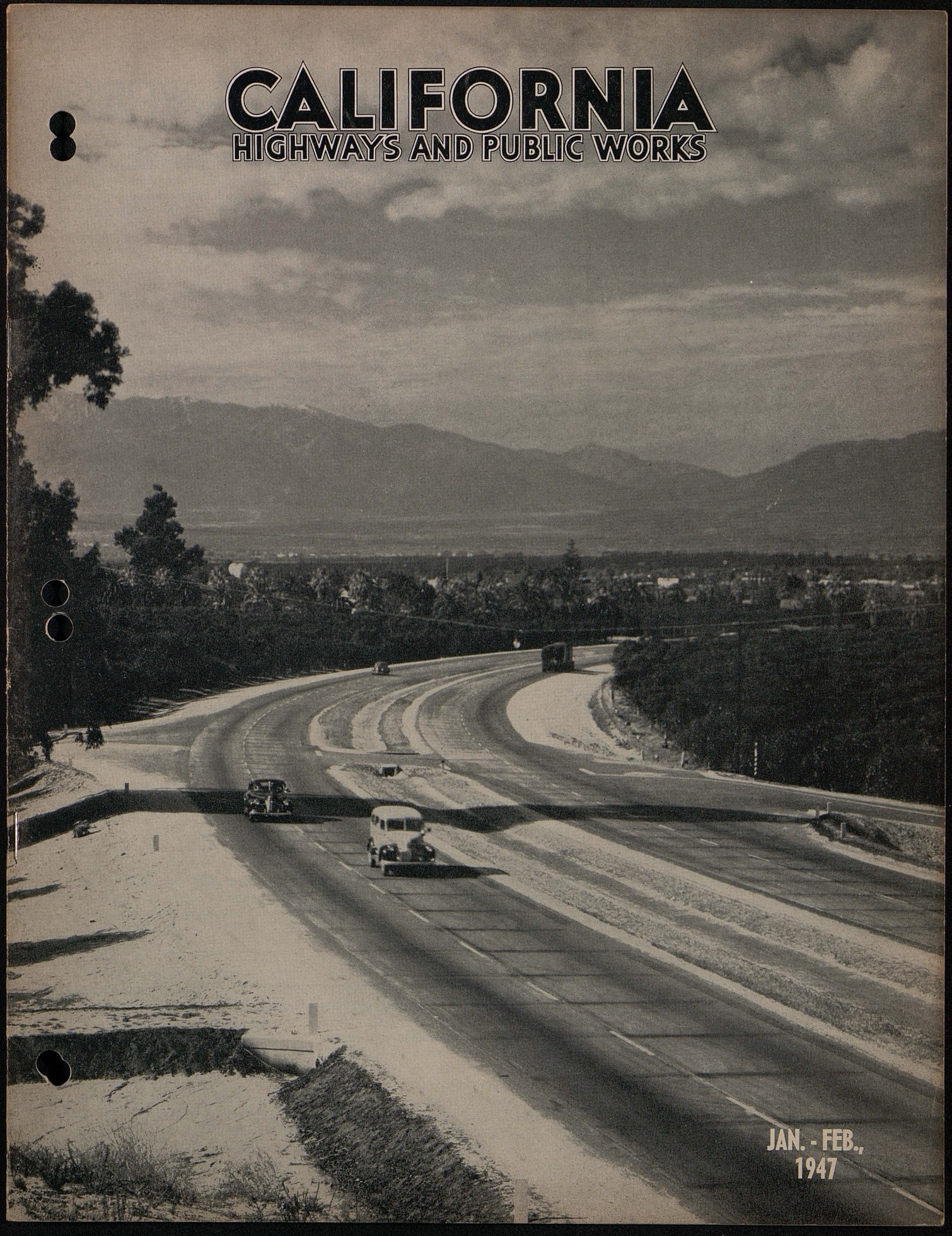
CALIFORNIA
HIGHWAYS AND PUBLIC WORKS



JAN. - FEB.,
1947

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

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

[PRINTED IN U.S.A.]

C. H. PURCELL, Director | GEORGE T. McCOY, State Highway Engineer | K. C. ADAMS, Editor

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Vol. 25 | JANUARY-FEBRUARY 1947 | No. 2

TABLE OF CONTENTS

State Proposes Second San Francisco Bay Bridge and Oakland Estuary Tubes at Total Cost of $99,300,000

THE CALIFORNIA Department of Public Works, in a report released on February 13, finds that "another bridge spanning San Francisco Bay is necessary and is economically and physically feasible."

A new bridge can be built without increasing tolls on the present San Francisco-Oakland Bay Bridge. Tolls on both structures would be the same.

Preliminary studies indicate the second crossing should be located just north of, and generally parallel to the existing bridge, and would cost, including approaches, an estimated $84,000,000.

This is the conclusion of a "Report Covering Preliminary Studies for an Additional Bridge Between San Francisco and the East Bay Metropolitan Area," filed with the California Toll Bridge Authority by Director of Public Works C. H. Purcell. The study was authorized on October 30, 1945.

Eleven crossing locations were studied in detail.

Submitted also was an estimate of $21,000,000 covering twin two-lane tubes under the Oakland Estuary with connections to the East Bayshore Freeway and to Alameda. In these two figures is an "interest during construction" item of $5,700,000. Total cost of the bridge, Alameda tubes, and the approaches is $99,300,000, exclusive of interest during the construction period.

"Proposed revenue bonds to finance the new span, supported by earnings from the present bridge which will be entirely paid for by 1953, will be self-liquidating, with such certainty as to attract investors to purchase," Director Purcell predicts.

WOULD PARALLEL PRESENT SPAN

The second bridge, the report recommends, should be built on a line between Rincon Hill and the Key System Mole via Yerba Buena Island, north of and approximately parallel to the present bridge. A number of advantages to crossing in this location are pointed out by the state engineers.

The proposed two-deck structure would be about 300 feet from the present bridge and would support five 12-foot lanes on each deck. Plans would permit one-way flow of traffic on each bridge, if desired.

No provision is made for steam train traffic. The report points out that on a high-level structure north of Hunter Point the rail elevation will be 200 feet above the elevation of the terminals, and since approach grades of 1 percent are the maximum that can be effectively operated over by passenger trains or short freight trains, and then only at slow speed, it would require over four miles of approach between the bridge and the rail terminals.

"The cost of providing railroad tracks through a tube may be practically divorced from that of providing for vehicular traffic since separate tubes and terminal facilities are required," the report says.

ESTIMATED COST

THE FOLLOWING costs for the recommended bridge and its approach connections have been estimated on the basis of known quantities and costs of constructing the San Francisco-Oakland Bay Bridge. The costs have been modified to conform to present-day prices and methods of construction.

(000 OMITTED)		
Bay and island crossings	$62,350	
Electrical, buildings and miscellaneous work	1,190	
San Francisco main approach	1,260	
Total main bridge construction		$64,800
San Francisco approach connections	$940	
Oakland approach connections	4,760	
Total approach construction		5,700
Property		4,300
Engineering, legal and insurance costs		4,500
Interest, during construction		4,700
Total, bridge and immediate approaches		$84,000
Twin two-lane tubes under Oakland Estuary with connections to the East Bayshore Freeway and to Alameda—		
Construction costs	$18,000	
Engineering and general costs	2,000	
Interest during construction	1,000	
Total, Estuary crossing		21,000
Grand total		$105,000

It will be noted that the above figures include interest during construction which, because of the fact that interest is paid from San Francisco-Oakland Bay Bridge revenues, is only a book charge. The cost, exclusive of interest, of the bridge and the Estuary crossing is seen to be $99,300

25,000,000 VEHICLES IN 1946

The parallel location was favored after it was determined that only about 5 percent of the present vehicular bridge traffic of 25,300,000 vehicles would be diverted if another crossing were located on a line between Hunter Point and Bay Farm Island; and that only 20 percent would be diverted to a second bridge between Potrero Point and the southerly line of Alameda.

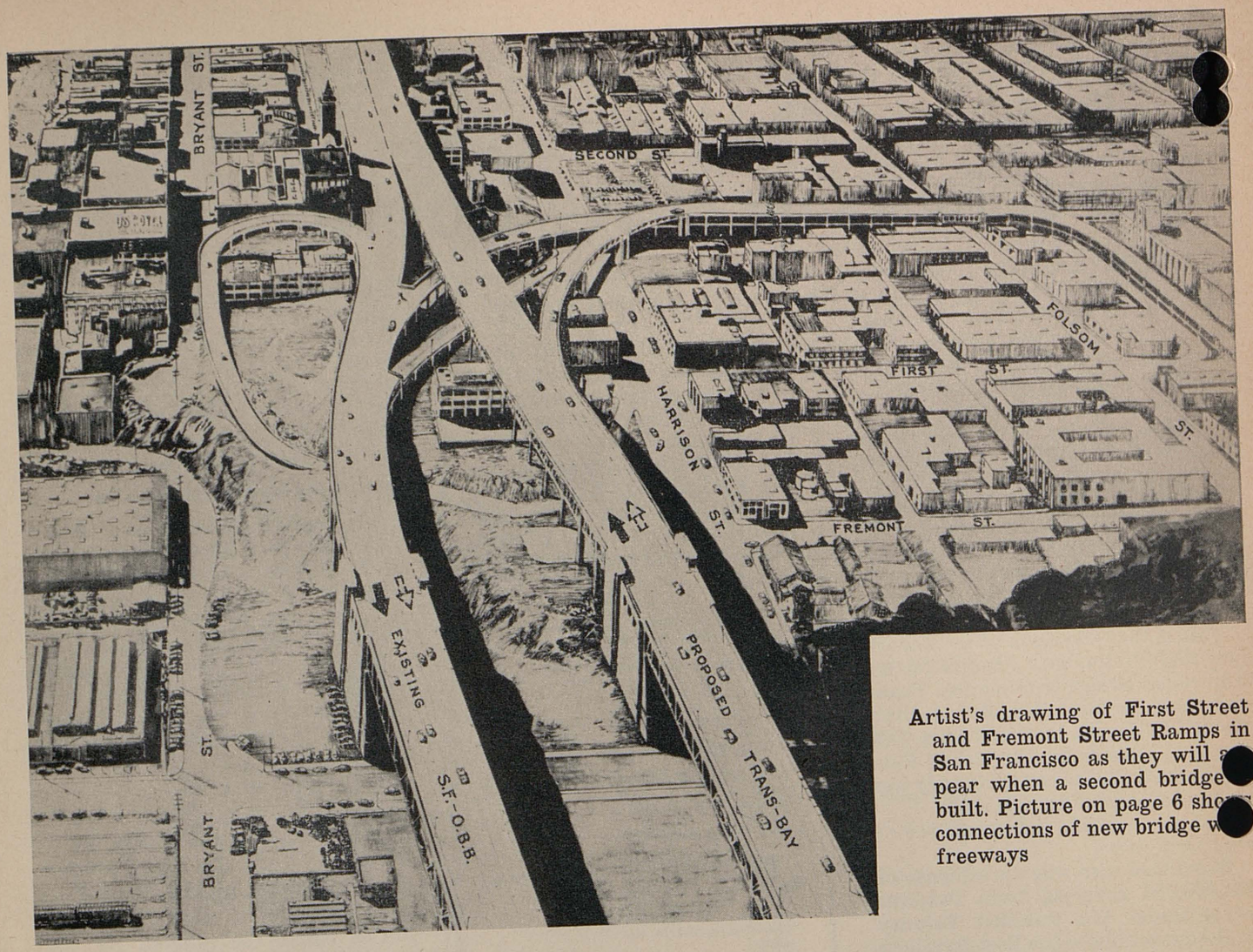
No location other than one in close proximity to the existing bridge is likely to divert anything like half the traffic now using the San Francisco-Oakland Bay Bridge, the report shows, while "congestion on the present bridge cannot be relieved for very long, or to any great degree, by the construction of a second bridge south of the general vicinity of Yerba Buena Island," the report emphasizes. "Traffic studies indicate that the more remote the new location is from the existing one, the less traffic it will divert from the already crowded structure." It was pointed out, further, that "there should be no toll differential."

NUMEROUS SITES STUDIED

Four terminal locations in San Francisco and four on the East Bay side were studied by the state engineers before recommending the parallel location. In San Francisco they were: Telegraph Hill, Rincon Hill, Potrero Point, and Hunter Point. On the East Bay side: Key Route Mole, Oakland Mole, the southerly line of Alameda, and Bay Farm Island.

NO ADDITIONAL INTERURBAN RAILS

No additional interurban rail transportation facilities are contemplated



Artist's drawing of First Street and Fremont Street Ramps in San Francisco as they will appear when a second bridge is built. Picture on page 6 shows connections of new bridge with freeways

in the report. It says in this connection: "Since the Bridge Railway is capable of handling twice as many passengers as now use it, and can be made to handle more if necessary, no provision for additional rail facilities seems justified."

Of other facilities on the lower deck the report finds that "While it cannot be said that with the present traffic pattern the present economic capacity of the lower deck (truck and bus) has been reached, it is close to the desirable limit."

"The number of passengers carried by the Bridge Railway, including government employees going to and from Treasure Island, rose to 37,000,000 for the year 1945, 11,000,000 of which were government toll-free passengers. Because of the large decrease in war activities, indications are that train passengers will not exceed 22,000,000 during 1947."

PRIVATE VEHICLES PAY BULK OF TOLL

The study shows transbay passenger traffic and revenue. Using 1945 figures, privately owned vehicles carried 45 percent of the passengers, busses and interurban trains 53 percent, while steam trains (crossing by ferry and bus, exclusive of military) amounted to 2 percent.

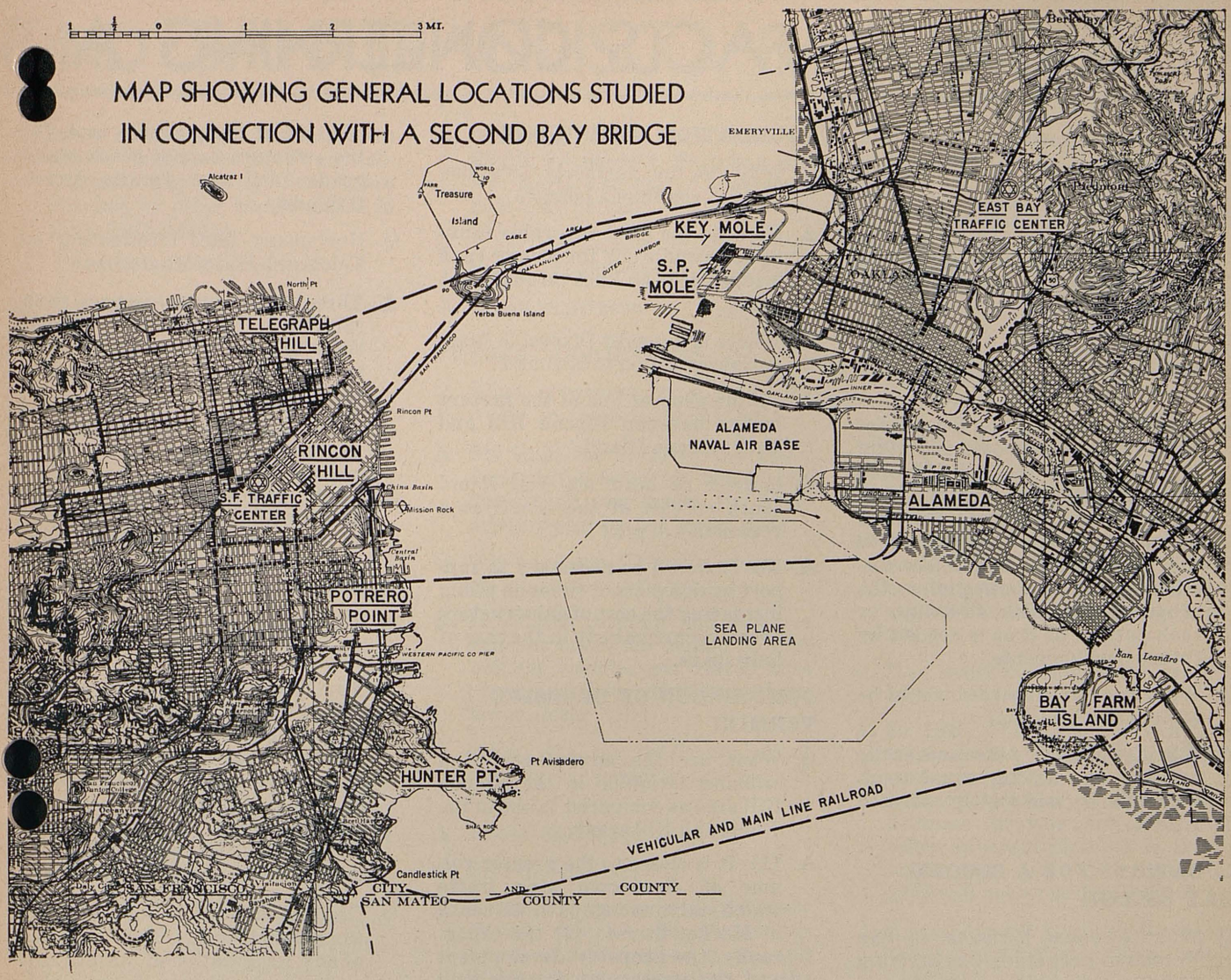
Revenue collected in 1945 shows 63 percent was from light passenger vehicles, producing $4,357,000; trucks numbering 1,377,000 or 20 percent, yielded $1,377,000. Privately owned vehicles therefore returned $5,734,000 or 83 percent of the revenue.

The yield from bus, Key System, Greyhound, Santa Fe, etc., was $536,000; from Key trains, $631,000, a total of $1,167,000 or 17 percent of the overall annual $6,901,000 return. The additional $1,000,000 earned in 1946 was obtained through an increase in privately owned vehicles only.

TRAFFIC TWICE ORIGINAL ESTIMATES

The report shows that present traffic is twice the originally anticipated amount, flowing now at a rate not predicted until 1970. In 1946, the bridge traffic was 69,000 vehicles daily, divided 63,000 on the upper deck and 6,000 on the lower. Peak day was Easter Sunday, April 21, 1946, with 79,016, of which 76,609 were handled on the upper deck.

Traffic increased materially during the war, although rationing of gasoline afforded some relief. When rationing ended August 15, 1945, the problem became acute and need for a second crossing became immediately apparent, Purcell declared. This is borne out by the changing traffic pattern. In 1940 the greatest traffic was on the week-end. At present, traffic on the five working days is greater.



IMPORTANT AS INTER-CITY ARTERY

"This change indicates the growing use of the bridge as an inter-city business artery. The maximum hourly peak established on October 8, 1946, between 4.45 and 5.45 p.m. and largely inter-city, was 7,300 vehicles." During peak hours the stopping of one lane by wrecks or stalled cars, and from entering streams of side traffic, "reduces the effectiveness of the remaining two lanes by more than half."

The origin and destination count, and distribution of vehicular traffic, further shows that 55 percent stops in the principal downtown area of San Francisco, both north and south of Market Street, and 79 percent stops [illegible] starts in this downtown area and [illegible] part of the city directly west and north of it, and also Treasure Island.

On the East Bay side, of all present bridge traffic, 65 percent stops or starts north and west of a line following Fourteenth Street, Lake Merritt, MacArthur Boulevard and High Street in Oakland.

Direct traffic between the southerly portion of San Francisco and that portion of the East Bay cities south and east of the above described line, amounts to only 8 percent of the bridge traffic. Direct traffic between the northerly areas on each side amounts to 50 percent, or six times as much.

Nine reasons are cited by the State's engineers for their recommendation that a second bridge be built on a line between Rincon Hill and Key System Mole via Yerba Buena Island. First, they agree "it should make suitable connections with all the important traffic centers and be so located and constructed that high-speed connections to other areas are feasible as soon as their development warrants them." The advantages given are:

(1) It affords the greatest and longest-lasting relief for the traffic congestion on the present Bay Bridge.

(2) The cost per additional transbay traffic lane is less than that of other practicable crossings. This is due to the type of structure, the favorable foundation conditions and the use of proven construction methods.

(3) The time and cost of engineering investigation and design will be less than for any other crossing, since plans for the present bridge can be used as a pattern for the new structure.

(Continued on page 6)

PERTINENT FACTS CONCERNING A SE

Q. What are the main purposes of a second crossing to consider in choosing its location?

A. (1) To reduce the congestion on the present bridge, (2) to provide a practical means of reaching all parts where future development is likely to occur.

Q. How will a second bridge in the vicinity of Rincon Hill best fulfill these requirements?

A. It will reduce traffic on the present bridge more than would any other crossing, it will serve the Mission District and the northwesterly areas via the Bayshore Freeway and connections, and, will serve the Potrero and Bay Vista districts through a connection to the proposed Maritime Freeway, or such portion of it as is needed by future developments.

Q. What type of structure would be built at this location?

A. A bridge generally the same as the existing one having equal roadway capacity and jointly operated with it.

LOCATIONS FOR A SECOND BAY BRIDGE

Q. What terminal locations in San Francisco were studied in arriving at this conclusion?

A. The physiography of the Peninsula provides favorable conditions for a terminus in four general areas: (1) Telegraph Hill; (2) Rincon Hill; (3) Potrero Point; and, (4) Hunter Point.

Q. What terminal locations on the East Bay side were studied?

A. (1) Key Route Mole; (2) Oakland Mole; (3) the southerly line of Alameda; and, (4) Bay Farm Island.

Q. What features limit the choice of locations in the East Bay area?

A. The general geography of the area, its harbor and airfield developments. (Oakland Harbor entrances, Alameda Naval Air Station, etc.)

FOUNDATION CONDITIONS

Q. Why do the northerly locations cross Yerba Buena Island?

A. Because the most favorable foundation conditions for a long-span bridge occur on lines through that point.

Q. Where is the most favorable foundation condition to be found?

A. On the general line of the present bridge between Rincon Hill and Yerba Buena Island.

Q. Is rock or hard material found south or east of the island at a reasonable depth?

A. No. It would be necessary to support bridge piers or tubes on piling increasing the cost of substructure greatly, particularly in the case of long spans.

COMPARISON OF CROSSING TERMINI

Q. What are the advantages of a crossing terminus in the Rincon Hill area as compared to one in the Telegraph Hill area?

A. (1) It is closer to the greater volume of downtown area traffic which starts and stops to the south of Market Street., (2) the topography, the property development and the street plan is relatively favorable for connections, (3) it provides direct connection with the Bayshore Freeway and its connections, (4) direct connections can be built to serve the Potrero and other more southerly districts, (5) it permits utmost flexibility in handling traffic together with the present bridge, and, (6) foundation conditions for the West Bay crossing are better.

Q. What are the disadvantages of a crossing terminus on the Oakland Mole as compared to one on Key Route Mole?

A. (1) It must remain at high level and have a long span (say 1,400 feet) near the end of the mole, (2) foundation conditions for the piers are poor, (3) the superstructure elevation interferes with the line of flight of Navy planes, and, (4) the structure cannot reach street grade until near Peralta Street, Oakland.

Q. How many lines terminating on Telegraph Hill were studied?

A. Three, in order to compare their suitability for terminal connections and to study various span arrangements for the West Bay crossing.

Q. How many lines terminating near Key Mole were studied?

A. Three, one on the direct line of Stanford Avenue, one parallel and to the north of the present bridge and one on the direct line of 22d Street.

Q. Which of the three lines crossing the East Bay is perferable?

A. The line parallel to the present bridge because: (1) Connections to both Stanford Avenue and to 22d Street can be built from it, (2) it provides a more flexible traffic handling combination with the present bridge, (3) it does not interfere with the yards and harbor development south of the bridge.

Q. Granted that a crossing parallel to the present bridge is the best one of any combination of termini that cross Yerba Buena Island, why should the second bridge be built to the north of the present one?

A. (1) The Bridge Railway interferes with the construction of connections on the south side of the present bridge, (2) although the foundations for the West Bay crossing for bridge to the south are somewhat more favorable, a crossing of the island to the north provides for better support and road connections, and, (3) there is less interference with existing development if built along the north side of the Key Mole.

DISTRIBUTION OF TRANSBAY VEHICULAR TRAFFIC

Q. How was the distribution determined for these studies?

SECOND SAN FRANCISCO BAY BRIDGE

A. Chiefly by origin-destination counts taken on the San Francisco-Oakland Bay Bridge which are checked by other traffic counts in the terminal areas.

Q. When were these counts taken?

A. November, 1943, and March 1946.

Q. What changes in traffic were indicated?

A. As would be expected, the 1946 count showed fewer vehicles starting and stopping in zones that included such war activities as the shipyards in Richmond and the Oakland Port of Embarkation.

Q. What proportion of the traffic starts and stops in the downtown section of San Francisco?

A. Fifty-five percent.

Q. What proportion is directly tributary to a bridge via Yerba Buena Island as compared to a location farther south?

A. About three-quarters of the traffic starting or stopping on the San Francisco side and two-thirds of that on the East Bay side.

Q. How much vehicular traffic would be diverted from the present bridge by a crossing on the Hunter Point-Bay Farm Island line?

A. About 5 percent.

Q. How much by a Potrero Point-Alameda line?

A. Probably not over 20 percent.

Q. Where are the centers of gravity of vehicular traffic on each side of the Bay located?

A. About Eighth and Mission Streets in San Francisco and Broadway and Mather Streets in Oakland.

Q. Have these centers changed since 1932 (Hoover-Young Report)?

A. The center in San Francisco has apparently moved south and west; the center in the East Bay area has moved north and west.

Q. What proportion of traffic starts and stops beyond the city limits.

A. San Francisco: North, 0.9 percent; South, 3.4 percent. East Bay Cities: North and east, 7.7 percent; South, 4.9 percent.

Q. What proportion of the bridge traffic is completely intercity?

A. About 83 percent.

PRESENT CONDITIONS

Q. What provisions were made for traffic on the present bridge?

A. Six lanes for autos on the upper deck; three lanes for trucks and busses and two tracks for interurban trains on the lower deck.

Q. What volume of traffic is carried on the present bridge?

A. 25,300,000 revenue and toll-free vehicles cross the bridge in 1946 (69,500 vehicles per day). Nine percent of these vehicles used the lower deck.

Q. What was the total number of passengers crossing the bay in 1946?

A. About 88,000,000.

Q. How did they travel?

A. Forty-five percent in privately owned vehicles, 53 percent in busses and interurban trains and 2 percent were handled by the three steam railroads.

Q. How much revenue was contributed by each?

A. Privately owned vehicles contributed 83 percent and busses and Key trains contributed 17 percent.

Q. What is the estimated vehicular capacity of the present bridge?

A. With little likelihood of a change in the traffic pattern the maximum limit for reasonable safety and tolerable delay is estimated to be 85,000 vehicles per day. This would mean an average of not over 75,000 vehicles per day.

Q. Is traffic on the Bridge Railway nearing its ultimate capacity?

A. No. It is now only about half the volume carried during the peak of war conditions and gas rationing.

Q. Can the capacity of the present bridge be increased?

A. Certain improvements, such as additional toll gates, are to be constructed which will alleviate the peak hour congestion to some extent, but will not appreciably affect the time of reaching capacity volume.

BRIDGE RAILWAY

Q. Can the present Bridge Railway be replaced by busses?

A. No. Under present conditions, and until more roadway for busses can be provided, trains are necessary to handle the peak-hour traffic.

Q. How many passengers are carried by the railway?

A. In 1945, 37,000,000 passengers were carried of which 11,000,000 were government toll-free. It appears, however, that with the decrease in war activities and other apparent changes in traffic habits that train passengers in 1947 will not exceed 22,000,000.

Q. Are additional facilities for interurban trains necessary on a second crossing?

A. Since the Bridge Railway has handled nearly twice as many passengers as now use it, and could be made to handle more, no additional tracks seem necessary.

Q. Is bus passenger traffic increasing?

A. Yes, at a fairly steady rate, the increase of traffic in 1946 over 1945 was about 3 percent.

MAIN LINE RAILROADS

Q. How is San Francisco freight handled at the present time?

A. By the Southern Pacific over its Dumbarton Cut-off to its yards at the south limits of San Francisco. By the Western Pacific and the Santa Fe on car ferries.

(Continued on page 25)

State Proposes Second San Francisco Bay Bridge and Oakland Estuary Tubes

(Continued from page 3)

(4) Substantially lower costs of administration, operation and maintenance will be possible.

(5) Many duplications of present operating facilities and appurtenances can be avoided.

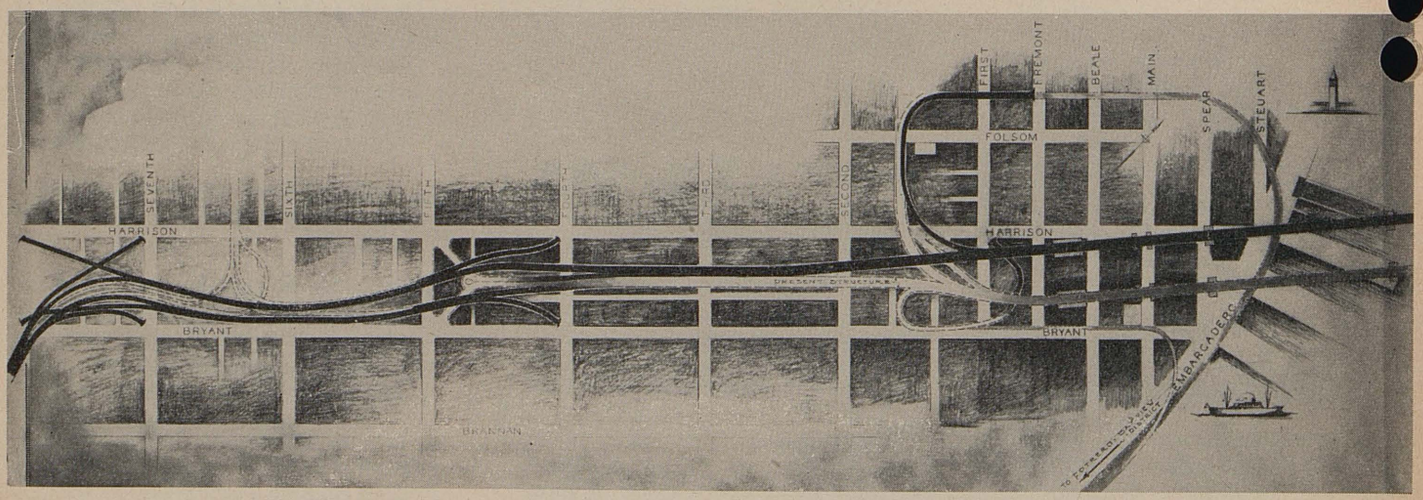
(6) The two structures in close proximity lend themselves to the greatest flexibility of operation. They can be operated each as a one-way bridge, which arrangement could be modified in order to meet future traffic needs and patterns.

(7) No additional hazard to navigation, interference with anchorage areas or obstruction of the glide angle for airplanes will result from its construction.

(8) It will connect directly with the Bayshore Freeway in San Francisco to be built by the State, providing four points of distribution in the downtown business district. Extensions reaching to the north of Market Street, to Van Ness Avenue, and south to the Potrero-Bay View districts via the proposed Maritime Freeway, are practicable.

(9) It terminates at the focal point of East Bay traffic arteries connecting with the East Bayshore Freeway (north and south) and MacArthur Boulevard. Additional traffic capacity of the terminal arteries will be obtained (a) by adding lanes to the present distribution structure for north-south, city traffic, (b) by the construction of a connection with 22d Street across the S. P. Co. tracks, and (c) by additional tubes under the Estuary connecting Alameda with the Bayshore Freeway.

"The proved financial soundness of the existing bridge should assure a ready market for new bonds secured by the same steady revenues. In fact, with two crossings, the risk of loss of revenue because of damage to either unit will be greatly reduced and the value of the securities should be enhanced by the assurance of steady revenue," Director Purcell declares in the report.



Bridge connections with Bayshore Freeway and with projected Shoreline Freeway

BACKGROUND DATA

The California Toll Bridge Authority directed the present investigation on October 30, 1945, and Congress followed in March, 1946, with an authorization for another Joint Army-Navy Board to study the problem from the standpoint of national defense and peacetime economy.

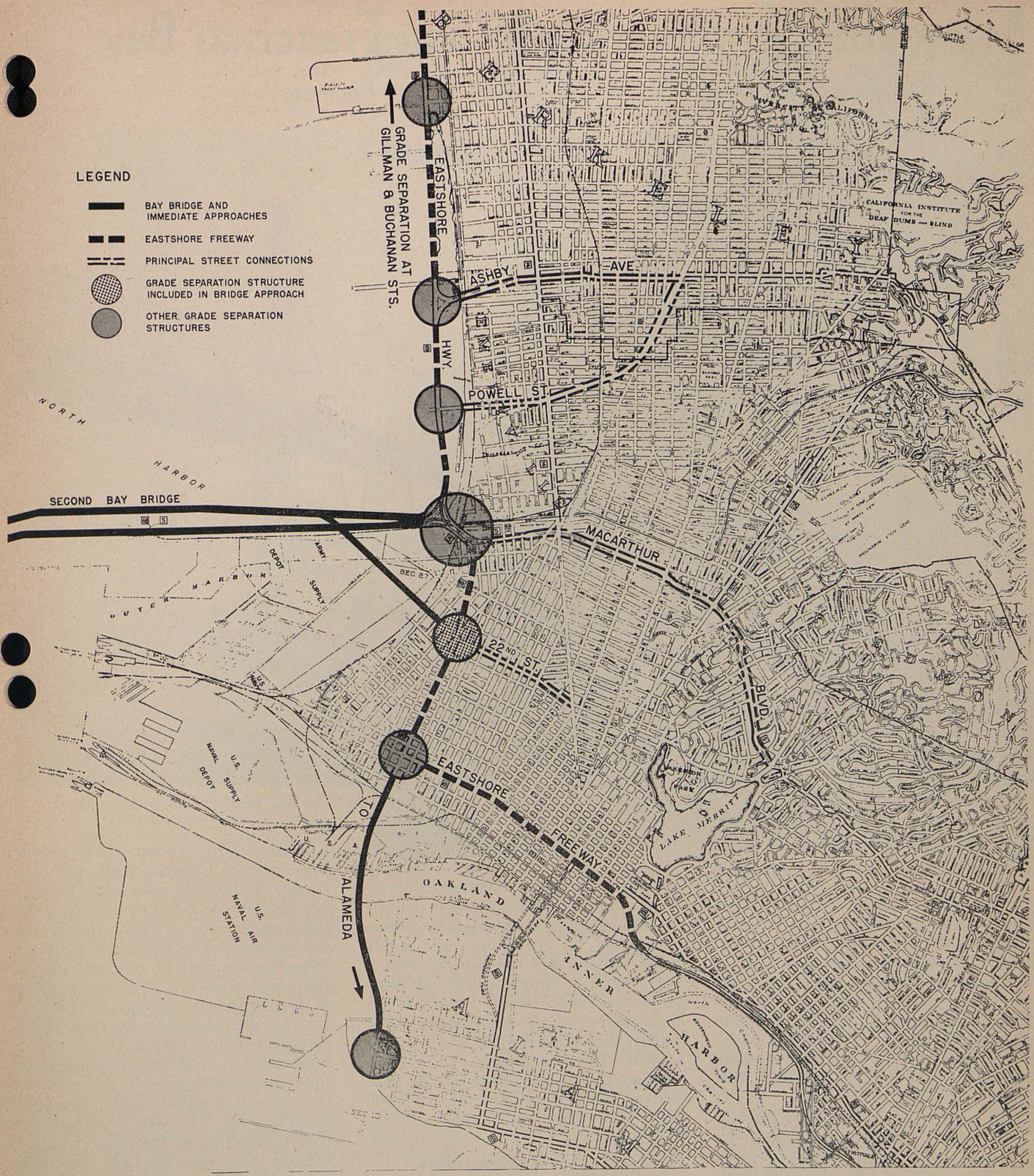
The State's investigation was done by a special Bay Bridge Studies organization, under the general supervision of Director of Public Works Purcell and chief engineer of the San Francisco-Oakland Bay Bridge, and the immediate direction of F. W. Panhorst, bridge engineer of the California Division of Highways.

The investigation included detailed studies of traffic volumes and capacity of the existing bridge to determine the need for an additional bridge. A general study was made of alternate locations.

Embraced in the report are origin and destination studies in detail, available and potential terminal distributive highways and streets, foundation studies, and design and cost studies.

In 1930, as part of its studies for the Hoover-Young Commission, the department made borings which, supplemented by actual construction record for the Bay Bridge, give a reliable idea of bedrock and these explorations were useful to the current study. In addition, new borings were made for the present study, particularly for comparison of locations each side of the existing bridge.

The San Francisco-Oakland Bay Bridge was opened to traffic on November 12, 1936. Continued increase of traffic on the Bay Bridge since th date has been far beyond the m optimistic estimates.


LEGEND
BAY BRIDGE AND IMMEDIATE APPROACHES
EASTSHORE FREEWAY
PRINCIPAL STREET CONNECTIONS
GRADE SEPARATION STRUCTURE INCLUDED IN BRIDGE APPROACH
OTHER GRADE SEPARATION STRUCTURES
GRADE SEPARATION AT GILLMAN & BUCHANAN STS.
EASTSHORE HWY.
ASHBY AVE.
POWELL ST.
SECOND BAY BRIDGE
MACARTHUR BLVD.
22ND ST.
EASTSHORE FREEWAY
TO ALAMEDA
NORTH HARBOR
OUTER HARBOR
ARMY SUPPLY DEPOT
U.S. NAVAL SUPPLY DEPOT
U.S. NAVAL AIR STATION
OAKLAND
INNER HARBOR
LAKE MERRITT
CALIFORNIA INSTITUTE FOR THE DEAF DUMB and BLIND

Foundation Exploration In San Francisco Bay

Everett L. Walsh, Senior Bridge Engineer

Drill barge taking borings on east side of San Francisco Bay. San Francisco-Oakland Bay Bridge in background

STRANGE jargon has been drifting about the air in the Bridge Department for the past few months. Some of the engineers have suddenly gone nautical. Such terms as "starboard," "port," "stern" and "aft," have replaced the usual engineering terminology. All of this was due to the unusual activity of exploring the subsurface formations of San Francisco Bay to determine foundation conditions for another crossing between San Francisco and the East Bay.

On October 30, 1945, the California Toll Bridge Authority requested the Department of Public Works to make a comprehensive engineering investigation and study of the need for an additional bridge from San Francisco to the East Bay without limitation as to location.

It is impossible to determine the relative economy or even the feasibility of any proposed crossing either as to its type or location without definite knowledge of the subsurface formation. The job of probing the strata below the earth's surface on land is comparatively simple and the methods employed vary with the type of information desired and the relative suitability and economy of the method chosen. However, when it becomes necessary to take borings in tidal waters ranging in depth to over 100 feet, the problem becomes more difficult.

FOUNDATION INFORMATION

It was necessary to obtain foundation information on various lines starting from various points between Hunter Point and Telegraph Hill, a stretch of approximately seven miles.

Prior to the construction of the present San Francisco-Oakland Bay Bridge, 41 borings were taken at various locations in San Francisco Bay by the Department of Public Works for the Hoover-Young Commission. While these borings were of general value in that they indicate a great irregularity of formation and depth to rock and showed the general suitability of the present bridge location, they were of little value in predetermining accurate foundation conditions on any particular crossing location other than the existing one. The depth of suitable rock foundation on the present bridge between the San Francisco pier head line and Yerba Buena Island varies from 88 to 231 feet below mean lower low water with a variation of rock elevation of 30 feet within the area of one pier.

JET BORINGS

The results of past experience indicated that the most practicable and economical method of determining whether any of the prospective lines afford suitable foundation at practical depth is by means of exploration with a high pressure water jet, and this method was employed to obtain samples along each of the proposed crossings. The suitability of this method of predetermining foundation conditions was definitely demonstrated by satisfactory results obtained during the construction of the present bridge. The jet borings for the study were necessarily exploratory in nature, their purpose being to determine general characteristics and material penetrated, and the distance to suitable rock formation when rock was encountered within the limits penetrated.

The method of making borings did not permit samples to be obtained at all strata penetrated nor core borings for a complete laboratory analysis. Nevertheless the information obtained by the use of the jet provided sufficient information to assist in, (1) a determination of the relative suitability and feasibility of the various proposed lines, (2) the selection of the most practicable type of structure as a basis for preliminary designs and cost estimates.

CONTRACT SET

As soon as the funds became available, specifications were prepared and bids were received to have the borings done by contract on an equipment rental basis. A service agreement was issued to Ben G. Gerwick, Inc. Work was started on September 20, 1946, and completed on December 6, 1946.

The borings were made from a drill barge which had an over-all length of 82 feet and a beam of 29½ feet. The barge carried 100-foot pile driver leads. On the deck of the barge at the bottom of the leads a working platform was cantilevered out ahead of the leads to provide a working space for the control of the jet pipe.

A tug boat was used to tow the drill barge from the mooring to the location of the jet borings or from one boring location to another. The tug remained with the drill barge at all times while work was in progress.

A gasoline launch was used to transport the crew and state engineers from the shore to the barge and stood by at all times during jetting operations.

Close-up of jet nozzle. Four-inch pipe reduced to two inches

LOCATING BORINGS

Two engineers of the department, George A. Baab and Richard W. Douglas, were on the drill barge at all times directing operations. The location of the proposed borings and of various land marks, such as permanent buildings, towers, smoke stacks, radio towers, high water tanks, etc., were shown on a print especially prepared from U. S. Coast and Geodetic coordinates, plotted with a scale of 1 inch = 1,000 feet. In locating the barge over a proposed boring, three visible land marks were selected and the angles between the borings and the land marks were measured by means of a sextant and transferred to the print by means of the three-armed protractor. The sextants were supplied with telescope attachments which greatly facilitated their use.

ANCHORING REQUIRED

To hold the barge at the desired location an adequate anchorage system was required. This was provided by a system of stern, bow and quarter anchors. Generally the stern anchors were dropped first with the stern of the barge against the run of the tide. This allowed a certain amount of control of the barge while getting it into position to drop the quarter anchors. After the two stern anchors and two quarter anchors were in place the bow anchor was lashed to the bow of the

tug. The tug then carried the anchor until it was over the location where the bow anchor was to be placed. When all anchors were down the leads of the barge were brought over the boring location by use of winches on the anchor line.

All anchors except the bow anchors were dropped directly from the barge and all anchors were raised by deck engines after the barge had been maneuvered directly over the anchor by use of winches.

SUBMARINE CABLES

About 50 percent of the borings were made within or near the vicinity of the areas occupied by submarine cables of the Pacific Telephone and Telegraph Company, Western Union and the Pacific Gas and Electric Company. Some of these cables carried as many as 1,200 conductors and extreme care had to be exercised that an anchor was not dropped on or close to one of these transmission cables as the breakage of one of the cables would seriously disrupt communication into San Francisco.

The Pacific Telephone and Telegraph Company cables were shown on a print prepared by that company. This print was made on the basis of "Range Lines" which represented 20-minute angles between three prominent landmarks. From these range lines it was possible to read directly the angle between the proposed anchor setting and the landmarks. These angles were set on the sextants and the barge towed in the direction necessary to be over the desired spot.

The system for locating the submarine cables used by the Western Union Company was somewhat differenct. Prior to the setting of the anchors a "tone" was put into the cables. This "tone" was a make-and-break signal with a cycle of from two to three seconds. After starting the "tone" from the shore stations the company's representatives came aboard the barge with an exploring coil. By means of this coil, an antenna and earphones, the "tone" could be heard from the surface of the Bay. This "tone" or make-and-break signal increased in volume as the barge approached a cable and became maximum when the antenna was directly over the cable.

Through long experience with this equipment the Western Union representatives were able to estimate the distance from a cable quite accurately by volume of the "tone" in the ear phones and could thereby judge when it was safe to drop the anchors. Because of the interference produced by the "tone" on communications being carried by the cable, the "tone" was not put into the cable until the barge was nearly on point and was removed again as soon as the anchors were set. The Telephone Company was also equipped to use this method of locating cables, but because the "tone" is audible and creates interference on transbay telephone conversations, it was not used.

The Pacific Gas and Electric Company located its cables by means of a three-stage audio-amplifier which picks up the 60 cycle field of the cable by antenna and is heard as a steady hum in the earphones. The hum approaches a maximum as the cable is approached, but directly over the cable the hum stops and the ear phones are dead. By using extreme caution in locating the anchors in the cable area, no particular trouble was encountered and no damage was done to any of the cables.

Sampler tube. This tube is weighted with lead to resist bouyancy

JETTING AND PROTECTIVE CASING

In shallow depths no extraordinary precautions were required to protect the jet pipe. When jetting operations were performed at locations where the depth of water was over 80 feet the jet pipe was protected from the sw[illegible] tidal currents by first lowering a [illegible] inch pipe of extra heavy strength. This

pipe came in 36-foot sections with flange connections which were bolted together. After sufficient pipe had been connected and lowered to touch bottom the pipe was set into the mud as far as possible by dropping the pile hammer on it.

As soon as the leads of the barge were on the point desired and the protective casing had been lowered where required, the tip section of the jet pipe was lowered inside the casing. The tip section was made up of four 20-foot pieces of 4-inch pipe plus a 2-foot nozzle with a reduced orifice from 4 inches to 2 inches. Except in very shallow water the tip section would usually lower itself through the soft surface mud by its own weight. Additional jet pipe was added as necessary in 60-foot pieces made up of 20-foot sections of the 4-inch pipe. Sections of this length were used in order to speed up the jetting operations by reducing the time consumed in making and breaking the joints.

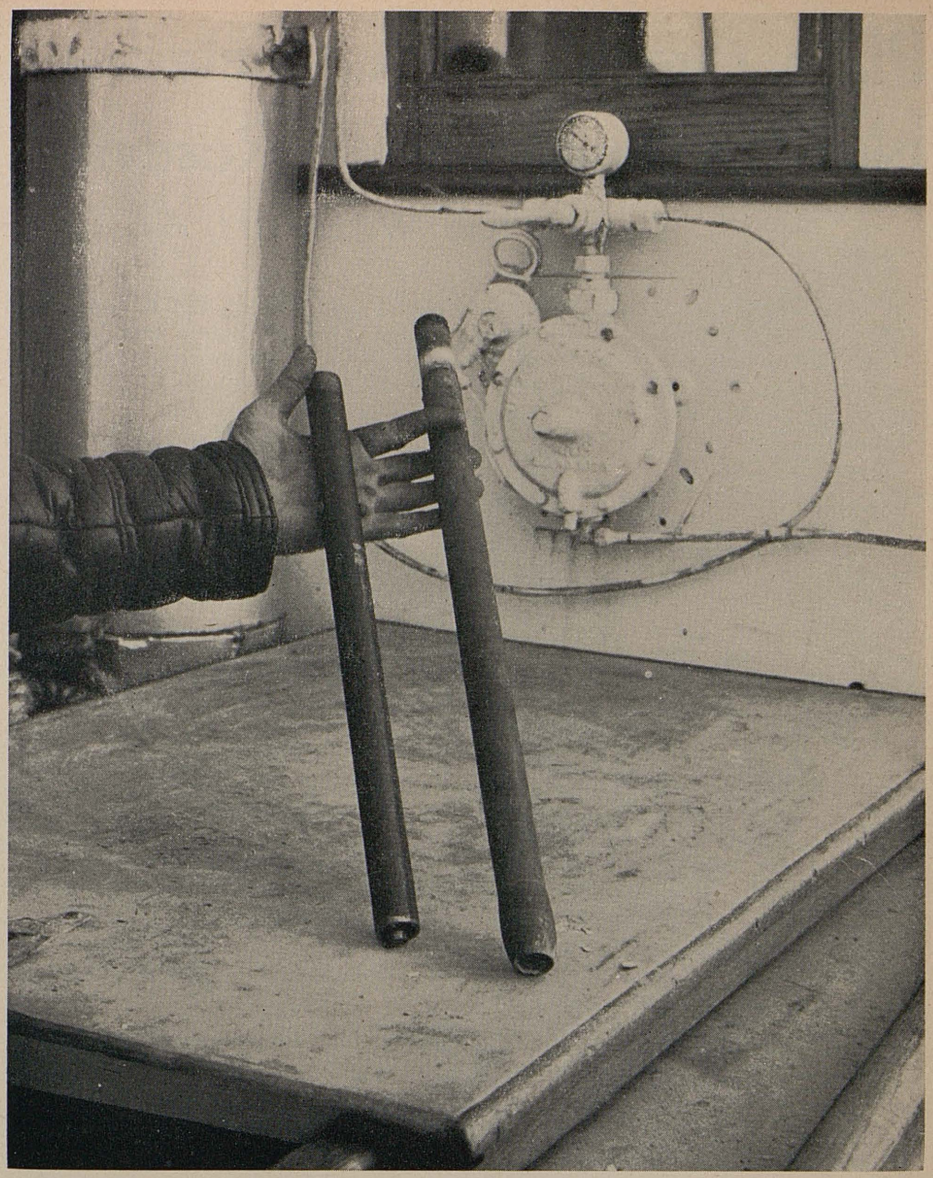
All jet pipe was 4 inches extra heavy strength tested to 1,200 pounds per square inch. The individual lengths were connected by threaded couplers, and the couplers were welded to the pipe to prevent breakage at the joints except at the sectional intervals. Connections of jet pipe sections were made from the working platform on a level with the bridge deck in front of the leads. Jet pipe when not in use was lashed to the bracing at the sides of the leads.

SYSTEM OF PUMPS

A system of pumps was used which developed gauge pressures of 500 pounds per square inch when the nozzle of the jet pipe was in a stratum which afforded this much resistance. However, pressures of this magnitude were not sustained for any appreciable period. The average pressure on the jet line was about 330 pounds per square inch. Jet borings were made to a maximum depth of 350 feet below mean lower low water. The jetting operations proved very successful in penetrating all types of subsurface materials to bedrock when such was encountered.

OBTAINING SAMPLES

Samples of the subsurface material were usually taken at depths where it was necessary to stop jetting to add another section of pipe, or at about 20-foot intervals. Samples could be taken at any desired interval, however, by removing a special sampling cap from the tip of the goose neck. Samples were obtained by means of an especially made sampler tube and tip. The sampler tube was constructed of a 12-foot section of two-inch pipe with a three-fourth inch pipe inside. The interstice between the pipes was filled with lead and both pipes and lead were perforated with one-fourth inch holes at from 6 inch to 12 inch centers. The purpose of the lead pipes was to give sufficient weight to overcome buoyancy of the water and to give sufficient weight to drive the sampler tip into the soft clay and soft shale strata.



Sampler tips. Cutting point on right used for hard material

Two types of sampler tips were used. One with a section of three-fourth inch pipe 18 inches long which screwed into the bottom of the sampler tube. Inside the bottom 12 inches of the tip was fastened a one-half inch ship auger. The auger protruded from the bottom of the three-fourth inch pipe about one-half inch and its purpose was to hold any material which the tip penetrated. The second type was a piece of tube (No. 1 soil tube) about 18 inches long, welded at the upper end to a short piece of threaded three-fourths inch pipe which screwed into the sampler tube. This sampler tip had on the lower end a No. 1 cutting point made of specially hardened steel and was used for obtaining samples of hard material which the other type of tip failed to penetrate.

(Continued on page 25)

Plans Are Being Completed for Much Needed Underpass In Roseville

By GEORGE W. SMITH, Associate Bridge Engineer

AT THIS writing plans are practically complete for the construction of the Roseville Underpass under the Southern Pacific tracks in the town of Roseville, Placer County.

Roseville, situated in the Sacramento Valley some 20 miles northeast of Sacramento, is a town of some 8,000 population. It is a division point on the Southern Pacific Railroad, many of its people obtaining their livelihood as employees of the railroad company. The railroad divides the town practically in half. What is now known as the old business district is located on the north side of the tracks, while the business district which has grown up in recent years is on the south side along with some of the newer housing units.

State Highway Route 3, also known as U. S. Highway 99E, now crosses the railroad at grade on Lincoln Street, and is one of the main routes of travel between Sacramento and other towns in the valley located to the north. As U. S. Highway 99 it begins at the Mexican border in the south and traverses the San Joaquin and Sacramento Valleys, goes through the state of Oregon and Washington to the Canadian border.

REALIGNMENT OF U. S. 99E

The proposed underpass will be part of a project of realignment of U. S. 99E through the town of Roseville. The project begins at the intersection of Grant and Vernon Streets, extends one block southerly along Grant to Oak Street, thence one block easterly to Washington Street, along Washington Street, thence across a residential section, finally meeting the present highway at a point one mile north of the present Andora Underpass, comprising a total length of about three miles. From Oak Street to a point just south of the Andora Underpass the proposed construction will be a four-lane divided highway.

Extension of the realignment through the Andora Underpass will alleviate a bad alignment condition which has existed for a number of years. This underpass has been the site of two spectacular gasoline tank truck accidents in which the gasoline ignited and burned the railroad ties such that disruption was caused to both highway and railroad traffic.

TRAFFIC IS HEAVY

A traffic count taken at the present crossing in September of 1945 during a 16-hour period, showed that 6,800 vehicles crossed the tracks. Over 50 percent of the vehicular travel is of local origin and destination, the remainder being through travel. Within this 16-hour period the crossing was blocked 176 times for a total of seven hours. Being close to the north end of the railroad yards, the number of times the crossing is blocked is due primarily to switching movements, as freight trains moving over the Sierras are regrouped in the yard. Approximate number of through trains is 40 daily, this figure comprising both passenger and freight.

ACCIDENTS NUMEROUS

Since 1926 there have been 93 recorded accidents at the crossing involving trains and vehicles. Injuries have resulted to some 26 persons in these accidents, but fortunately there have been no deaths due primarily to slow train speeds prevalent within the yard limits. However, the critical deficiency of the present crossing is excessive delay and the project will eliminate that condition.

LOCATION CAREFULLY CHOSEN

The proposed underpass will be located on Washington Street which is one block south of the present crossing at Lincoln Street. Washington Street does not cross the tracks at present. By constructing the underpass at this location all traffic will benefit, and it will provide a non-delay connection between both portions of the town, which is an important factor when considering movement of units for protection of the public safety and property.

The site chosen will provide the greatest benefit for a majority of the people. The main factor taken into consideration in selecting an underpass was in providing a structure which would have a good appearance and utility without disturbing any more of the present movements of traffic than was necessary on the existing city streets.

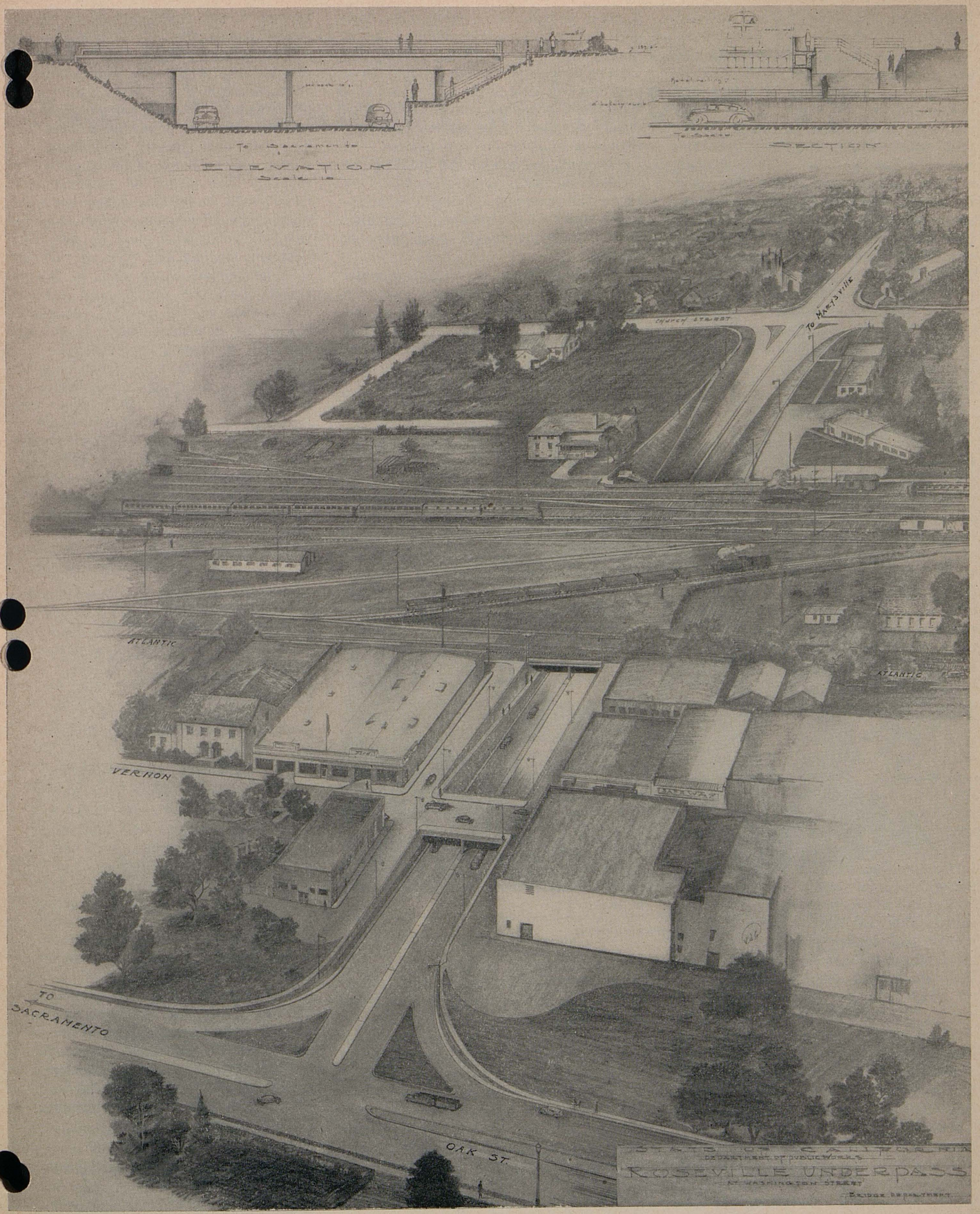
DESCRIPTION OF STRUCTURE

The depressed portion of the structure is some 1400 feet long, from Oak Street on the south thence along Washington Street passing under the present State Highway (Vernon Street) continuing under 17 tracks of the Southern Pacific Railroad, and finally again coming to natural ground elevation at Church Street. Outer roadways will be constructed from the alley which is located between Oak and Vernon Streets to Atlantic Street, thus providing connections which will allow as many traffic movements as possible between existing streets.

Within the underpass there will be two 24-foot roadways with a 6-foot dividing strip. At the Oak Street end the entrance to the depressed portion will be an open cut, so constructed that the motorist will have a maximum of overall visiblity regardless of the direction from which he may be entering the underpass. Retaining walls of the reinforced concrete cantilever type are a standard design adopted by the Bridge Department of the State of California.

UNDERPASS BARREL 360 FEET

A reinforced concrete continuous slab structure consisting of two 31-foot spans will carry Vernon Street over the depressed portion. Vernon Street is 80 feet between property lines and the structure will be constructed to this width, which includes two 12-foot sidewalks. While the slabs have a parabolic soffit, an outer curtain beam of a uniform depth will be placed in order to carry out the general theme of straight line construc-


To Sacramento
ELEVATION
SECTION
CHURCH STREET
TO MARYSVILLE
ATLANTIC
VERNON
TO SACRAMENTO
OAK ST.
DEPARTMENT OF PUBLIC WORKS
ROSEVILLE UNDERPASS
AT WASHINGTON STREET
BRIDGE DEPARTMENT

tion which is dictated by the railroad structure.

The underpass barrel directly under the tracks is some 360 feet in length and located on a 5,000-foot radius curve. Adjacent to the west roadway is a pedestrian ramp seven feet wide, which requires that the westerly roadway be a 39-foot span and the easterly one 31 feet. The deck for the 39-foot and 31-foot spans consists of 33-inch steel wide flange beams weighing 200 and 152 pounds per lineal foot respectively, spaced at 2-foot 6-inch centers, over which is placed a reinforced concrete slab four inches thick. On top of the concrete slab will be placed 1½ inches of waterproofing material, over which the ballast is placed supporting the ties and rails.

DIVIDING STRIP

The intermediate support placed within the 6-foot center dividing strip was designed for a minimum of width in order that as much clearance as possible could be attained between it and the adjacent curbs. It consists of a steel box girder four feet deep which rests on 24-inch steel wide flange columns spaced at 12-foot 6-inch centers founded on a continuous reinforced concrete footing. Within the 360-foot length of deck, three expansion joints are located transversely extending through the box girder and deck, taking care of the expansion and contraction caused by the temperature differential.

In order to utilize rolled sections and to meet the design requirements for loading it was necessary to utilize structural silicon steel for the columns. This steel has a basic working stress of 24,000 pounds per square inch as compared with 18,000 pounds per square inch for the structural carbon steel, which is being used for all other structural steel on the job. Abutments and center pier for the railroad structure are founded on reinforced concrete spread footings.

PEDESTRIAN RAMP

The aforementioned pedestrian ramp extends from Vernon Street on a down grade until it passes under the tracks in the underpass barrel adjacent to the westerly roadway and emerges at the north end with a ramp rising to natural street grade on Washington Street and a stairway which will rise to natural ground and allow pedestrians to cross the depressed portion on a reinforced concrete box girder which forms a facia beam for the north end of the barrel. This concrete box girder provides a pleasing entrance to the underpass as it spans both roadways and the pedestrian ramp thereby giving the entrance a more open appearance.

Through the barrel the level of the pedestrian ramp is some seven feet above the roadway, giving a satisfactory separation between vehicular and pedestrian travel with greater safety.

Along the tops of retaining walls and adjacent to pedestrian ramps a steel handrail will be placed, the rail will be three feet high, and consist of three horizontal hollow tubular members with round vertical posts placed at approximately 8-inch centers.

LIGHTING IS ADEQUATE

A considerable amount of thought and planning has been given to adequate lighting both within the underpass and at other strategic locations for the safety of the traveling public. There will be no dark spots within the underpass and the public will feel free to utilize the pedestrian walkway without fear. For the covered section a greater volume of light has been provided at the entrance end of each roadway, gradually diminishing as the opposite end is reached, such that a transition in light intensity will allow the motorists' eyes to properly adjust themselves in both daytime and nighttime driving. On account of the length of the barrel it will be necessary to maintain 24-hour lighting for some of the lights.

Lighting facilities in connection with the underpass will be included in the contract plans. The City of Roseville will maintain those lights in which illumination of city streets is involved.

DRAINAGE BY PUMPING

The depressed portion covers approximately two acres, all of which will be drained by pumping. A pumphouse placed behind the retaining wall will be located at the northeast corner of the intersection of the subway with Atlantic Street. In addition to surface water a small amount of subsurface water will be handled. Altogether a capacity of 1,400 gallons per minute will be discharged by two pumps into a 48-inch sanitary sewer. A storage box having a capacity of approximately 10,000 gallons will be located under the roadway adjacent to the pumphouse.

Utilization of this box allows a smaller pump capacity than would be required than if all of the water were immediately discharged, particularly during periods of intense rainfall. The box and pumps have been designed on the basis of an intensity of rainfall that would be realized once in 10 years, or putting it another way, once every 10 years as determined by rainfall records it can be assumed that the storage box will be full for a short period, since rain is falling faster than the pumps can take it away, then as the rainfall decreases below the pumping rate the storage box will gradually be emptied.

At the present time there is a 36-inch city storm drain along Washington Street, which discharges into Antelope Creek immediately south of Oak Street. Between the pumphouse and the creek a distance of about 800 feet, this line will be replaced by a 48-inch pipe to handle the additional water from the underpass pumping plant, as at present the 36-inch line is practically taxed to capacity.

Necessary Paper Work

January 7, 1947

Mr. S. V. Cortelyou
District Engineer
Division of Highways
808 State Building, Civic Center
Los Angeles 12, California

Gentlemen: How can public officials get their important work done when they feel they must reply to every petition or query of a voter with a long letter such as your very kind reply to me? Certainly, the detail and paper work is so ponderous that there is no time for thought or accomplishment of practicable objectives.

I think the voter and taxpayer who demands an explanation and voluminous reply to every protest or comment is a dope. Can appreciate your position—but wouldn't it be wonderful if you could just devote your time to doing things?

Yours very truly,
Mrs. Lewis A. Kingsley
6331 Quebec

New Directional Service for All of State's Historical Landmarks

By M. A. O'BRIEN, Maintenance Department

THE DISCOVERY of Gold in California in 1848, the Gold Rush days of 1849 and the Admission of California to the Union in 1850 will be the theme for three centennial celebrations to be held during the next three years. It is therefore fitting that special attention be given to the historical landmarks that formed an important part in our early history.

It is proposed by the Division of Highways to revamp the present method of signing and directing travel to historical landmarks. The new plan should encourage a large number of tourists to visit these landmarks as they will know in advance the historical significance of each site.

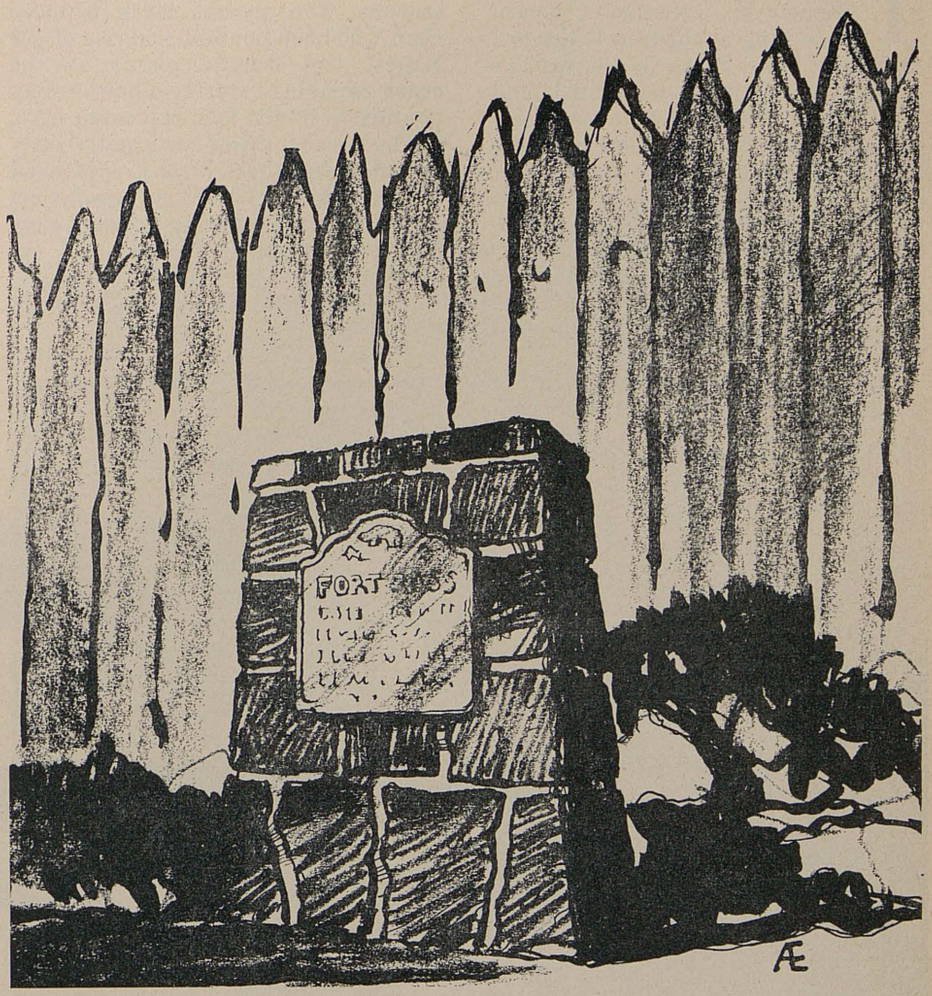
At the present time, a chocolate colored sign indicating the landmark name and number is erected at the site, when the landmark is on or adjacent to the state highway; and at the nearest road junction, if the landmark is located on a county road.

The State Chamber of Commerce, acting through its Historical Landmark Registration Committee, investigates all historical landmarks submitted for approval and its aid and cooperation were obtained in developing the new plan. This committee selected 42 of the more important historical landmarks for this special directional service, and will provide the text for the historical description.

The work to be done contemplates the construction of a parking area of turnout, which will be graded and oiled. As most of the historical landmarks selected for this special treatment are located some distance and off of the State Highway System, the parking areas will be constructed in advance of the county road intersections leading to the landmarks.

A rubble masonry monument containing a bronze plaque showing the landmark name and number, will be constructed in this parking area. The plaque will carry a 40-word description of the landmark and its historical significance. New distinctive signs having brown letters on a stucco-colored background will also be placed at the nearest intersection of the state highway and county road leading to the landmark. This new sign will also be placed at the sites, when located on state highways, in lieu of the present chocolate markers. In addition to the above signs, there will also be installed an advance sign, giving notice of "Historical Information Ahead," which will be placed approximately 500 feet in advance of the parking areas.

The 42 landmarks selected by the Historical Committee are located throughout the State. They have all been inspected, parking sites selected, and the work of grading the parking areas and constructing monuments will be undertaken within a short time. It is anticipated that the first project will be completed sometime in July of this year.



Artist's sketch of rubble masonry monument containing a bronze plaque bearing the landmark, name, and number

New Noyo River Bridge Will Permit Expansion of Commercial Fishing Port

By RALPH W. HUTCHINSON, Associate Bridge Engineer

THE CALIFORNIA Division of Highways recently learned something about fish. It learned that the United States is the world's second largest producer of fish and that 28 percent of the nation's fish came from California, where fishing is the third largest industry in the State. This education in the fishing business was the result of a recent investigation of complaints by commercial fishermen that the state highway bridge across the Noyo River, in Mendocino County, was a hindrance to navigation.

The Noyo River enters the ocean at the south edge of Fort Bragg. It provides a small cove and a navigable river channel which permits anchorage of small fishing boats. Since 1940 the Noyo River has been a growing fishing port until now it is the second in size on the coast between San Francisco and Astoria, Oregon.

About 200 fishing boats are berthed at Noyo and about 100 more work out of the port during the favorable seasons. The annual catch is more than 7,000,000 pounds, and one of the largest fish storage plants on the coast, capable of storing a half million pounds of frozen fish, is located here.

The port facilities are greatly overcrowded and there is an urgent need for expansion. All of the present activity is confined to the channel below the state highway bridge, and expansion of the port upstream is prevented by lack of clearance under the bridge.

The existing bridge across the Noyo River was built by Mendocino County in 1927 prior to the development of the fishing industry on the river. In 1933 the bridge was taken into the State Highway System as a part of Route 56.

During 1944 the Noyo River fishermen requested the State to relocate the bridge so as to permit port expansion upstream. In spite of the merit of the request the State was reluctant to spend highway funds for the wartime replacement of the Noyo River Bridge until a definite program had been adopted for the expansion of the port. The existing bridge was estimated to have a remaining useful life of 10 years, while there were same 20 bridges on this section of State Highway Route 56 which were in more urgent need of replacement. Twelve of these bridges were restricted to less than legal highway loadings and were being maintained at considerable expense. The Office of Defense Transportation was urging the replacement of these weak bridges as a war measure.

In 1945 the United States War Department adopted a plan for the extension of the port at Noyo River and declared the existing state highway bridge to be a hindrance to navigation. In compliance with this ruling, the State agreed to replace the existing bridge within two years with a structure to provide a navigating

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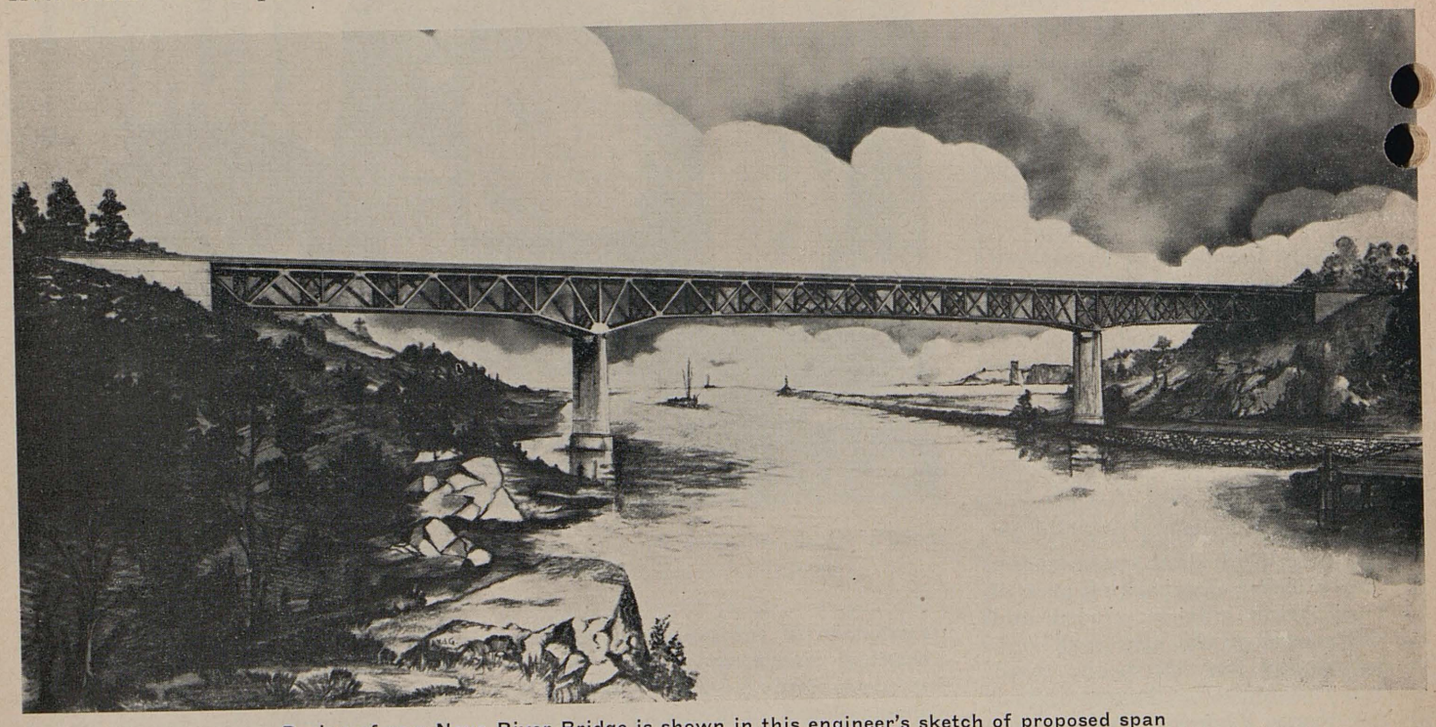


Design of new Noyo River Bridge is shown in this engineer's sketch of proposed span

Roadway Taking Shape on High Standard Highway in San Bernardino Mountains

By C. V. KANE, District Locating Engineer

GOOD construction progress is being made on the first 3.2 mile unit of the projected 15-mile City Creek Road. The high standard roadway is now taking shape on the precipitous mountain slopes, as shown by the accompanying photographs.

This highway, penetrating the San Bernardino Mountains, will be a through traffic artery for the use of the heavy summer and winter recreational traffic to the resort and playground areas at Big Bear Lake and Arrowhead Lake. It will also serve communities having an estimated 20,000 permanent population.

An alternate highway to relieve the intolerable recreational traffic overload on the present Waterman Canyon Route has been a pressing need for a number of years. Peak hour traffic volumes of 2,000 cars on weekends and holidays are a common occurrence for the existing two-lane highway constructed by the State in 1932. This volume is three times the maximum capacity considered safe by nationally accepted standards.

A feature of the design that received special consideration was the provision made at frequent intervals for overtaking and passing slower vehicles. It is accomplished by the inclusion of sections of straight alinement to afford sufficient sight distance to perform passing with safety. This is a departure from older mountain highway design where the faster vehicles often are forced to stay behind slower ones for several miles before being able to pass with safety.

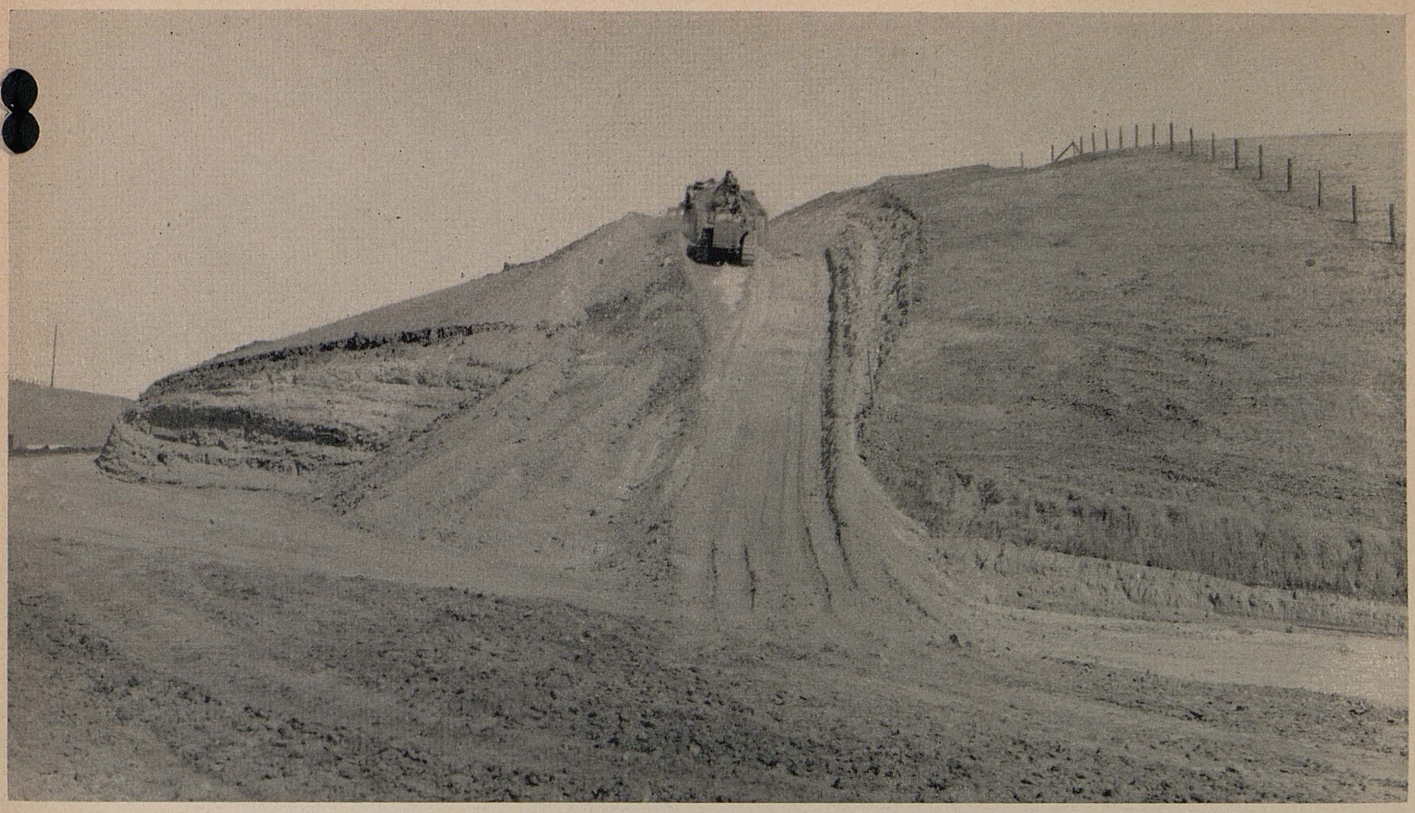
Rights of way for this project are being purchased with controlled access. This method of acquisition eliminates the development of unsightly wayside stands that would create danger to traffic.

The statistical design and construction information for the current contract on this project was published in the California Public Works issue of July-August, 1946.

Above—This embankment on City Creek Road which is one-half completed will have an ultimate height of 110 feet. On opposite page, upper—Portion of 50-foot high embankment under construction, showing erosion protection features. Lower—Progressive work on sidehill excavation utilizing ramps within the roadway prism

MODERN ROADS REQUIRE HUGE VOLUME OF MATERIALS

A train of 1,480 cars would be needed to transport material used to surface 10 miles of concrete highway. To haul material for 10 miles of bituminous surfacing 720 cars are required.



Pioneering cut on Willow Pass Highway in Contra Costa County, now under construction

Construction of the Willow Pass Limited Access Freeway Under Way

By G. L. BECKWITH, Associate Highway Engineer

A SECTION of the Industrial Highway in Contra Costa County between Concord and Pittsburg and known locally as the Willow Pass Road is now under construction.

This section of state highway, taken into the State System in 1933, was designated as a county road by the Contra Costa County Board of Supervisors on March 7, 1853, and by Ordinance No. 56 it was designated as the Willow Pass Road on March 8, 1892.

The original road was a winding dirt road through the pass and received its original surfacing of an 18-foot oil macadam in 1921.

The rapid increase in traffic over this route has kept pace with the industrial growth of the Cities of Port Chicago, Pittsburg and Antioch and the growth of the agricultural areas to the east and the East Bay metropolitan area.

Due to the industrial areas as noted, a large percentage of truck traffic uses this route.

With the limited width of the old pavement, steep grades and short radii curves, it was not uncommon to find a line of traffic a half mile long following some slow moving truck through the pass. These conditions contributed to the high accident rate on this portion of the route.

The contract now under way provides for a four-lane divided highway consisting of two 23-foot Portland cement concrete pavements eight inches in thickness constructed over a cement stabilized base and divided by a six-foot division strip separating traffic in opposite directions. Eight-foot shoulders are provided to enable parked or disabled vehicles to stand clear of the paved traffic lanes.

A minimum of one foot of select material is to be placed over the grade, the upper four inches of which is to be stabilized with approximately 4 percent of Portland cement as a base for the concrete pavement.

The project is 2.6 miles in length and the new alignment reduces the curvature from 554 degrees in the old road to 133 degrees and the number of curves from 26 to 7. The maximum gradient on the old road was 9 percent which has been reduced to 7 percent on the new location.

There are 455,000 cubic yards of excavation and 5,350,000 station yards of overhaul included in the contract.

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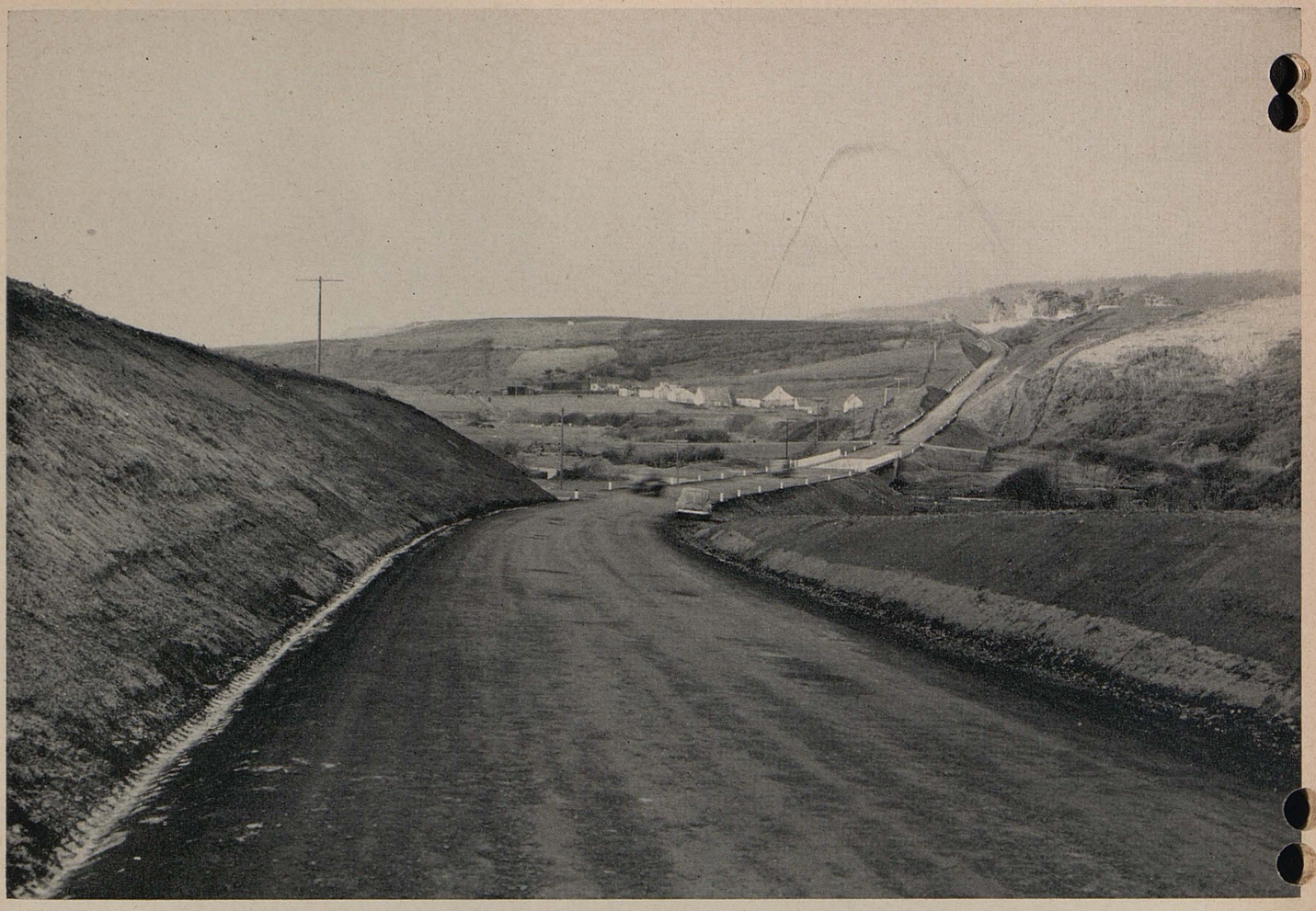


Alder Creek Bridge and approaches. Location of old road can be seen in left background

Replacement of Posted Bridges in District I

By C. P. SWEET, District Construction Engineer

THE TOPOGRAPHY of District I with its many creeks, rivers, and deep precipitous canyons necessitates the use of bridges in highway design to an extent not equaled elsewhere in the State.

A majority of the structures, erected both by the State and counties in early days, were of timber particularly redwood construction and designed to carry the comparatively light loads of that period. Even the few steel bridges erected were of such light design that they cannot support the heavy truck traffic using the highways today.

The posting of many of these bridges for restricted load limits pending their replacement has for many years presented to the district the problems of restrictions to free movement of traffic and high obligation of construction funds.

MANY POSTED BRIDGES

A very fitting example of this condition is on that portion of the Shoreline Highway, State Route I, between the Sonoma County Line and Westport in Mendocino County. This portion of highway originally constructed by Mendocino County and taken into the State Highway System in 1933 included, in 81 miles of roadway, over three miles of bridges, or a total of 82 structures.

Many of the bridges in 1933 were in such weakened condition that immediate posting for restricted load limits was mandatory. Fifty-five of the old structures have since 1933 been replaced or contracts are underway for erection of new bridges or replacement by culverts and fills.

While this large number has been replaced at a cost of approximately $2,500,000, a new bridge across the Noyo River near Fort Bragg, now partially under contract will cost almost a million dollars. The cost of replacing several of the remaining old structures will be in excess of one-half million dollars each, while the Shoreline Highway has presented the most critical bridge problem in the district, other bridge replacement costs have for many years obligated

a large portion of the funds allocated to the district for construction and ill continue, especially on the sec- dary system, to do so for several ars.

BRIDGE REPLACEMENTS

Restrictive controls on highway construction during the war years coupled with a marked increase in heavy truck traffic intensified the critical deficient bridge problem and funds for the first year of the Postwar Highway Program were allocated almost entirely to the replacements of several of the most critical bridges.

Three of these bridge replacement projects on State Highway I at Blue Slide Gulch, Alder Creek, and Slick Rock Creek have been completed or will be completed during 1947 at an estimated cost of $310,000, and will eliminate three posted bridges from the State Highway System. Their construction will also provide about 2.40 miles of graded and surfaced highway in relocated approaches.

BLUE SLIDE PROJECT

The Blue Slide project north of Fort Bragg involved the replacement of a timber bridge posted for a maxi- um loading of 12 tons one vehicle nd 21 tons semi. The new bridge is reinforced concrete slab type struc- re consisting of five 28-foot spans supported on steel piling encased in concrete and is 142 feet and 6 inches in length.

This structure is rather unique in that it does not span a stream or body of water; the purpose for which a bridge is usually built. It does however span a small deep ravine which is the outlet for a mass of moving hillside, appropriately called Blue Slide. This condition precluded the construction of an orthodox embankment.

This contract was constructed by Contractor John Burman & Sons at a cost of $69,000, and was supervised by Resident Engineer D. E. McCollum and N. E. Spicklemire of the Bridge Department.

ALDER CREEK PROJECT

North of Point Arena a dangerously obsolete wooden bridge at Alder Creek was repeatedly threatened by collapse during periods of high water. This was replaced on new alignment y a steel plate girder bridge 124 feet l length with a roadway width between curbs of 26 feet. The relocation upstream from the old structure made a 21 percent decrease in length of road and provides a safe highway at maximum speeds.

This project was constructed by Contractor Guerin Bros., under the supervision of Resident Engineer E. F. Richardson, at a cost of about $202,000.

The grading of the project was complicated by the encountering of numerous springs and water-bearing sand strata at various elevations in all roadway cuts. The control of this subsurface water was mandatory during grading operations, otherwise the material could not be readily excavated nor compacted into embankment. Bench sections designed for slide prevention were therefore extended and used to prevent water from flowing into the excavation below, when temporary ditches were maintained to collect and discharge subsurface water not intercepted by the bench sections.

Subdrainage of the wet roadway cuts below subgrade elevation was provided by a pervious gravel blanket placed on a subgrade sloping toward an underdrain or by underdrains constructed on one or both sides of the cut. Such subsurface drainage soon provided a firm and dry subgrade which when reinforced with a crushed gravel base and a bituminous treated wearing surface gives no indication to the casual motorist of the difficulties experienced by the contractor in obtaining the required result.

SLICK ROCK CREEK

About 5½ miles south of Point Arena the timber bridge at Slick Rock Creek, posted for a loading of 16 tons, was one of the district's top priority postwar replacement projects, as its critical condition prevented the free movement of farm, ocean, and forest products to the Bay Area. This contract involved the construction of two reinforced concrete arch culverts and the grading and surfacing of 1.0 mile of highway on new location at an estimated cost of $130,000. These arch culverts, 27 square feet in waterway area were constructed at Slick Rock and Morrison Creeks and were respectively 225 and 168 feet in length exclusive of wing-walls.

Though work on the contract has been suspended for the winter by Contractor Piombo Bros. and Company, traffic is now routed over the new roadway at Slick Rock Creek thereby eliminating the hazard of a failure of the posted bridge. Work on the contract was under the supervision of Resident Engineer C. C. Buckman, with the contractor being represented by Superintendent Ben R. Dow.

HIGHWAY REALIGNMENT

Relocation and construction of the northerly two miles of State Highway 29 in Lake County between Lakeport and Upper Lake west of the present highway is now underway. Two bridges, one at Scott Creek and the other at Robinson Creek, are necessitated by the relocation and will replace four posted bridges originally constructed by Lake County, over Robinson, Scott, Middle, and Clover Creeks on the existing highway.

The existing steel truss bridges across Scott and Middle Creeks were built by Lake County in 1906 and 1911, respectively, and were adequate for that period. Their light steel members, restricted widths and heights are not, however, adequate for present day traffic and both bridges are posted for one-way traffic with loads being restricted to eight tons at Scott Creek and six tons at Middle Creek. The existing bridges over Robinson and Clover Creeks are deck type structures. One is posted for one-way traffic and the other for a 16-ton load limit.

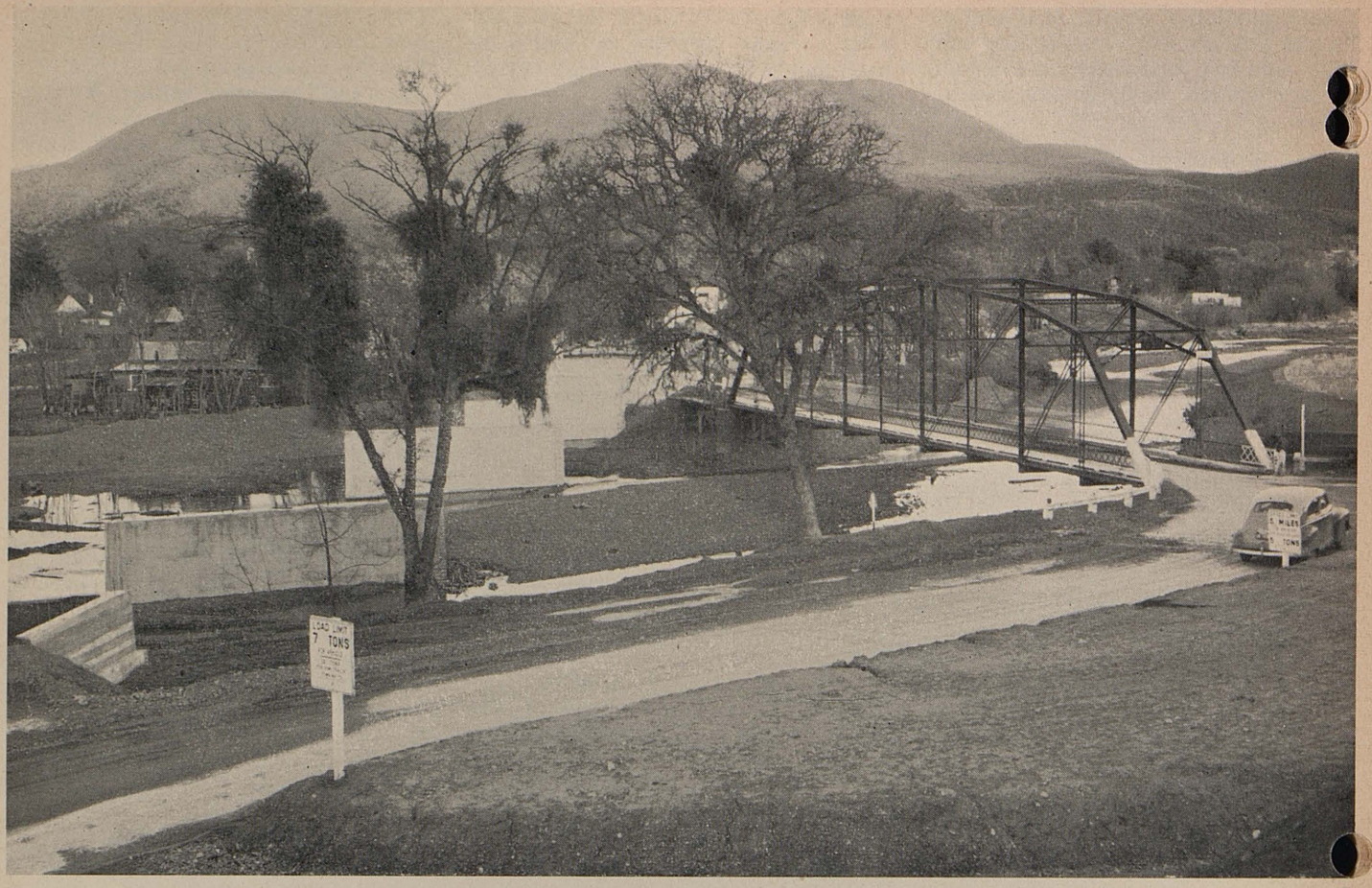
These four posted bridges constitute a definite hindrance to the movement by truck of agricultural products from the rich farming and fruit growing areas of Lake County to world markets and their replacement should provide an added stimulant to the economic life of the county.

DETOURS TEMPORARY

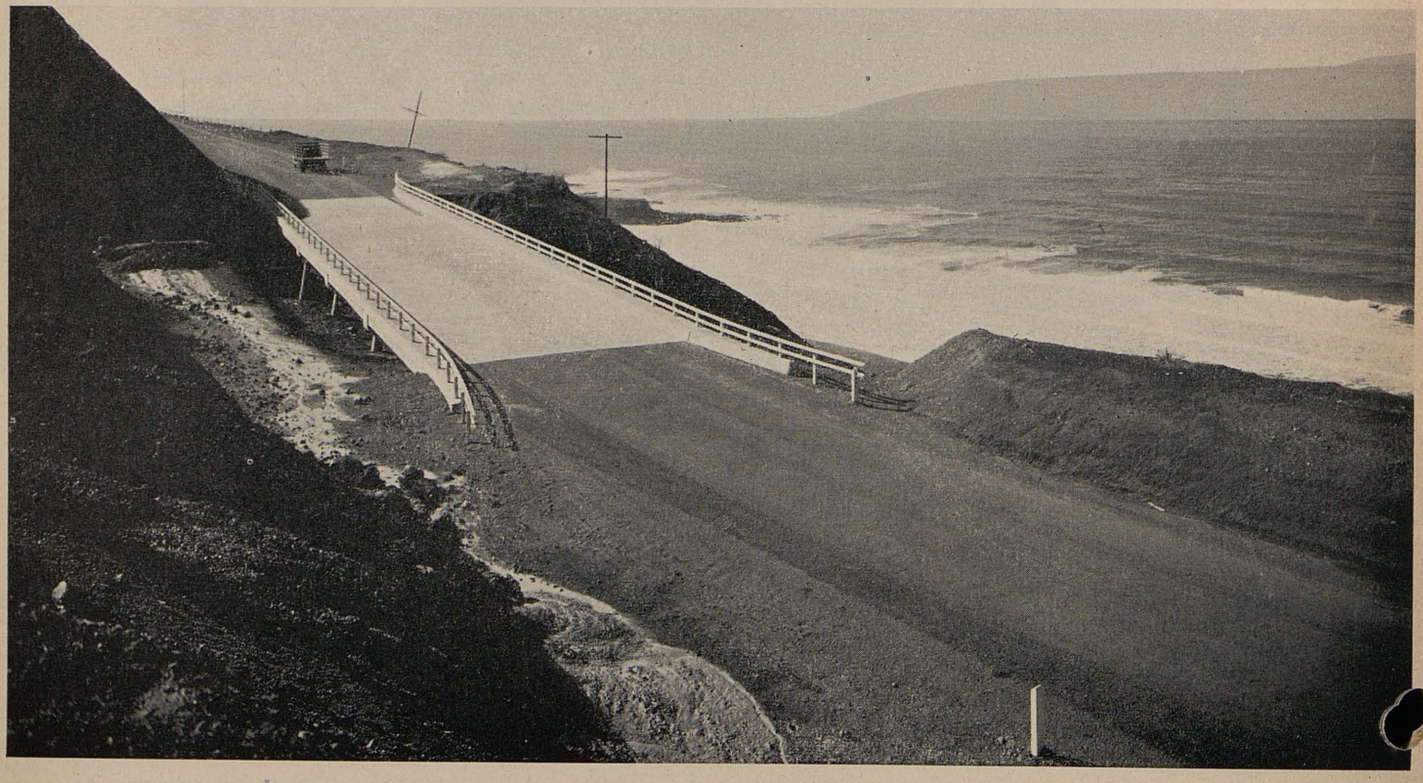
During the summer season state maintenance forces have annually constructed detours across Scott and Middle Creeks thereby saving trucking interests several miles of detouring over other roads to reach Lakeport. These detours, of necessity, are removed each fall and are therefore only a temporary expedient to relieve the situation caused by inadequate bridges.

Three major streams, Scott, Middle and Clover Creeks drain the mountainous northwesterly section of Lake County. Before reaching a confluence near Upper Lake they flow through

(Continued on page 35)



Upper—On left of existing posted span are shown piers for a new bridge at Kelseyville. Lower—New Blue Slide Bridge, Mendocino Cou



Bay Area Metropolitan Traffic Survey

THE PUBLIC Roads Administration, the Division of Highways and cities on San Francisco Bay are cooperating in a comprehensive traffic survey. The areas included in this study consist of San Francisco, Daly City, and the East Bay Territory from San Pablo to South San Leandro.

The purpose of the study is to present sound data that will permit thoroughgoing analysis of the traffic movement within the area (pedestrian traffic excepted).

A designer confronted with laying out an urban traffic facility must know the traffic that is flowing along the general line of a proposed improvement. In addition he must estimate how much will be attracted from parallel routes, and where and in what numbers vehicles on the proposed line will come into conflict with cross-traffic. In the case of freeways where the channelization of traffic is emphasized, access being permitted only at certain designated points, these problems are intensified. They are not the only traffic questions bothering the designer, for he must also be concerned with the entirely new traffic that will come into existence as a result of the improvement and with what may be termed the natural growth of traffic. These are matters upon which he has frequently been faced with an undesirable amount of speculation. Adequate enough in rural areas and on the outskirts of cities, the methods heretofore used in estimating traffic have shortcomings which become increasingly pronounced as the great cities are penetrated more deeply.

When M. R. Nickerson, Public Works Department Photographer, was taking the pictures which accompany this article, the inquisitive little dog shown in this photograph injected himself into the picture unbeknown to the cameraman and the traffic checker

ORIGIN AND DESTINATION

Although they show total use of a street, traffic counts may fail to show that the street is loaded to capacity, and that traffic has been forced to use parallel streets and to travel a circuitous course. Origin and destination studies have been used for many years on rural highways to gauge the effect of proposed improvements, particularly where a choice of routes existed. Except in special cases this method is inapplicable within cities.

During the past few years remarkable progress has been made in the improvement of city traffic studies. The method of the Bay Area Metropolitan Traffic Survey was developed by the Public Roads Administration in cooperation with the Bureau of the Census. It has been, or is being used in approximately 50 large cities. Simply stated, the method consists of interviewing a representative sample of people in their homes concerning their travel on the preceding day. Such a study through which the traffic generated by the residents of an area is determined, is referred to as an "Internal Survey."

Though the sampling idea which is the basis for the internal survey is simple, great care is necessary in putting it into practice. Every twentieth dwelling unit is selected, be it house, apartment, or hotel room. The selection is made either from a study of Sanborn maps or from field inspection in the areas not covered by maps. The residents of these dwellings are then interviewed and their travel for the preceding day is recorded from one street address to another. The mode of travel, whether as an auto driver, auto passenger or street car passenger, is noted. Other notes show the approximate time of starting and arrival and whether the trip was to work, for shopping, etc. In the case of an auto driver, the kind of parking is also obtained.

While recollection serves adequately for the home interviews, it cannot be relied upon for the trips made by trucks and taxis, many of which make as many as 50 trips daily. In such cases the sampling procedure is modified. The interviewer is furnished with the registration numbers of specific vehicles and required to contact the drivers through the owners. The proportion of trucks contacted is also increased to one in seven trucks. In many cases truck owners maintain accurate records of truck trips and these are utilized. Where no records are available, drivers are asked to maintain a simple log of their travel on the following day.

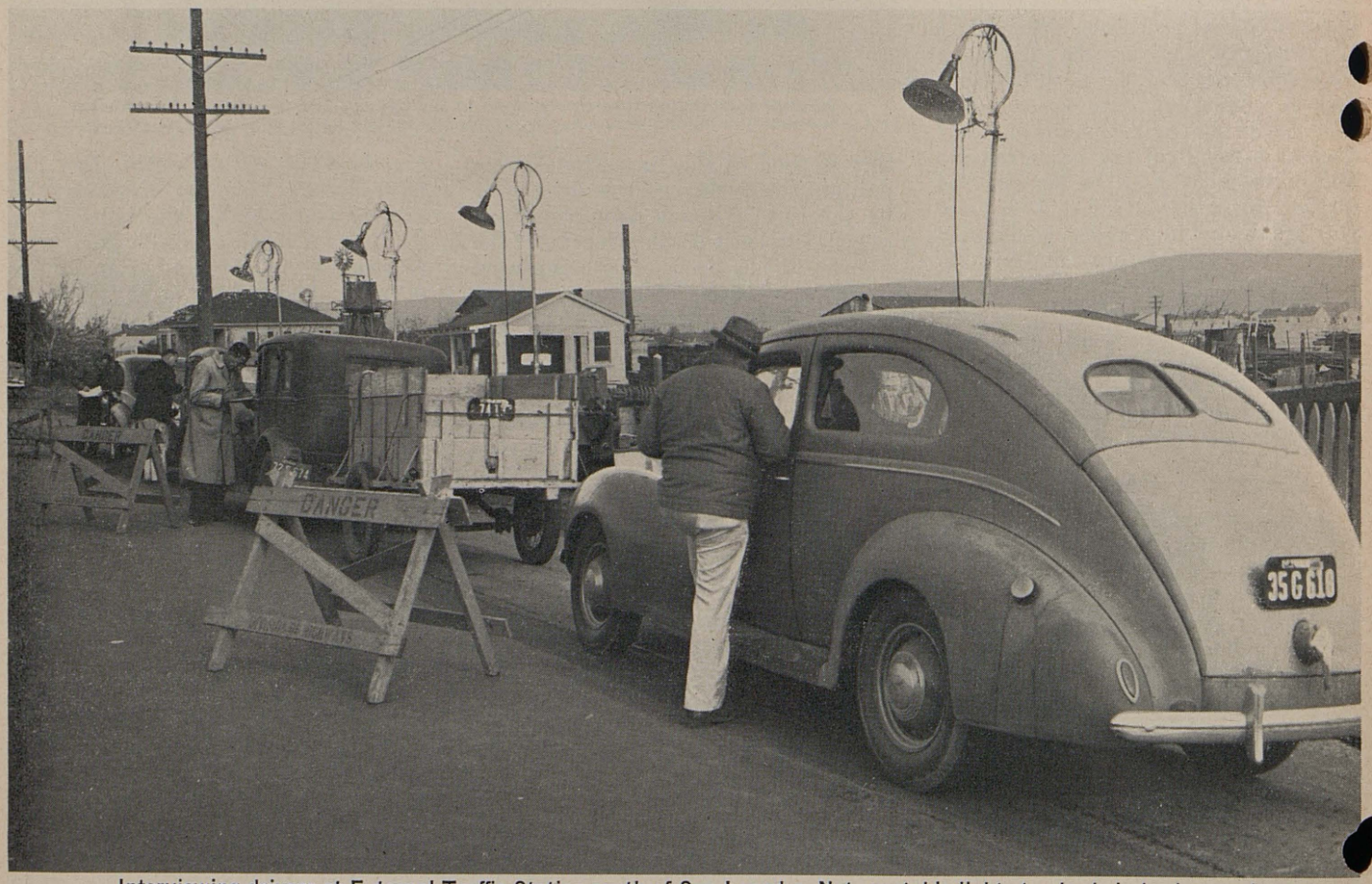
STUDY NEARING COMPLETION

The interviews at the 26,000 dwelling units in the Bay area are 71 percent complete and will be finished in

Truck drivers being interviewed on Washington Avenue near the south city limits of San Leandro on State Route 69, Alameda County

April. It appears now that the average number of trips per dwelling unit will approximate 5. The time required to complete an interview for a dwelling, including time spent in travel and in making more than one visit where necessary, is slightly less than one hour. The response from the public has been good, as is attested

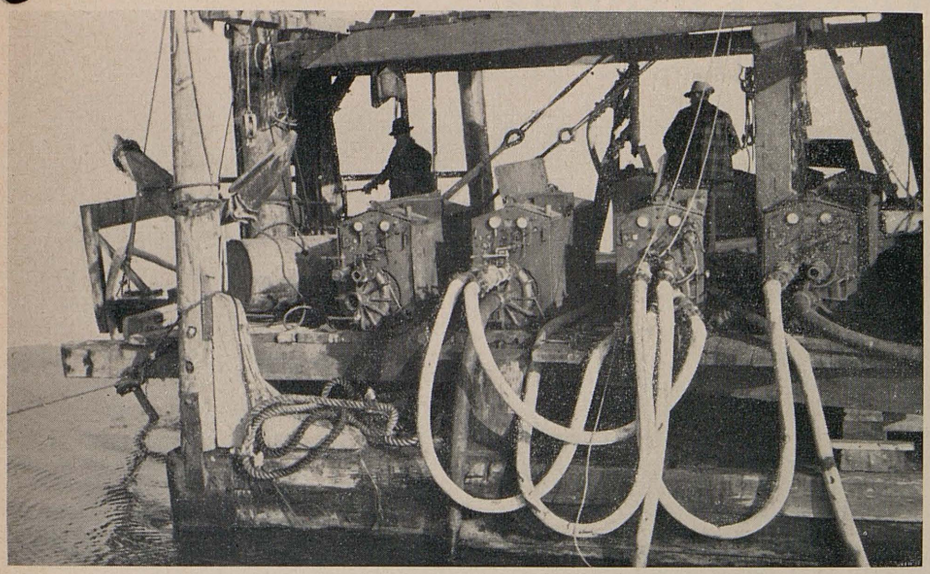
(Continued on page 36)



Interviewing drivers at External Traffic Station south of San Leandro. Note portable light standards in background

Foundation Exploration in San Francisco Bay

(Continued from page 11)



Pumps used to develop high water pressure for jetting

METHOD OF OPERATION

Samples usually were obtained by removing the goose neck from the top of the jetpipe. The sampler and tip were lowered inside of the jet pipe by means of three-fourth inch cable on one of the deck engine drums. Cable on the drum was allowed to run free, giving considerable momentum to the sampler and allowing the tip to penetrate any subsurface material except the hardest rock. If samples were desired at intermediate points before the full length section of pipe had been jetted its entire length, the sampler cap was removed from the top of the gooseneck and the same procedure was followed. The samples were classified, immediately sealed in half-pint fruit jars, and are now on file in the Public Works Building in Sacramento. Elevations of changes of subsurface strata were determined by reactions of jet, i.e., by changes in speed and force of descent, by changes in jet line pressure gauge readings, by feel of the pipe as it jounced, and by the ring of the pipe when on extremely hard strata. A total of 143 samples were obtained from the 40 jet borings.

DIFFICLTIES ENCOUNTERED

Many difficulties were encountered during the progress of the preliminary foundation investigation which handicapped progress, but did not cause serious set-backs.

Due to the narrowness of the barge in relation to the height of the leads, winds of any particular magnitude created the most serious difficulties encountered during the jetting operations. This was particularly true if the wind caught the barge broadside. This width to height ratio created a strong rocking motion which was magnified at any height on the leads and made the addition of jet pipe difficult. South east winds of gale intensity accounted for four days lost time and predictions of high winds which failed to materialize accounted for two lost days.

Next in severity to the wind but for short duration were broadside swells caused by passing ships and ferry boats. The side wheel ferries created the largest swells.

Heavy fogs added to the difficulty of locating the barge by obscuring the landmarks and accounted for six lost days. On several foggy days it was possible to work at a location close enough to shore or the existing Bay Bridge to be able to begin work without the necessity of sights. After the fog cleared bearings were taken and the exact position plotted.

Due to the various maritime strikes at the time of the jet boring operations, numerous ships were riding at anchorages in the Bay. Consequently, it was necessary in some instances to move the location of a boring in order to clear the sweep of a ship as it turned at anchor with the wind or tide.

The presence of submarine cables caused delay and loss of time in anchoring and spotting the barge but otherwise created no serious difficulties.

The results of the borings together with other pertinent considerations and investigations are being assembled in a special report to be submitted to the California Toll Bridge Authority.

Facts About Second Bridge Over S. F. Bay

(Continued from page 5)

Q. Are these methods satisfactory?

A. The Southern Pacific would gain no advantage for the bulk of its traffic through a crossing farther north than its present one. The other two railroads might save a little in operating costs by operating over tracks but not nearly enough to justify the investment required. The present ferries having handled the war traffic are ample for normal business.

Q. How are passengers from the trains taken across the bay now?

A. Southern and Western Pacific passengers are transported by ferry, Santa Fe passengers by bus across the Bay Bridge.

Q. Can any savings in time be gained by transporting passengers over a bridge via Hunter Point?

A. The time required to reach a terminal at Townsend Street would be longer than now required to cross the bay and the location of this terminal is more remote from the center of traffic than either the Ferry Building or the bus station at Fourth and Mission Streets.

Twelve Miles of U. S. 40 Converted To Four-Lane Divided Highway

By M. C. FOSGATE, District Construction Engineer

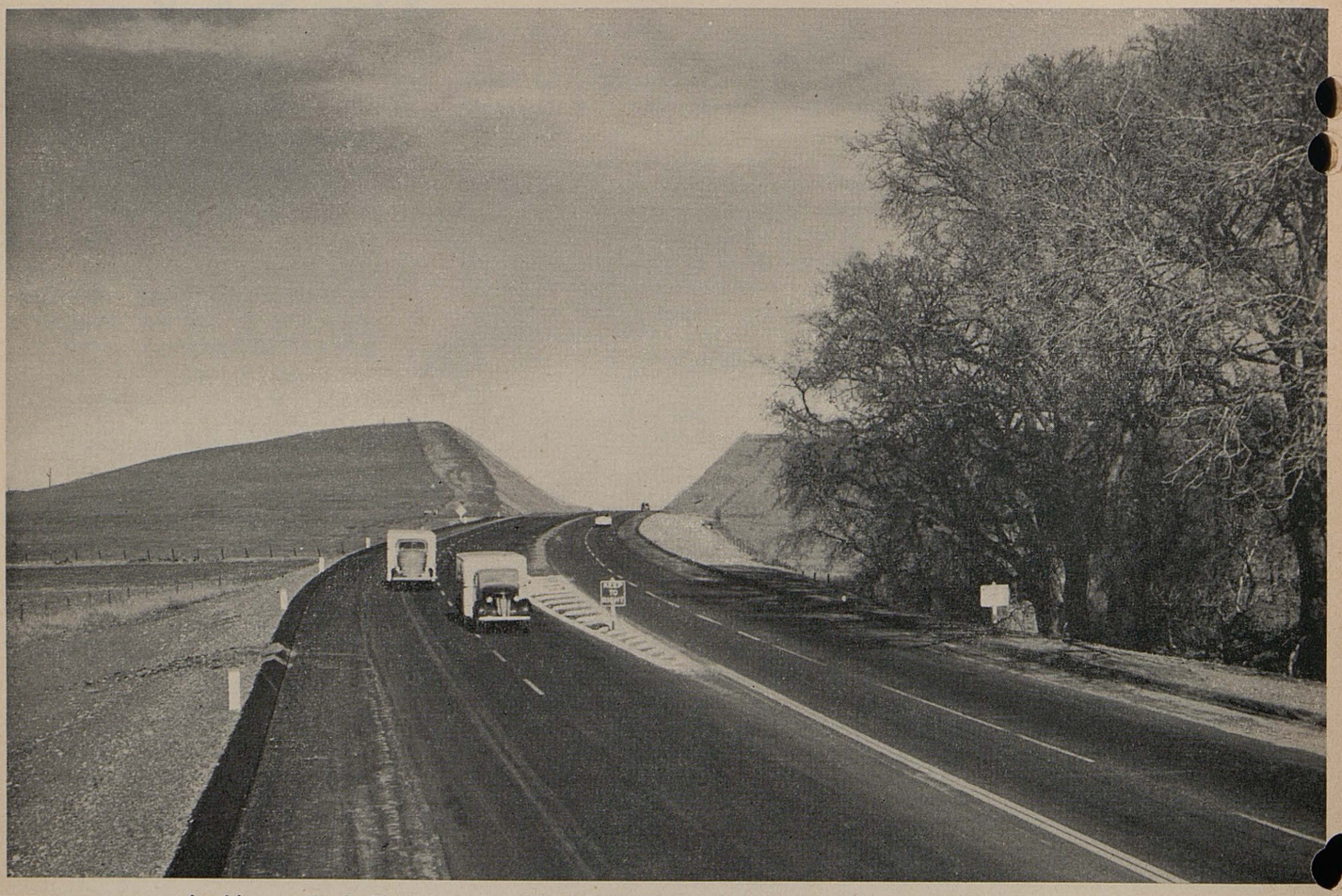
THE FIRST two postwar projects to be completed in District X were opened to traffic at 4.00 p.m. January 27, 1947.

These two projects are adjacent and have a combined length of 12.15 miles and extend from Vacaville to 1.3 miles north of Dixon on U. S. 40. The first project which is 6.02 miles in length extends from Vacaville, northerly, to Midway, and provided for the construction of two lanes of Portland cement concrete pavement having a total width of 23 feet which parallels the existing highway making this section a four-lane divided highway, with the new pavement on the easterly side of the existing highway.

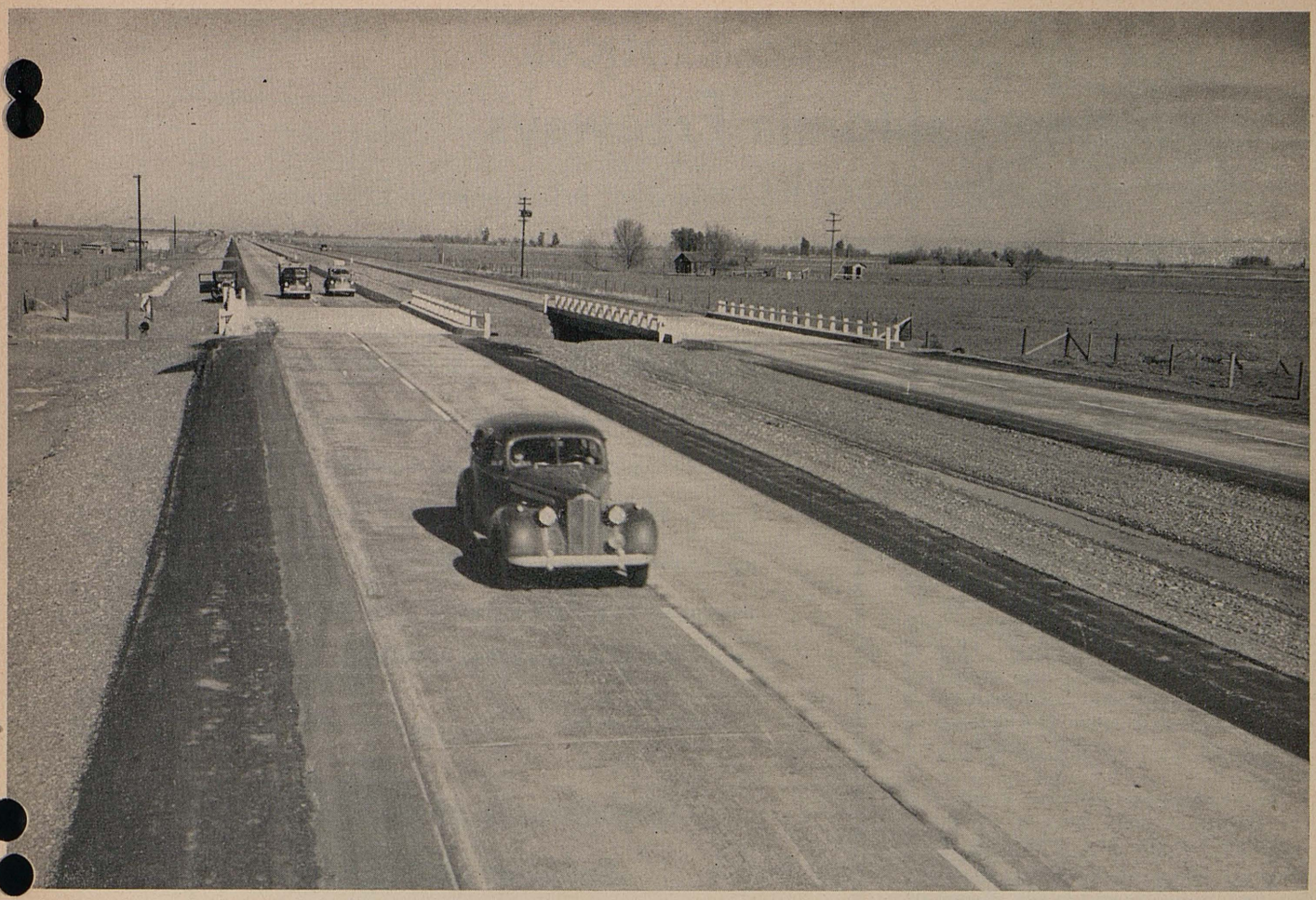
The second project which extends from Midway to 1.3 miles north of Dixon is located on new alignment, and therefore it was necessary to construct four lanes of pavement to complete the divided highway.

The new work consisted of Portland cement concrete pavement throughout placed on a gravel base. The lanes are separated by a uniform dividing strip 36 feet wide from Midway to 1.3 miles north of Dixon. The section from Vacaville to Midway has a varying width of dividing strip caused by natural barriers. This dividing strip has a 12-foot width on the south end where the construction is located through a large cut, and attains its greatest width, which is 136 feet, where Horse Creek and Gibson Canyon Creek are carried for some distance between the two lanes. These channels required some straightening and rip-rap protection where they were turned to cross the highway under two new bridges.

The design of the concrete pavement on these projects was a departure from the Standard concrete construction which had been employed in California for many years. Prior to this time, the standard design of concrete pavement had thickened edges at each side of each lane and expansion joints placed at varying distances, the average of which would probably be 75 feet.



Looking northerly from the point of starting of the new four-lane divided highway near Vacaville



This photograph was taken north of Midway looking toward Dixon and shows bridge units of project

Between these expansion joints, contraction joints were constructed at intervals of 15 feet or 20 feet; these intervals varying under different native climatic conditions. These contraction joints were constructed by inserting a mental strip transversely in the concrete while it was fresh. These metal strips were $\frac{1}{4}$ inch x $1\frac{1}{2}$ inches in cross-section and slightly beveled and extended the full width of the pavement lane. When the concrete became partially set, the strips were removed, the resulting space left open and the edges tooled. This caused a weakened plane to be established at this location so that when the concrete contracted, the crack would be carried down to the subgrade along this weakened plane. This method of construction controls cracking and facilitates the maintenance of the pavement by making it possible for the maintenance crews to readily fill these openings with asphalt and thereby eliminate water from rainfall from entering into the subgrade.

The design of the pavement on these projects was an an 8-inch slab without thickened edges, and with contraction joints placed at intervals of 15 feet throughout. There were no expansion joints placed in this pavement, the pavement thereby becoming a continuous slab throughout by the placing of tie bolt assemblies whenever the placing of concrete in the pavement was stopped for any reason whatsoever. This concrete was placed in two adjacent lanes, the driving lane being 11 feet wide and the passing lane 12 feet wide. These two slabs were tied together by tie bolt assemblies. These bolts are $\frac{5}{8}$ inch in diameter and extend into each slab for a 15-inch distance. The bolts are placed 30 inches apart. This eliminated the tendency of the slabs separating at the joints. In addition to this, a tongue and groove joint is provided between the slabs. This joint is a protection against the possibility of one slab raising above the other at the joint.

Further design features on this project are 2-foot plant-mix borders adjacent to the passing lane and 3-foot plant-mix borders adjacent to the driving lane. The shoulders on the passing lane are 5 feet in total width, and on the driving lane 8 feet in total width. The area outside of the plant-mix borders has received a penetration oil treatment.

Crossovers are placed at strategic points and at intersecting county roads. At the county roads, most of which intersected the highway at quite severe angles, these intersections were redesigned so that the traffic would meet the highway at right angles. Curbs, and in some places, traffic bars have been placed, in order to control the crossing movements.

As these projects are both limited freeways, all entrances to this highway are controlled. The rights of egress and ingress are limited to designated openings, and no other approaches than at these locations are permitted. Places of business, such as service stations and at roadside eating places, curbs are

(Continued on page 39)

Erection of Signs and Notices Designating California Freeways

By H. L. COOPER, Assistant Maintenance Engineer

FOR MANY years, the only available means of controlling the use and development of lands abutting State highways in California was through the enactment of zoning and setback ordinances by the city and county officials within whose respective territories the state highway was located.

As the volume of traffic using the state highways continued to increase year by year, it became evident to state highway officials that measures would have to be taken to protect the large investment which the State had in these roads in order to insure their integrity and serviceability. It was apparent that this could only be accomplished through some legal control of the right of way which would make it possible to regulate the movement of traffic.

In recognition of this need, the Legislature in 1939 enacted the Freeway Law, which placed California in the small group of states first to apply the principle of controlled access to highways. This law, as set forth in Section 23.5 of the Streets and Highways Code, defined a freeway as "a highway in respect to which the owners of abutting lands have no rights or easement of access to or from their abutting lands or in respect to which such owners have only limited or restricted right or easement of access." It authorized the department to designate certain routes as freeways, to acquire the necessary rights of way and rights of access from private property, and to construct and maintain such freeways.

Illustration A

FREEWAY

ACCESS RIGHTS RESTRICTED ON THIS SECTION OF HIGHWAY

INFORMATION AS TO ENTRANCES AVAILABLE MAY BE HAD AT DISTRICT OFFICE

(ADDRESS TO BE INSERTED HERE)

DEPT. OF PUBLIC WORKS — DIV. OF HIGHWAYS

PUBLIC NOTICE is given that this lot has been acquired for the construction of a freeway. This means that lots adjacent to such freeway will not have rights of ingress or egress therein. The purpose of this notice is to advise the public that purchasers of adjacent properties will not be able to develop the same as ordinary highway frontage since direct passage across the right of way boundaries will be prohibited.

Department of Public Works
Division of Highways

Illustration B

Since the enactment of the Freeway Law, the California Highway Commission has adopted resolutions declaring 714 miles of the State Highway Systems freeways as of January 1, 1947. Of these, 175 miles have been constructed.

The application of the freeway principle to the utility services and owners or purchasers of abutting property has posed many new problems for the division. The utilities in particular were not inclined to relinquish the privileged locations they normally enjoyed within highway rights of way. The policy governing encroachments affecting this group was adopted by the division only after numerous and extended hearings wherein representatives of both the private and public utilities were afforded ample opportunity to discuss and present their views.

While the division realized the importance of likewise defining the limitations of access applying to property abutting freeways, it also appreciated the practical difficulties of accomplishing this purpose in the face of changing ownership and property development. It was finally decided to define this status through the medium of special signs and, further, to mark the definite limits of such access with concrete monuments.

Following is a brief description of each type of marker, their design, and the conditions governing their placement:

On freeways in rural areas, signs similar to **Illustration A** will be placed facing the highway at one-quarter mile intervals along the abutting property adjacent and parallel to the right of way line. Similar treatment will be

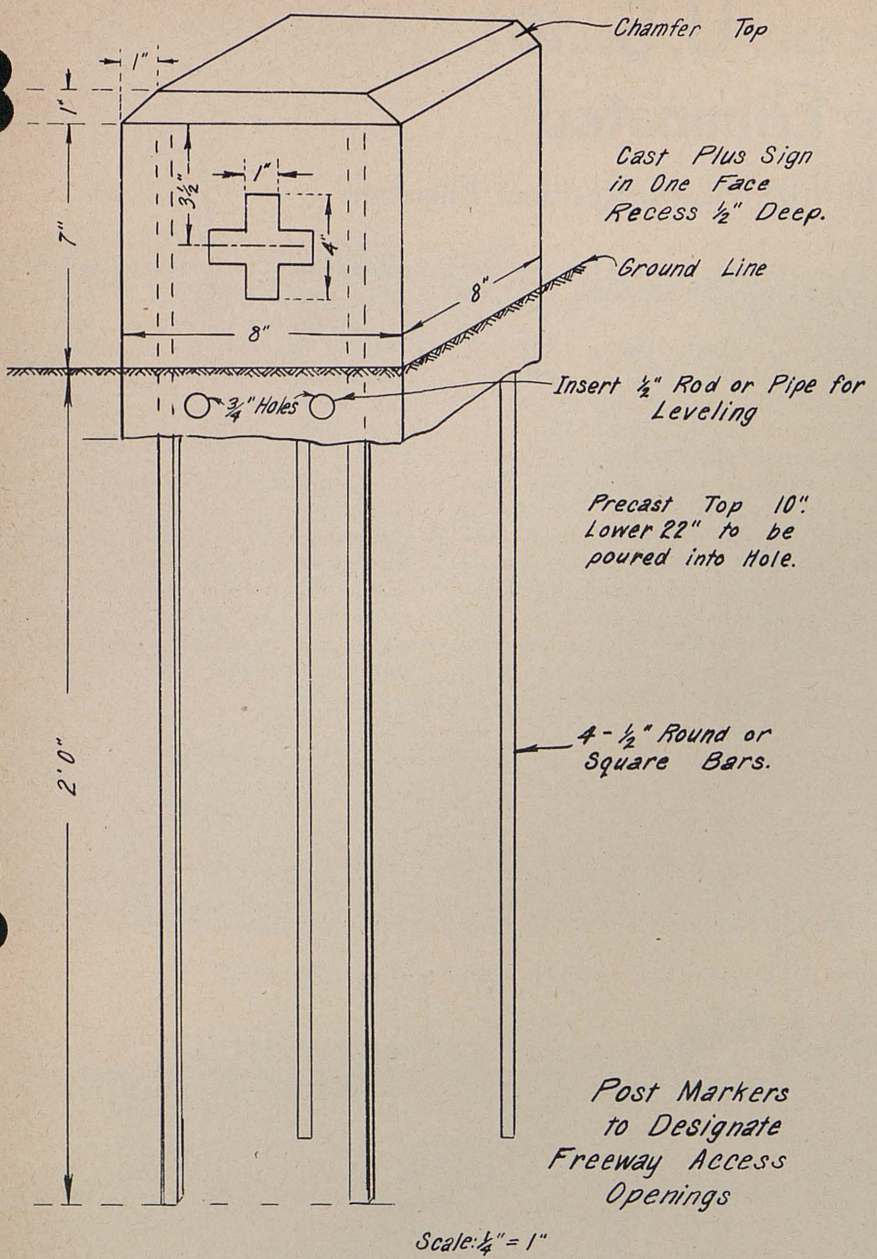


Illustration C

accorded freeways in urban areas where the right of way is not fenced.

A special sign made of 10-inch x 12-inch cloth mounted on wood and supported by 2-inch x 2-inch x 4-foot wooden posts similar to **Illustration B** will be used at locations where the acquisition of right of way has taken one tier of lots of the abutting frontage and the right of way line is along the lot line of the next tier of the adjoining parcel of property. This type of sign will be installed adjacent to the right of way line and in front of each lot of such abutting parcel.

On freeways where the abutting property has a limited access right, the outer boundaries of such access openings will be marked by concrete monuments similar in design to **Illustration C.** These marker posts will be located within the highway right of way immediately adjacent to the right of way line at the outside limits of the access opening, with a plus (+) sign on the monument facing the space included in the permitted access opening. Where access openings on adjoining properties are contiguous, but one monument will be set on each property marking the outer limits of the respective openings.

This system of signing should serve to acquaint the public as to the highway's freeway status and avoid any misunderstanding of the access rights vested in such abutting property. The concrete marker posts will also prove a ready aid to our maintenance men in observing conformance with the permitted access openings.

In Memoriam

Francis G. Somner

Francis G. Somner, one of the first district engineers of the Division of Highways, passed away on February 5, 1947.

Mr. Somner was born in Dunedin, New Zealand, on August 10, 1863. His father, a building contractor brought his family to California when the son was 10 years old, and settled in Plumas County. Mr. Somner attended school in Quincy, and took an engineering course at the University of California. He was a classmate in 1888 of Governor Hiram Johnson. Returning to Quincy, Mr. Somner married Mary Cate, a native daughter. He was County Surveyor of Plumas County in the early nineties. He was roadmaster for the Southern Pacific, Shasta Line from 1895 to 1905. Afterwards he was Chief Engineer of the Diamond Match Company at Chico.

On January 1, 1912, he began his highway service under the first State Highway Engineer, A. B. Fletcher, in charge of Division L (now district), with headquarters at Willits. Mr. Somner had charge of locating and constructing the state highway through the Redwood Empire from Cloverdale north to the Oregon line. During the early days of reconnaisance in the primeval forest, the activities were largely carried on by foot, horseback, mudsled and oxteam. In 1923 Mr. Somner was transferred to Bishop, in charge of Highway District IX, where he built roads from Mojave East of the Sierra to the Nevada line. He blazed a trail through forest, mountain and desert that may well be appreciated in the development of California.

Mr. Somner was a life member of the Masonic Lodge at Red Bluff. He retired from state service in June, 1932, and has been living ever since in San Francisco. He is survived by his widow, Mary, a daughter, Mrs. E. Y. Himmilwright of San Francisco, a daughter, Mrs. Philip Piltz of Stockton, and a son, Frank, of Los Angeles.

The oldtimers of the "Highway" will long remember Mr. Somner for his outstanding work, and his genial acceptance of jokes and incidents on himself that helped to smoothen the rough profile of the "Roadway of Life."

Serious Bottleneck on U. S. 101 South of Salinas Is Eliminated

By G. H. HAMLIN, Resident Engineer

THE RECENTLY completed four-lane section of U. S. 101, State Route 2, extending two miles south from the south city limits of Salinas has eliminated a serious bottleneck on the Coast Route.

As originally planned, the contract was to have been let in 1942, but outbreak of the war forced a change in these plans, so the work was held over and made one of the first postwar projects.

The enormous production of lettuce and vegetables in the Salinas area is reflected in a very heavy produce truck movement, the peak of this traffic occurring during the summer months when tourist traffic is at its height.

Some idea of the traffic volume of the section of U. S. 101 immediately south of Salinas can be gained by reference to the July, 1946, traffic count, which shows a 16-hour total of 11,291 vehicles, with an hourly peak of 1,051 vehicles. The problem is further aggravated by an intense development of packing sheds and other industrial establishments in the area, creating a considerable volume of intersecting traffic, especially severe at the beginning and ending of work shifts. An additional hazard is the grade crossing of the Southern Pacific's Spreckels branch line, over which a considerable number of slow speed train movements are made each day.

CONGESTION RELIEVED

The relief of these congested conditions was brought about by the construction of a divided, four-lane highway providing two lanes of 12-foot and 11-foot width on each side of the concrete curbs of the central dividing strip, and providing eight-foot wide shoulders on both outer edges.

Widening of division strip at county road intersection

Curved division strip with acceleration lane provided for future county road intersection

The existing 20-foot asphalt concrete pavement was utilized as a base for new surfacing through the greater part of the job. Insofar as was practical, this pavement was used to carry traffic through the job while work on the new lanes was in progress, thus creating the least possible delay and inconvenience to the public.

Roadway excavation was a relatively minor item and consisted mainly of excavating along the edges of the existing asphalt concrete pavement and under the new roadway section to provide sufficient depth for the imported borrow. The limited area to be excavated, the excess of excavation over embankment, and the necessity for keeping traffic interference to a minimum, made it necessary to handle practically all excavation with a dragline and trucks.

TRAFFIC NOT INCONVENIENCED

The use of the familiar tractors and scrapers was limited to the minor roles of removing topsoil and balancing out small quantities of material within the excavated sections. Excavation, as with other items of the work, was accomplished with a minimum of inconvenience to the traffic entering or leaving the numerous commercial establishments and intersecting roads along the route.

Due to low terrain and poor bearing ratio of soils, the area under traffic lanes and shoulders was covered with a minimum of one foot of imported borrow. As planned, traffic lanes consisted of seven inches of cement treated base surfaced with three inches of asphalt concrete, and shoulders were surfaced with plant-mixed surfacing over the imported borrow. Because of excessive ravelling of the cement treated base under heavy traffic prior to surfacing, it was necessary to modify the plans slightly and cover the cement treated base with a one-half-inch blanket of plant-mixed surfacing. This expedient eliminated all ravelling and provided an excellent base for laying asphaltic concrete.

CEMENT TREATED BASE

Cement treated base was produced by the contractor on the job through a commercial concrete batching plant equipped with a pug mill. The excellent control of materials through this plant in conjunction with its location at the midpoint of the job provided a very minimum of hauling time, permitting ample leeway for spreading and compacting the material within the specified time limit.

Both plant-mixed surfacing and asphalt concrete were mixed at Central Supply Company's Aromas plant and hauled to the job in covered trucks, a distance of 20 miles. Just prior to the commencement of paving operations, the contractor purchased a new Barber-Greene paver which was utilized in paving operations for both leveling and surface courses, except the thin protective layer of plant-

mixed surfacing over the cement treated base. The machine was also successfully used in laying road approaches with returns as sharp as 20-foot radius.

GRADE CONTROLS

One of the major difficulties encountered in paving was that of establishing and maintaining grade controls at the centers and outer edges of the traffic lanes. Grade at inner edges was established by the curbs and gutters, and provided control at this point only so prior to the start of cement treated base, a device was worked out to make use of this one control point. This consisted of a 12-foot straight edge to which an ordinary carpenter's level was fastened, pivoted at one end, and adjustable at the other by means of a bolt and wing nut under spring tension. The movable end of the level was provided with an indicator which was calibrated accurately for slopes to the nearest one-fourth of 1 percent. The required slope was set on this device for any given station and the grade carried outward from the gutter to the required width. This device was in continuous use on cement treated base, plant-mixed surfacing, and asphalt concrete, and proved sufficiently accurate to control grades within the allowable tolerances.

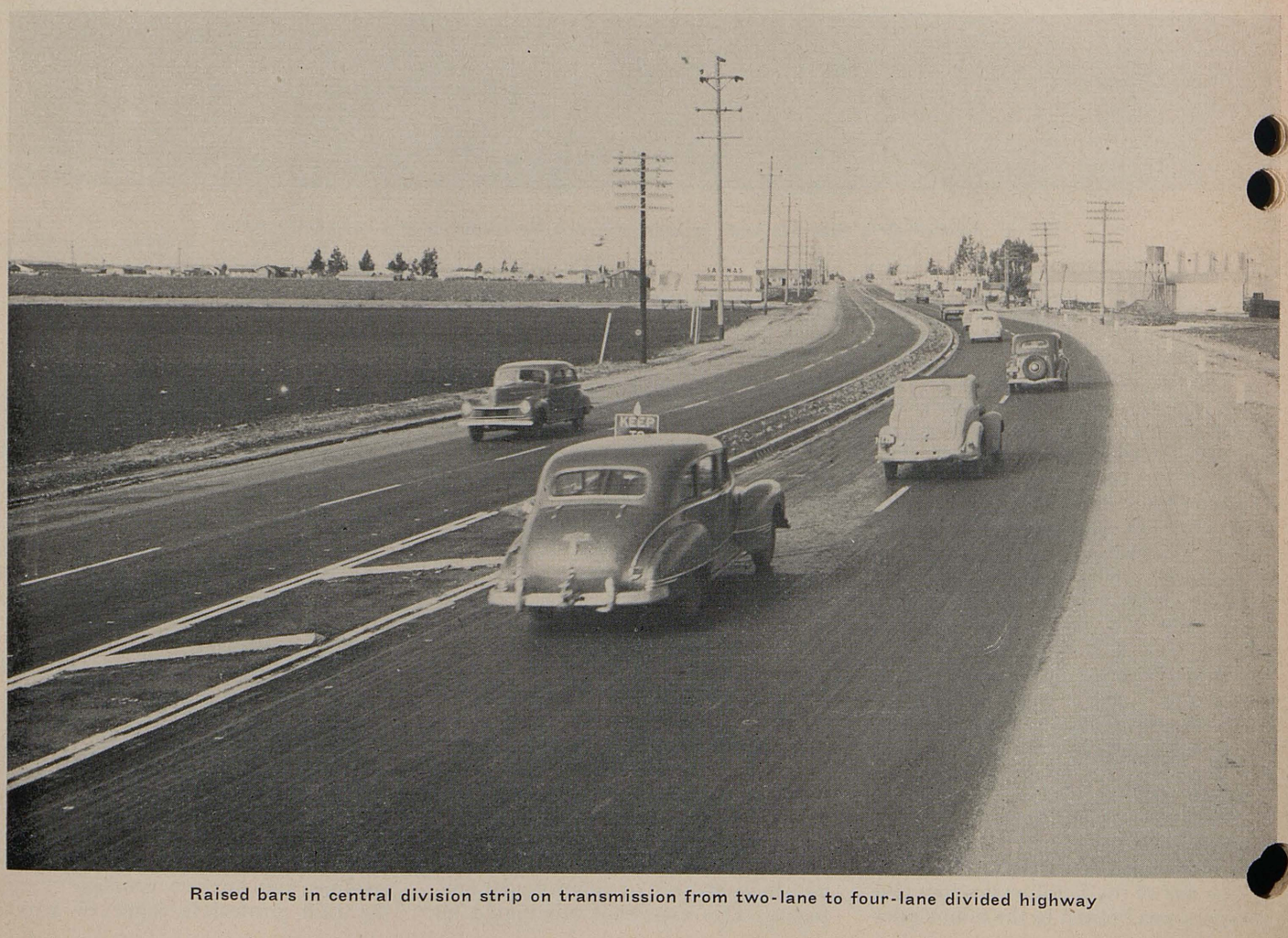
MAJOR CONTRACT ITEMS

Major contract items involve the following quantities:

Roadway excavation		29,500 cu. yd.
Imported borrow		24,000 cu. yd.
Plant-mix surfacing		5,600 tons
Cement treated base	aggregate	13,500 tons
	cement	4,300 bbls.
Asphalt concrete		7,350 tons
Portland cement concrete (curbs and gutters)		590 cu. yd.

The completion of the project has resulted in a marked improvement in the flow of traffic through the area. The channelization and control of traffic by separation of opposing lanes, and the control of intersecting traffic through the strategic location of dividing strip openings, has materially reduced delay and hazard to traffic. Improvement has also been effected at the grade crossing of the Southern Pacific's Spreckels branch, reducing the distance to which traffic piles up when stopped by train movements.

The improvement was let as one contract to Granite Construction Company of Watsonville, and the total cost was approximately $210,000. The contractor's forces were under the supervision of Superintendent William E. Cowan. Resident engineers for the State were L. L. Funk and G. H. Hamlin, Mr. C. E. Waite, District Construction Engineer and Mr. L. H. Gibson, District Engineer.



Raised bars in central division strip on transmission from two-lane to four-lane divided highway

Highway Bids and Contract Awards for December, 1946 and January, 1947

December 1946

ALAMEDA COUNTY—At Fruitvale Avenue, in the City of Oakland, the substructure for an overhead structure over the tracks of the Southern Pacific Railroad to be constructed, and a portion of outer highway to be constructed. District IV, Route 69. Fredrickson and Watson Construction Co. and Lew Jones Construction Co., Oakland, $390,641; Johnson Western Company, Alameda, $398,-296; Dan Caputo and Edward Keeble, San Jose, $427,799; Guy F. Atkinson Co., South San Francisco, $436,767; M & K Corp., San Francisco, $439,650; A. Soda & Son, Oakland, $500,596. Contract awarded to S. J. Amoroso Construction Co., San Francisco, $387,032.

ALAMEDA COUNTY—On East 14th Street between Plaza Drive and 158th Avenue, a reinforced concrete box culvert to be constructed. District IV, Route 105, Section B. J. R. Armstrong, El Cerrito, $10,883; Evans Construction Co., Berkeley, $11,366; Gallagher & Burk, Oakland, $11,828; Willis F. Lynn, Berkeley, $11,930; Kiss Crane Co., San Pablo, $11,990; McGuire & Hester, Oakland, $12,916; R. N. Murdock, Oakland, $13,-010; N. M. Ball Sons, Berkeley, $13,843. Contract awarded to Wheeler Construction Co., Oakland, $10,506.

KERN AND TULARE COUNTIES—Between Poso Creek and Ducor, about 18.3 miles to be graded, imported borrow placed and bituminous surface treatment applied. District VI, Route 129, Sections AB,A. Westbrook and Pope, Sacramento, $298,176; N. M. Ball Sons, Berkeley, $298,775; Geo. E. France, Visalia, $305,572; Clyde W. Wood, Inc., North Hollywood, $309,026; Fredrickson & Watson Construction Co., Oakland, $312,985; George von KleinSmid, Bakersfield, $329,867; Guy F. Atkinson Co., South San Francisco, $339,891; J. E. Haddock, Ltd., Pasadena, $354,074; Griffith Co., Los Angeles, $356,854; Rexroth & Rexroth, Bakersfield, $359,917; Ted F. Baun, Fresno, $375,935; M.J.B. Construction Co., Stockton, $384,354; John M. Ferry, Glendale, $387,197; Heuser & Garnett, Glendale, $393,318; A. R. McEwen & C. M. Syar, Willits, $402,608; Arthur A. Johnson, Laguna Beach, $409,952; Dimmitt & Taylor, Los Angeles, $571,442. Contract awarded to Rand Construction Co., Bakersfield, $297,975.

KERN COUNTY—Between Keene and Tehachapi, one concrete bridge and subtsructures for four bridges are to be constructed and about 10.2 miles to be graded and bituminous surface treatment. District VI, Route 58. Sections E., F., Thpi, N. M. Ball Sons, Berkeley, $1,173,519; Winston Bros. Co., Los Angeles, $1,212,284; Bressi & Bevanda Constructors, Inc., Los Angeles, $1,239,881; Morrison-Knudsen Company, Inc., Los Angeles, $1,295,889; A. Teichert & Son, Inc., Sacramento, $1,299,277; Clyde W. Wood, Inc., North Hollywood, $1,368,678; Vinnell Co., Alhambra, $1,530,121; Haddock-Engineers, Ltd., Oceanside, $1,573,128. Contract awarded to Guy F. Atkinson Co., South San Francisco, $1,096,600.

LOS ANGELES AND ORANGE COUNTIES—At intersection of Firestone Boulevard, with Paramount Boulevard, Downey Avenue, and San Antonio Drive, and at an intersection of Manchester Boulevard and Grand Avenue, traffic signal systems and intersection illumination to be furnished and installed. District VII, Routes 170, 171, 174. Sections BA, AB. C. D. Draucker Co., Los Angeles, $44,440. Contract awarded to Econolite Corp., Los Angeles, $43,314.

LOS ANGELES COUNTY—On Hollywood Parkway at Grand Avenue in the City of Los Angeles, a reinforced concrete box girder overcrossing to be constructed. District VII, Route 2. Byerts & Dunn, Los Angeles, $236,321; Contracting Engineers Co., Los Angeles, $239,747; Guy F. Atkinson Co., Long Beach, $243,809; Haddock Co., Pasadena, $247,741; E. W. Elliott Construction Construction Co., San Francisco, $257,457; E. B. Bishop, Orland, $301,254. Contract awarded to Oberg Bros., Inglewood, $225,667.

LOS ANGELES COUNTY—At 11 intersections on Garvey Avenue between Atlantic Avenue and Del Mar Ave., traffic signal systems to be furnished and installed. District VII, Route 26, Section Mon P,A. Robert E. Ziebarth, Long Beach, $41,140; Econolite Corp., Los Angeles, $42,609. Contract awarded to C. D. Draucker Co., Los Angeles, $40,365.

LOS ANGELES COUNTY—On Santa Ana Parkway at Lorena Street in the City of Los Angeles, a reinforced concrete box girder overcrossing to be constructed. District VII, Route 2. Oberg & Cook, Los Angeles, $147,922; E. B. Bishop, Orland, $148,146; Haddock Co., Pasadena, $150,193; Oberg Bros., Inglewood, $153,063; The Contracting Engineers Co., Los Angeles, $162,676; Byerts & Dunn, Los Angeles, $166,007; Guy F. Atkinson Co., Long Beach, $166,650. Contract awarded to W. J. Disteli, Los Angeles, $140,733.

LOS ANGELES COUNTY—About 4.3 miles south of Santa Monica, the existing bridge across Ballona Creek to be cleaned and protective coating applied. District VII, Route 60, Section C. L. H. Clawson Co., Los Angeles, $13,500. Contract awarded to Angelus Waterproofing & Paint Co., Los Angeles, $12,720.

LOS ANGELES COUNTY—About ½ mile north of Palmdale, about 0.8 mile, to be graded and surfaced with plant-mixed surfacing on cement treated base. District VII, Route 23, Sections E, F. John M. Ferry, Glendale, $56,-915; Cox Bros. Construction Co., Stanton, $68,229; R. R. Hensler, Glendale, $69,953; Clyde W. Wood, Inc., North Hollywood, $72,-119. Contract awarded to A. A. Edmonson, Glendale, $54,528.

LOS ANGELES COUNTY—On Santa Ana Parkway, at Esperanza Street and at Indiana Street in the city of Los Angeles, a reinforced concrete box girder overcrossing and a reinforced concrete box girder undercrossing to be constructed. District VII, Route 2. E. B. Bishop, Orland, $275,439; Guy F. Atkinson Co., Long Beach, $295,634; The Contracting Engineers Co., Los Angeles, $298,617; Winston Bros. Co., Los Angeles, $315,694. Contract awarded to Haddock Co., Pasadena, $259,144.

ORANGE COUNTY—On Harbor Boulevard between Wilson Street in Costa Mesa and Manchester Avenue south of Anaheim, about 11.2 miles to be widened and surfaced with plant-mixed surfacing and bituminous surface treatment to be applied to shoulders. District VII, Route 742. Arthur A. Johnson, Laguna Beach, $265,238; Sully Miller Contracting Co., Long Beach, $268,873; Vido Kovacevich Co., South Gate, $285,388; Cox Bros. Construction Co., Stanton, $309,747. Contract awarded to Griffith Co., Los Angeles, $241,258.

SANTA BARBARA COUNTY—At Hollister Wye between Santa Barbara and Goleta, a traffic signal system and illuminating devices to be furnished and installed. District V, Route 2, Section P. C. D. Draucker Co., Los Angeles, $23,933; Econolite Corp., Los Angeles, $35,000. Contract awarded to L. H. Leonardi Electrical Construction Co., San Rafael, $17,172.

SANTA CLARA COUNTY—On Stevens Creek Road, between Orange Avenue and Stevens Creek, about 0.4 mile to be graded and paved with Asphalt concrete and Portland cement concrete and a bridge to be widened. District IV, Route 1000. N. M. Ball Sons, Berkeley, $68,861; Eaton & Smith, San Francisco, $79,054; Peter Sorenson, Redwood wood City, $82,388; Johnson, Drake & Piper, Inc., Oakland, $99,933. Contract awarded to Dan Caputo & Edward Keeble, San Jose $58,785.

VENTURA COUNTY—On Las Posas Road, between U. S. 101 and Somis Road, about 4.3 miles to be surfaced with plant-mixed surfacing on existing surfacing and on imported borrow and portions to be graded. District VII, Route 877. Jesse S. Smith, Glendale, $82,120; J. E. Haddock, Ltd., Pasadena, $82,964; Fairey-Hammond, Inc., San Francisco, $89,736; Dimmitt & Taylor, Los Angeles, $105,999. Contract awarded to MacDonald & Kruse, Inc., Glendale, $76,804.

January 1947

FRESNO COUNTY—Across Kings Slough about 2.7 miles south of Mendota, the existing bridge to be reconstructed. District VI, Route 41, Section P. Rexroth & Rexroth, Bakersfield, $24,800. Contract awarded to Lord & Bishop, Sacramento, $17,600.

IMPERIAL COUNTY—In the City of El Centro on 4th Street and Adams Avenue between Main Street and Imperial Avenue, about 1.2 miles, to be graded and paved with Portland cement concrete and plant-mixed surfacing. District XI, Route 26, Section E, Cn. Basich Bros. Construction Co. & Basich Bros., Alhambra, $346,230; Haddock-Engineers, Ltd., Oceanside, $387,941. Contract awarded to R. E. Hazard Contracting Co., San Diego, $317,620.

KERN COUNTY—Between 12 miles east of Mojave and Muroc Junction, about 5 miles to be graded and plant-mixed surfacing to be placed. District IX, Route 58, Section A. John M. Ferry, Glendale, $159,378; George E. France, Visalia, $164,048; Frank T. Hickey, Inc., Los Angeles, $165,619; Fairey-Hammond, Inc. & R. A. Farish, San Francisco, $169,361; Clements & Co., Hayward, $176,159; Dimmitt & Taylor, Los Angeles, $181,045; A. H. Famularo and A. A. Edmondson, Glendale, $189,155; George Herz & Co., San Bernardino, $203,035; Haddock Engineers, Ltd., Oceanside, $210,683; Griffith Company, Los Angeles, $217,434. Contract awarded to Basich Bros. Construction Co. & Basich Bros., Alhambra, $143,373.

LOS ANGELES COUNTY—At intersection of Colorado Street with Kinneloa Avenue, Madre Street, Lotus Avenue and Rosemead Blvd. and at the intersection of Foothill Blvd. and Azusa Ave., traffic signal systems and intersection illumination to be furnished and installed. District VII, Routes 161, 168, 9, 62. C. D. Draucker Co., Los Angeles, $36,494. Contract awarded to Econolite Corp., Los Angeles, $35,268.

LOS ANGELES COUNTY—On Santa Ana Parkway at Olympic Parkway in the city of Los Angeles, a reinforced concrete

undercrossing to be constructed. District VII, Route 2. E. B. Bishop, Orland, $328,259; Byerts & Dunn, Los Angeles, $341,062; Guy F. Atkinson Co., Long Beach, $347,345; The Contracting Engineers Co., Los Angeles, $349,362; Carlo Bongiovanni, Hollywood, $353,773; Winston Bros. Co., Los Angeles, $369,339; Vinnell Co., Alhambra, $383,757. Contract awarded to Haddock Co., Pasadena, $317,090.

LOS ANGELES COUNTY—At 13 intersections on Atlantic Ave., between Firestone Blvd. and Fifty-Second Street, traffic signal systems to be furnished and installed. District VII, Route 167, Econolite Corp., Los Angeles, $51,589; C. D. Draucker Co., Los Angeles, $56,538. Contract awarded to R. E. Ziebarth, Long Beach, $48,075.

LOS ANGELES COUNTY—On Arroyo Seco Parkway at Sunset Blvd. in the city of Los Angeles, a reinforced concrete box girder overcrossing to be constructed. District VII, Route 165. E. B. Bishop, Orland, $556,427; Contracting Engineers Co., Los Angeles, $585,170; Carlo Bongiovanni Construction Co., Los Angeles, $595,568; Haddock Co., Pasadena, $599,268; Guy F. Atkinson Co., Long Beach, $634,169; Peter Kiewit Sons Co., Arcadia, $712,054. Contract awarded to Winston Bros. Co., Los Angeles, $485,769.

LOS ANGELES COUNTY—At 7 intersections on Firestone Blvd. between Hooper Avenue and Santa Fe Avenue, traffic signal systems to be furnished and installed. District VII, Route 174, Section B. Econolite Corp., Los Angeles, $22,131; C. D. Draucker Co., Los Angeles, $23,200. Contract awarded to Prescott Electric & Mfg. Co., Los Angeles, $19,500.

ORANGE COUNTY—Between one mile north of Doheny Park and San Juan Creek, about 0.9 mile, to be graded and paved with Portland cement concrete on cement treated subgrade. District VII, Route 2, Section A. O'Brien & Bell Construction Co., Santa Ana, $109,945; Clyde W. Wood, Inc., North Hollywood, $117,060; A. H. Famularo & A. A. Edmondson, Santa Ana, $125,346; N. M. Ball Sons, Los Angeles, $133,400; Chas. J. Dorfman, Los Angeles, $147,902. Contract awarded to Cox Bros. Construction Co., Stanton, $106,362.

ORANGE COUNTY—Between Laguna Beach and Dana Point, about 4.9 miles, to be graded and surfaced with plant-mixed surfacing. District VII, Route 60. A. F. Heinze & John J. Swigart Co., Alhambra, $257,272; Warren Southwest, Inc., Los Angeles, $269,815; Basich Bros. Construction Co. & Basich Bros., Alhambra, $270,225; John M. Ferry, Glendale, $273,573; Griffith Company, Los Angeles, $279,250. Contract awarded to Cox Bros. Construction Co., Stanton, $256,060.

SAN JOAQUIN COUNTY—Across San Joaquin River at Mossdale, the substructure for a bridge to be constructed. District X, Route 5, Section B. Macco Corporation, Clearwater, $275,103; Healy Tibbitts Construction Co., San Francisco, $288,467; Guy F. Atkinson Co., South San Francisco, $310,564; United Concrete Pipe Corp. & Ralph A. Bell, Baldwin Park, $326,424; H. F. Lauritzen, Pittsburg, $329,060; Johnson Western Co., Alameda, $359,791; Stolte Inc. & The Duncanson Harrelson Company, San Francisco, $367,504. Contract awarded to Lord & Bishop, Sacramento, $248,606.

TUOLUMNE COUNTY—In the City of Sonora, on Stockton Street, between Solinsky Street and Washington Street, about 0.4 mile, to be graded and surfaced with plant-mixed surfacing. District X, Route 13. Fairey-Hammond, Inc., San Francisco, $77,884; Folsom & Drollinger, Sacramento, $84,570; Louis Biasotti & Son, Stockton, $91,474; J. Henry Harris, Berkeley, $108,396. Contract awarded to Beerman & Jones, Sonora, $74,716.

Two Highway Commissioners Reappointed

TWO MEMBERS of the California Highway Commission, Homer P. Brown of Placerville and C. Arnholt Smith of San Diego, were reappointed by Govern Earl Warren on January 31st for four-year terms ending January 15, 1951. Both have been members of the commission since September, 1943.

Mr. Brown became a resident of El Dorado County during the early part of 1927 and constructed the plant known as the Diamond Springs Lime Company, which he owns and operates in the manufacture of lime products.

He was born in Butte County, July 4, 1878, and before going to El Dorado County was engaged in the sugar industry for 21 years. He is a member of the Sutter Club of Sacramento and the Bohemian Club of San Francisco.

Mr. Smith is one of the leading bankers of Southern California. He is President of the Clearing House Association of San Diego, Vice President and Chairman of the Board of the United States National Bank of San Diego and President of the City Bank of Monrovia. He is also President of the National Iron Works of San Diego.

Born in Oregon, Mr. Smith moved to San Diego when still a youth and attended the public schools in that city. He later resided in Los Angeles for several years. He is married and the father of two children, a boy and a girl.

Noyo River Bridge

(Continued from page 16)

channel 140 feet wide and a vertic clearance of 80 feet.

In order to economically obtain the required clearances the new bridge was located about 1,000 feet downstream, where rugged bluffs on each side of the channel would place the approach roadway at the proper elevation above the water. Further study indicated that a saving could be made by combining in one line change the replacement of existing weak bridges across Mitchell Creek and Hare Creek. Both of these bridges were of light timber construction in bad condition. Both were restricted as to loading and were being kept in service by constant repairs and replacement had been scheduled as an early postwar project.

To coordinate the construction work the entire project has been included in one contract. This includes grading and surfacing with plant mixed surfacing a 22-foot roadway about 3½ miles long ending at the south limit of Fort Bragg. At Mitchell Creek a 10-foot concrete arch culvert 385 feet long is to be built. At Har Creek the bridge is to be a three spa reinforced concrete arch. Side span will be 90 feet and the main span to be 199 feet. The deck will provide a 26-foot roadway and two three-foot sidewalks.

About half of the cost of the project is in the bridge across the Noyo River, which will be a structural steel cantilever with a main span of 405 feet and side spans of 222 feet. The deck will provide a 26-foot roadway with three-foot sidewalks.

Bids on the project were received on August 28, 1946, and Contractor Guy F. Atkinson was the low bidder with a bid of $1,322,647. Before the contract could be awarded, President Truman proclaimed structural steel a critical material and ordered the deferment of all public works projects including quantities of structural steel. To conform to the presidential policy a revised contract for $874,215 was negotiated with the contractor, which eliminated the structural steel superstructure of the Noyo River Bridge. The piers and abutments are to be constructed under this contract which will permit the rapid completion of the bridge when the structural steel is obtainable.

Showing culvert and fill replacement of old Slick Rock Bridge, Mendocino County

Replacement of Posted Bridges in District I

(Continued from page 21)

flat bottom land developed in part by reclamation. Upon reaching a confluence they flow in a common channel to discharge into Clear Lake. This common channel is inadequate for carrying the peak run-off of storms and consequent flood waters are ponded and flood all low areas, particularly those drained by Scott Creek. These flood waters overflow the existing highway by as much as five feet and effectively block all traffic using Route 29 north from Lakeport to the junction with Route 20 at Upper Lake. The new highway has been located and designed to correct this condition.

ALL WEATHER ROAD

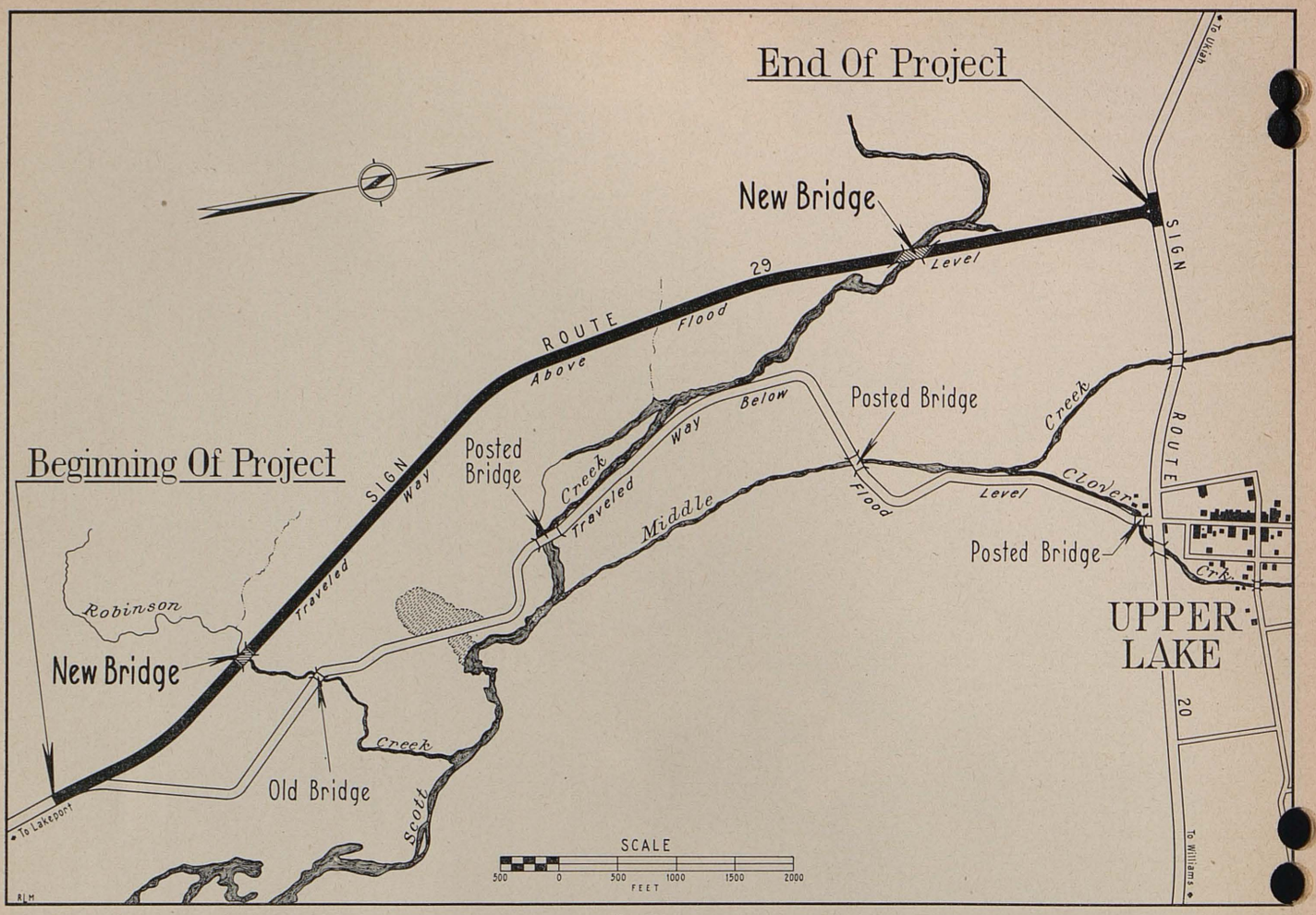
The new highway, besides eliminating three bridges from the highway system and providing an all weather road, will replace 2½ miles of road construction on narrow and winding alignment. The new location has only three curves, the minimum radius being 1,500 feet and the road is surfaced to its full width, with three inches of plant-mixed surfacing on imported base material. A "Y" type intersection, having acceleration and deceleration lanes on Route 20 was constructed at its northerly termini near Upper Lake.

The grading and surfacing of the new highway is now completed but is not open to traffic. The substructure for the new Scott Creek Bridge is completed but nondelivery of the steel girders has prevented completion of the structure. Work on the reinforced concrete pile bridge at Robinson Creek is underway with completion of both bridges anticipated early next summer.

The contractor for the grading and surfacing contract was Louis Biasotti & Son, and Kiss Crane Company for the bridges. The Resident Engineer for the grading and surfacing was C. A. Shervington, and Resident Engineer G. A. Crayton as supervising the bridge contract. The estimated cost of both projects is $317,000.

Further south on State Route 29, near Kelseyville, Contractor A. Soda & Son has completed the substructure for a steel girder bridge 372 feet in length which will replace an existing steel truss bridge across Kelsey Creek.

The existing structure was constructed by Lake County many years



ago. Its restricted width and height and light steel members necessitated posting for one-way traffic and a maximum loading of seven tons for one vehicle and 12 tons for semi.

Approaches to the new bridge have been graded and surfaced and are in use, but completion of the new bridge has been delayed by the nondelivery of steel girders. By arrangement with the contractor a pile timber span and approach fill have been constructed from the easterly pier of the old bridge to permit traffic to use that bridge. Otherwise, traffic entering or leaving Kelseyville would have been required to make a detour of several miles. This replacement of a posted bridge, estimated to cost $214,000, will provide 0.65 mile of new highway on high standard alignment. It is a matter of interest that the first bridge built across Kelsey Creek at this location in very early days, a timber pile structure cost approximately $2,500. The Resident Engineer representing the Bridge Department is George A. Greene who was assisted by R. L. Myers on the grading and surfacing portion of the contract.

The construction of these new structures will go a long way toward correction of the critical deficiency bridge problem in Lake County where free flow of truck traffic has been restricted for many years.

Bay Area Metropolitan Traffic Survey Made

(Continued from page 24)

by the small number of refusals, four-tenths of one percent.

Taxi interviews were 90 percent complete at the end of January, at which time the truck interviews were begun. The data from the internal survey furnish the material for estimating traffic generated by residents of the Bay area as it is defined in this study.

The traffic created within the area by residents from other parts of the State is had through an "external survey" in which vehicles on all principal routes leading into the area are intercepted and the drivers questioned as to origin, destination, and place of residence.

In the external survey approximately 70,000 interviews have been obtained. These interviews also will be completed in April.

It is yet too early to assess fully the values of such studies. One thing, however, is clear. They will permit a coordinated attack on the traffic problems of metropolitan areas and enable those problems to be looked at as a whole, hence with greater possibility of solution than heretofore possible.

Unique Method for Pile Encasement for Newport Bay Bridge Successful

By W. H. JOHNSON, and C. J. BEER, Resident Engineers

TO OBTAIN maximum service life from existing state bridges, the Bridge Department of the Division of Highways frequently has had to develop methods for repairing timber piling damaged by decay and marine borers. One of the preferred methods consists of encasing defective piles in concrete extending from high water line to about five feet below the mud line.

Recently, 33 timber pile bents of the bridge across the North Arm of Newport Bay, on the Coast Highway between Los Angeles and San Diego, were repaired with concrete encasements. Novel feature of the method was the building of circular concrete pile jackets above the water, which were then lowered to the bottom and filled with tremie-deposited Portland cement grout. Significant details of the construction are shown in **Figure 1.**

Scaffolding was suspended just above the high tide elevation by ropes over the caps. All work was done from the scaffolding.

The first operation was to clean the piles of barnacles, mussels and other marine growth.

The next step consisted of constructing a concrete cylindrical shell around each pile. A two-inch space was left between pile and inside of shell, which was later filled with grout. The shell extended from high tide to an elevation of three to five feet below the mud line.

HOLLOW SHELLS GUNITED

The hollow shells were gunited in five-foot lifts. After completing each lift, the shell was lowered five feet. This continued until the final depth was obtained. The construction of the concrete shell was started by nailing 1 inch x 2 inch vertical strips to the piles above high tide elevation. These provided the two-inch minimum space for grout filling.

In order to facilitate the lowering, these strips were placed with a slight taper. This was accomplished by nailing rope around the pile below the tops of the strips. A thin layer of asphalt felt was laid over the form strips to act as the inside form. Wire mesh reinforcement, crimped to keep it off the felt, was then fastened in place over the felt. Two S-shaped hooks and guides were placed in the form, 180 degrees apart, and later cast in the concrete. Two C-shaped guides were placed at the quarter points. The hooks served to hold up the shell during construction, and the guides prevented the shell from crowding the pile during the lowering operation. A 1½ inch concrete jacket was then applied pneumatically through a hose and nozzle.

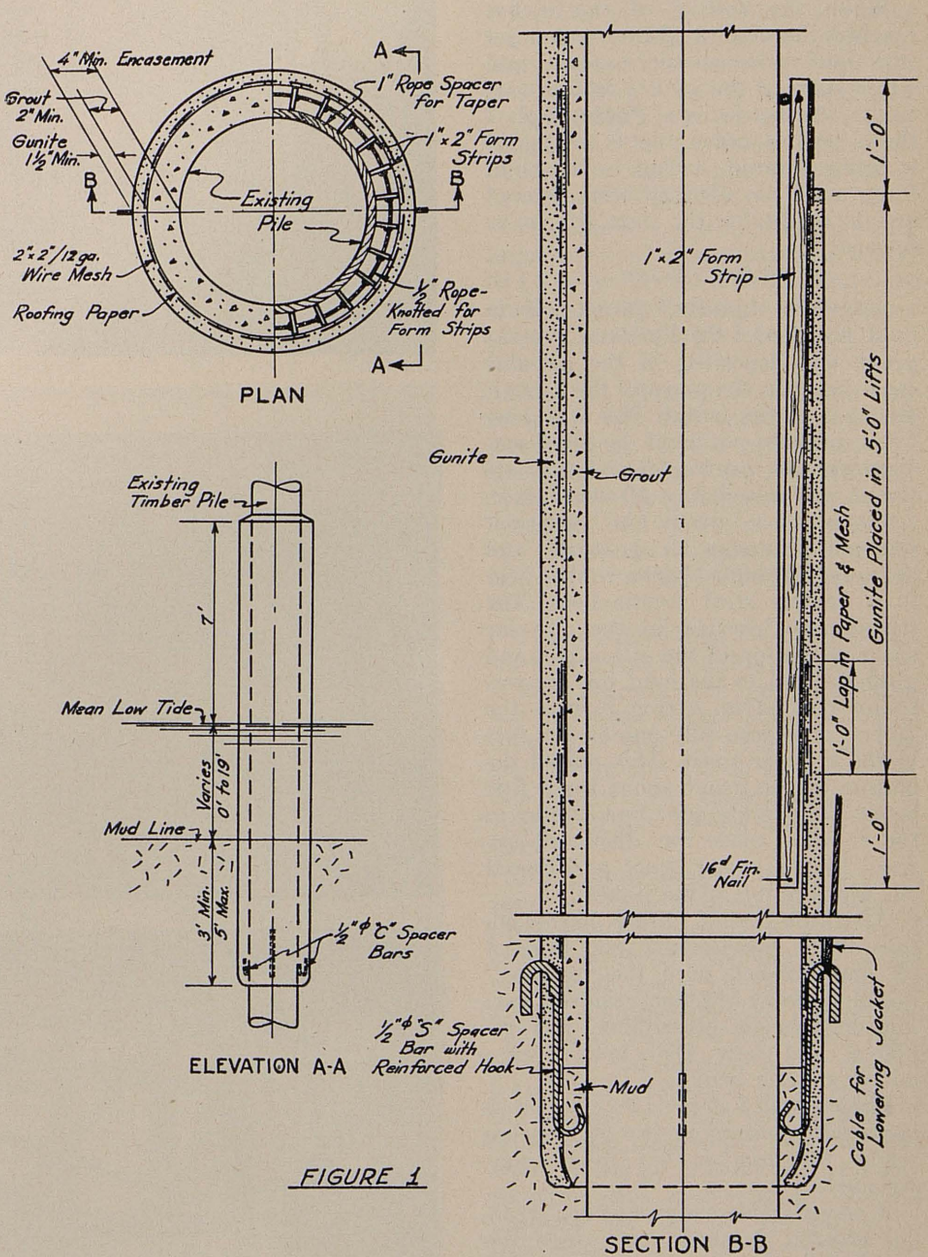


FIGURE 1

This completed the first step of the encasement operation. After the concrete had set the jacket was lowered away from the form strips, and another section cast on top of the previously cast section. The same form strips were used, and new felt, reinforcing and gunite applied in the manner already described.

When the bottom of the jacket reached the mud, a 1½-inch water jet was used to loosen the material and allow sinking the jacket to five feet below the mude line. **Photograph 1** shows jetting under way as the jacket is being lowered. Jacket in the right foreground has already been lowered and is ready for the next lift to be formed.

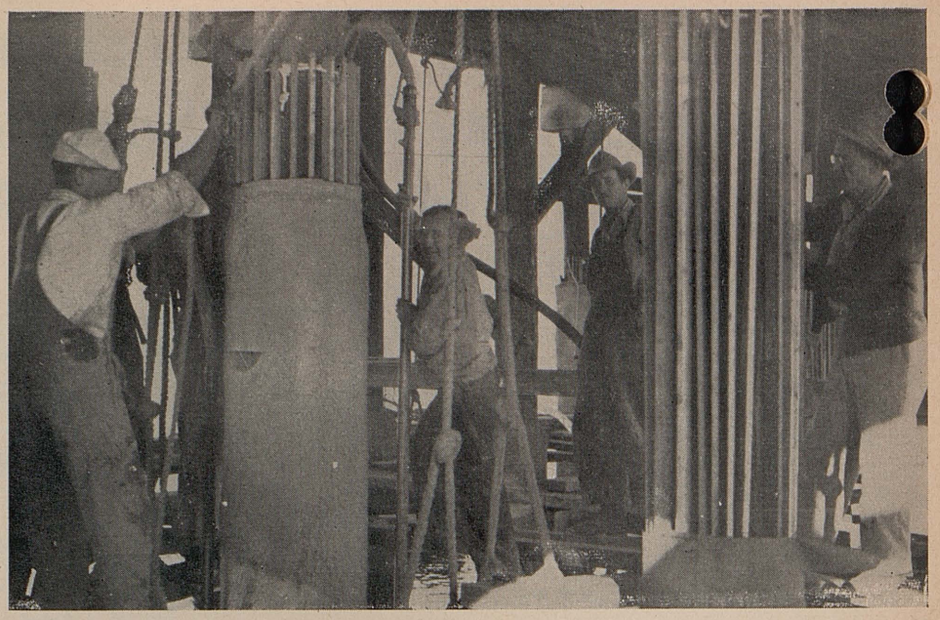
GROUT FILLING

After the "gunite" jacket was in final position, 1:2½ Portland cement grout was deposited in the annular space between the pile and the asphalt felt back of the jacket. This was done by a process patented by Johnson-Western Co., contractors on the job. Grout was mixed in a 10-sack mixer, conveyed to a "grout bin" where it was placed under air pressure, and delivered through 1½ inch rubber hose to a flexible steel tremie hose. The tremie was inserted in the annular space at the top of the pile jacket and pushed down to the mud line. It was found that after jetting to sink the jacket, mud rose only one or two feet in the annular space. This placed the bottom of the grout about three feet below the outside mud line. Water in the annular space was displaced upward by the rising grout and flowed out over the top of the jacket.

After the grout filling hardened, tops of the encasements were tapered off and finished with the "gunite" machine. Sway bracing, removed during encasement operations, was replaced and new sash braces were added at each bent.

Photograph 2 shows two completed bents with jackets on two other bents ready for another lift to be constructed.

A considerable amount of boat traffic, chiefly pleasure craft, uses the main channel under the steel span of the bridge. A timber bulkhead 14 feet high is used to protect the double pile bents at each end of this span from damage by boats. The lower half of the bulkhead had been badly damaged by marine organisms and was replaced with new creosoted timber. The upper half was reinstalled after pile encase-



ments were completed. To stiffen the pile bents supporting the bulkhead, [illegible]n foot "gunite" diaphragm walls [illegible]e built between groups of three [illegible] four piles in these bents.

Photograph 3 shows mortar being applied to one of the walls and illustrates the method of application to all of the pile jackets.

A heavy submarine telephone cable, resting against the timber piles caused some difficulty in sinking two of the concrete jackets to the specified depth. Investigation by a diver disclosed a slight arc in alignment of the cable, from which slack might be obtained. By using a water jet and a series of chain hoists the diver was able to lift the cable out of the mud and rearrange slack sufficient to clear the pile jackets. This work was done by force account under a contract change order. **Photograph 4** shows diving work in progress.

4

Twelve Miles of U. S. 40 Converted To Four-Lane Divided Highway

(Continued from page 27)

being erected adjacent to the legal entrances so that traffic must use the approved and legal entrances to these places.

These curbs are placed within the right of way one foot from the right of way line. At each side of all of the legal private openings an 8 inch x 8 inch concrete marker is placed on the right of way line. In order to appraise the general public on all freeways or limited freeway routes, signs are being placed at one-fourth mile intervals near the right of way line informing the public that this is a limited access project, and that only authorized access openings may be used. This will inform prospective purchasers of the necessity of determining whether property they are contemploaing buying has a legal opening to the highway. Many cases have already been disclosed, where property has been purchased, and after the purchase was completed, the purchaser discovered he had no legal right of ingress or egress to the highway.

The second project, Midawy to 1.3 miles north of Dixon, makes a saving of 1.3 miles over the old route and takes traffic completely outside of the metropolitan development of the City of Dixon.

Both of these projects were constructed by the same contractor, Frederickson Bros. of Emeryville. George R. Hubbard was resident engineer until the pavement was nearly completed when, on account of illness, the work was completed by W. L. Hurd who had assisted throughout the construction.

The estimated final construction cost for both projects totals $1,676,000.

Both projects were constructed during the same epproximate period of time which shows 219 working days on one project and 245 on the other. The first project was started January 3, 1946, and the second February 13, 1946.

The improvement in riding comfort resulting from a smoother pavement surface; a decrease in the activity of back seat drivers, on account of the removal of nearly all curves and the greater safety provided for passing vehicles by reason of the divided highway; and the decrease in the time of travel which induces an increase in the number of trips and permits of trips which time would not otherwise allow, would all indicate that this construction was primarily to increase business for the oil companies. A further analysis however would prove that the automobile or truck owner himself saves time and cost in the operation and maintenance of his equipment, and this saving, together with the saving in lives, equipment, and insurance costs, due to the decreased accident hazard, is passed on to the general public in lower commodity costs and improved services.

Maintenance Crews Expect to Do These Things As Routine

Mr. A. J. Rivett, Safety Engineer
Division of Highways
Room 529, 1120 N Street
Sacramento, California

Dear Mr. Rivett: Because I believe you should know and because I am confident you will be pleased to learn of the details, it affords me great pleasure to relate an experience I had this afternoon.

Proceeding south on the East Shore Highway (skirting San Francisco Bay between Albany and the East Bay Bridge) and at a point approximately 200 yards north of University Avenue, Berkeley, I just managed to evade an empty barrel that rolled across the highway directly in front of me. In my rear vision mirror I saw a great bit of dodging on the part of motorists following me and witnessed some mighty close shaves between many cars in their frantic attempts to go around the barrel.

The wind seemed to be changeable at that point for my last vision of the barrel disclosed it rolling in the opposite direction but, of course, right across the highway which is, as you know, a very busy thoroughfare.

Arriving at the University Avenue intersection I noted one of your highway trucks and a crew which was, I believe, painting the electric light poles. Pulling off the highway, I reported the hazard created by the barrel. Two men were immediately dispatched to remove the hazard and although nothing was said about hurrying these men started off on the double.

The prompt reaction of these men may have averted a serious accident.

I regret that I failed to note a number on the truck but with the description of the location and knowing the time (2.30 p.m.) it is likely you will know the men comprising the crew who should, I believe, be commended for their eagerness to remove a dangerous hazard from the highway.

Yours truly,

Jenkel-Davidson Optical Company

F. P. Schaeffer,
Sales Manager

Farm Can Help Provide Steel For Bridges

WARTIME'S spirit of metal salvage is again being called upon, this time for highway bridges. That old cultivator or other antiquated farm machinery rusting away in the barnyard can help the road program by supplying iron and steel scrap for modernizing old bridges and building new ones, according to Charles M. Upham, engineer-director of the American Road Builders' Association, in a statement issued to highway engineers.

Mr. Upham, in supporting the government's plea for scrap salvage, points out that lack of steel has been one of the obstacles holding up highway construction.

"Roads crossing streams must have bridges, and thousands of highway projects cannot be started because steel for bridges is not available," said Mr. Upham. "In a normal prewar year, highways used over 1,600,000 tons of structural and reinforcement iron and steel. Since it is estimated that 30,000 bridges on state roads alone are obsolete and must be replaced, postwar requirements will be greatly in excess of the prewar consumption. There are 800,000 bridges in our street and highway system, 600,000 in rural areas and 200,000 in urban areas."

In Memoriam

William Bryant Thompson

With the passing of William Bryant Thompson a wife lost a devoted husband and the engineering profession a member whose capacity for accuracy and detail was unexcelled either in design or application.

"Bill" Thompson was an honor student of the class of 1904 University of Nevada where for a while, following graduation he was a member of the faculty.

His early practical experience was gained in the relocation and double-tracking of the Southern Pacific over the Sierra Nevadas. Later he was Assistant Engineer in Maintenance located in Sacramento.

In 1928 he came to the State Division of Highways as Chief of Party, District X and later in District IV.

When the San Francisco-Oakland Bay Bridge project was assured in 1933 he was put in charge of East Bay surveys and the distribution structure. Here he gained wide reputation among engineers for his exactness and his keen sense of loyalty. After seeing the bridge in operation he retired from active engineering and made his home in Modesto.

In 1917 while he was consulting and locating engineer for the Verdi Lumber Co. he met and married the postmistress, Miss Mabel Soden, who now survives him.

Following a lingering illness death came on October 25, 1946. Services were held in Shannon Chapel, Modesto, and his ashes repose in Masonic Lawn.

Construction of Willow Pass Under Way

(Continued from page 19)

The right of way for the project was secured on the basis of a limited access freeway limiting ingress and egress from adjacent properties to stipulated locations and providing crossovers through the central division strip at carefully selected locations.

Present operations on the project consists of grading and drainage structures with contemplated paving being under way in the early spring, permitting completion early in the summer of 1947.

Near the easterly end of the project the roadway crosses the 65-inch water line of the East Bay Municipal Utility District.

At this location a second 60-inch pipe is being installed for future service and both conduits are being encased in a reinforced concrete jacket under the roadway section for their protection.

The cost of the project exclusive of right of way costs is $620,000.

Harms Brothers of Sacramento are the contractors on the project with Jim Sheldon as their general superintendent. The work is under the general supervision of Jno. H. Skeggs, District Engineer, R. P. Duffy, District Construction Engineer and G. E. Beckwith, Resident Engineer.

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printed in CALIFORNIA STATE PRINTING OFFICE 68113 2-47 19,600

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