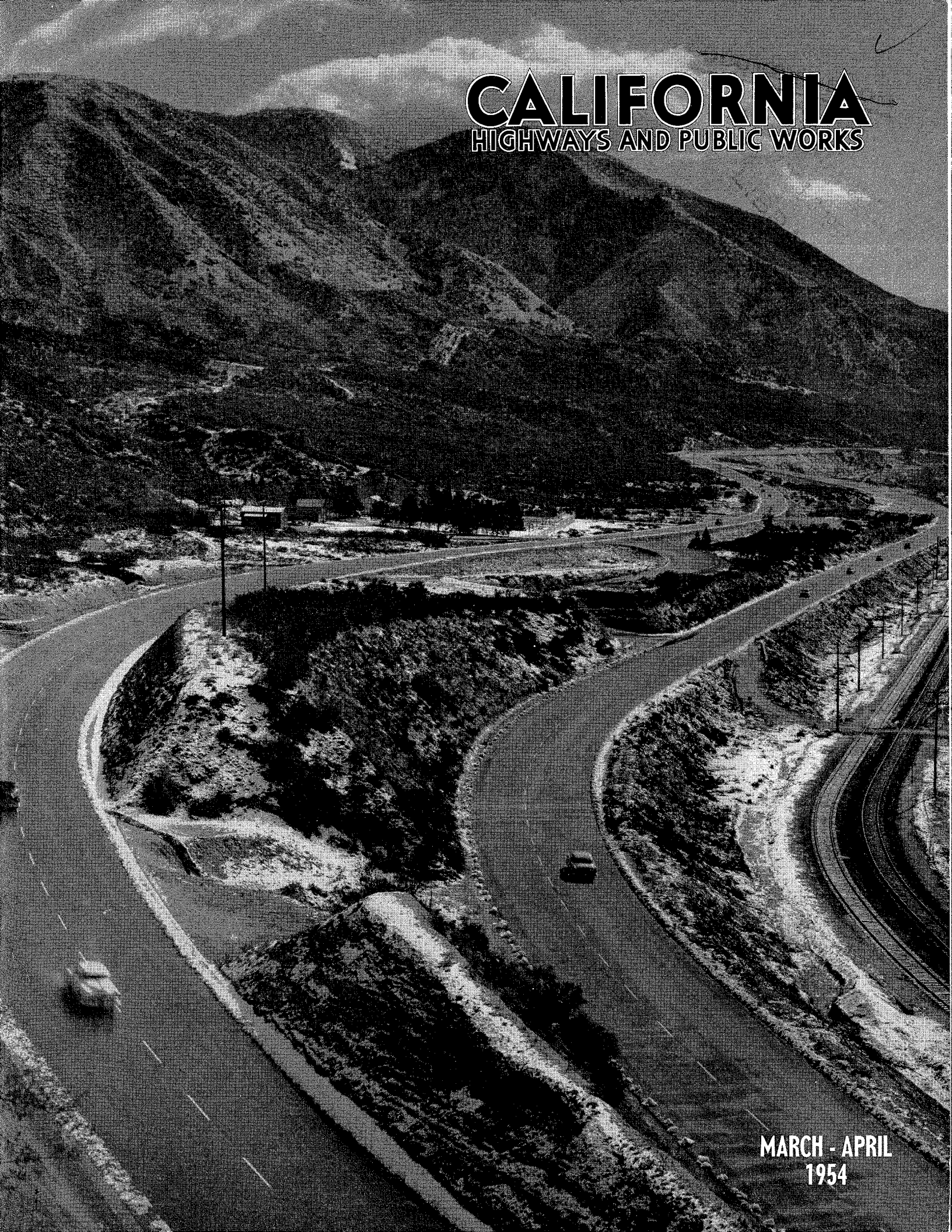


CALIFORNIA

HIGHWAYS AND PUBLIC WORKS



MARCH - APRIL
1954

California Highways and Public Works

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

KENNETH C. ADAMS, *Editor*

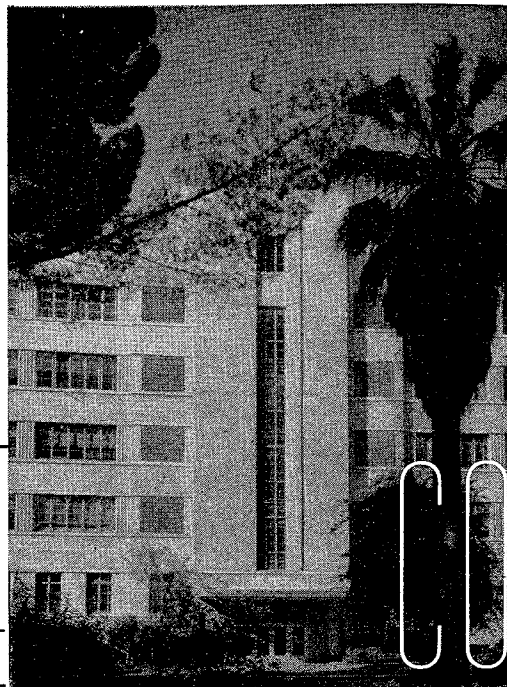
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Vol. 33

March-April

Nos. 3-4



Public Works Building
Twelfth and N Streets
Sacramento

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Published in the interest of highway development in California. Editors of newspapers and others are privileged to use matter contained herein. Cuts will be gladly loaned upon request.

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Sacramento, California

Bay Area

By B. W. BOOKER
Assistant State Highway Engineer

Multi-million Dollar Program Of Construction Under Way

Freeways

STRIDES which have been made in the construction of freeways in the metropolitan area of Los Angeles and vicinity were reported in the January-February issue of *California Highways and Public Works*.

In the major metropolitan district comprising the nine counties in District IV in the San Francisco Bay area, a similar effort to improve highway transportation for a large segment of California's population has and is being made.

Previous reports on the completion of the various important freeway projects have been confined generally to individual contracts or groups of related contracts, resulting possibly in an impression of disjointed progress. To meet particular and pressing needs, and in apportioning available funds, small sections of freeway appeared in a manner which may have indicated no comprehensive plan.

Seventh Year of Program

In this seventh year of construction, and with the aid of further funds, acceleration in the program is unfolding the planned continuity of the system. Short stretches of freeway have expanded to long avenues of modern highway and loose ends are gathered into connected thoroughfares.

The geography of the Bay area imposes severe restrictions upon the design of a freeway system. In connecting the cardinal points of the district, traffic must be funneled into the existing crossings of the extensive bay waters. Further, the primary function of any system of transportation in this area must be the movement of workers from suburban homes to occupational centers. It necessarily follows that points of convergence are in the heavily populated sections of San Francisco and Oakland, presenting a problem in costly right of way, the acquisition of



B. W. BOOKER

which must conform to the principle of minimum disturbance of established interests consistent with maximum benefit. Thus, it is that the progress of a metropolitan freeway system is governed to a large degree by our ability to purchase right of way and the acceptance by the public of the location and extent of the facility.

Right of Way Acquisition

In a successful effort to expedite the purchase of right of way, the 1952 Session of the Legislature provided funds for advance acquisition of right of way on highway routes through areas of potential or imminent development. Saved for construction will be millions of dollars of future funds which would have been expended on homes and industrial plants, the building of which can now be kept from the path of planned routes. Further aid

was provided by the 1953 Legislature, which increased the advance right-of-way acquisition fund from \$10,000,000 to \$30,000,000 and at the same time made it a revolving fund. Additional construction revenue was provided by increasing the gasoline tax to 6 cents per gallon, with the other highway user taxes increased in proportion.

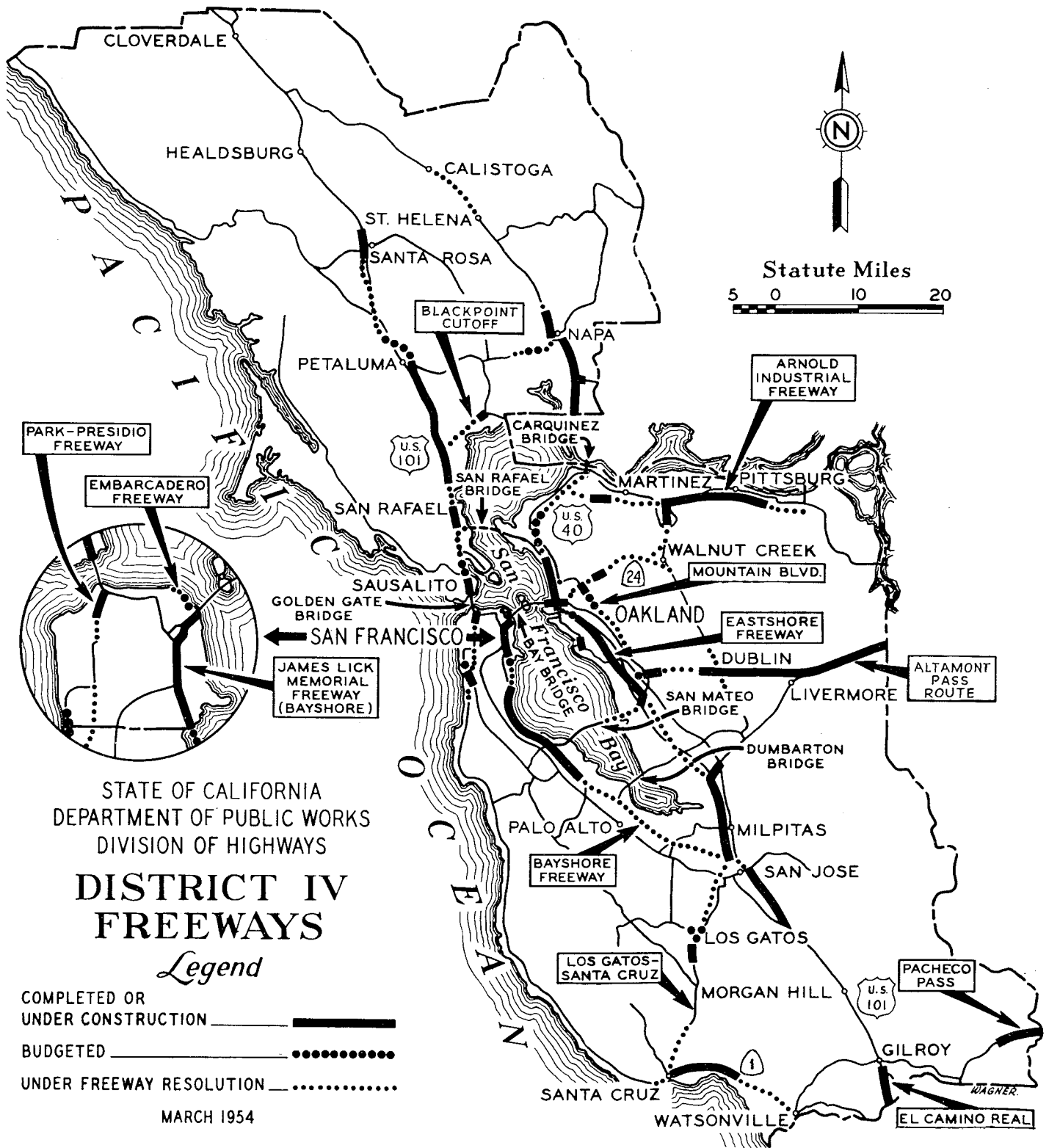
New funds provided by additional highway taxes have produced discernable progress toward an integrated freeway system. The flow of vehicular travel throughout the area already reflects the potentials of modern highway engineering. Full effect of the accelerated program is yet to be felt. The next few years should witness great strides forward in providing a workable measure of modern roads capable of sustaining rapid and convenient movement between residential and occupational centers of the Bay area.

The story of progress since the laying of the cornerstone is told in the development of the routes which are designated by the California Highway Commission as freeways.

The accompanying map and tabulation showing status of District IV freeway projects indicate in a general way the progress that has been made. To date, a total of 140 miles of freeways and expressways have been completed in District IV and 36 miles are under construction.

The total sum that has been expended for completed freeways, freeways in progress and right-of-way acquisition therefor, is \$195,000,000.

The budget for the 1954-1955 Fiscal Year which has been adopted by the California Highway Commission, allocates a total in excess of \$48,000,000 for expenditure upon District IV freeways, which will add 25 miles of multilane urban freeways and intercity expressways to the highway system in this district.



Thus the total expended and obligated for District IV freeways is \$243,000,000 which amount will provide over 200 miles of modern highway transportation facilities in the San Francisco Bay area.

Brief description of the status of each of the District IV freeway projects follows:

BAYSHORE FREEWAY

The Bayshore Highway was originally constructed to relieve the mount-

ing pressure on the El Camino Real. A part of the historical route of the Padres, this north-south route along the bay side of the peninsula not only approached its physical limitations but fell victim to strangulation through

roadside development, and finally assumed, to all intents and purposes, the characteristics of a city street.

For many years the Bayshore Highway, known also as US 101 (Alternate), served its purpose well. Carrying through inter- and intrastate traffic, commuter traffic between residential San Mateo Peninsula and San Francisco, and commercial traffic between the industrial centers of the metropolitan area, this primary route soon indicated the need of a freeway development. Its alignment, generally easterly from the peninsula cities, lent itself with few modifications to freeway transition.

The initial project to be completed as a modern freeway, a short section between Broadway in Burlingame and Peninsular Avenue in San Mateo, was finished in 1947. Constructed as a full freeway, this original link provided controlled access, grade separations and outer highways serving as front-age roads.

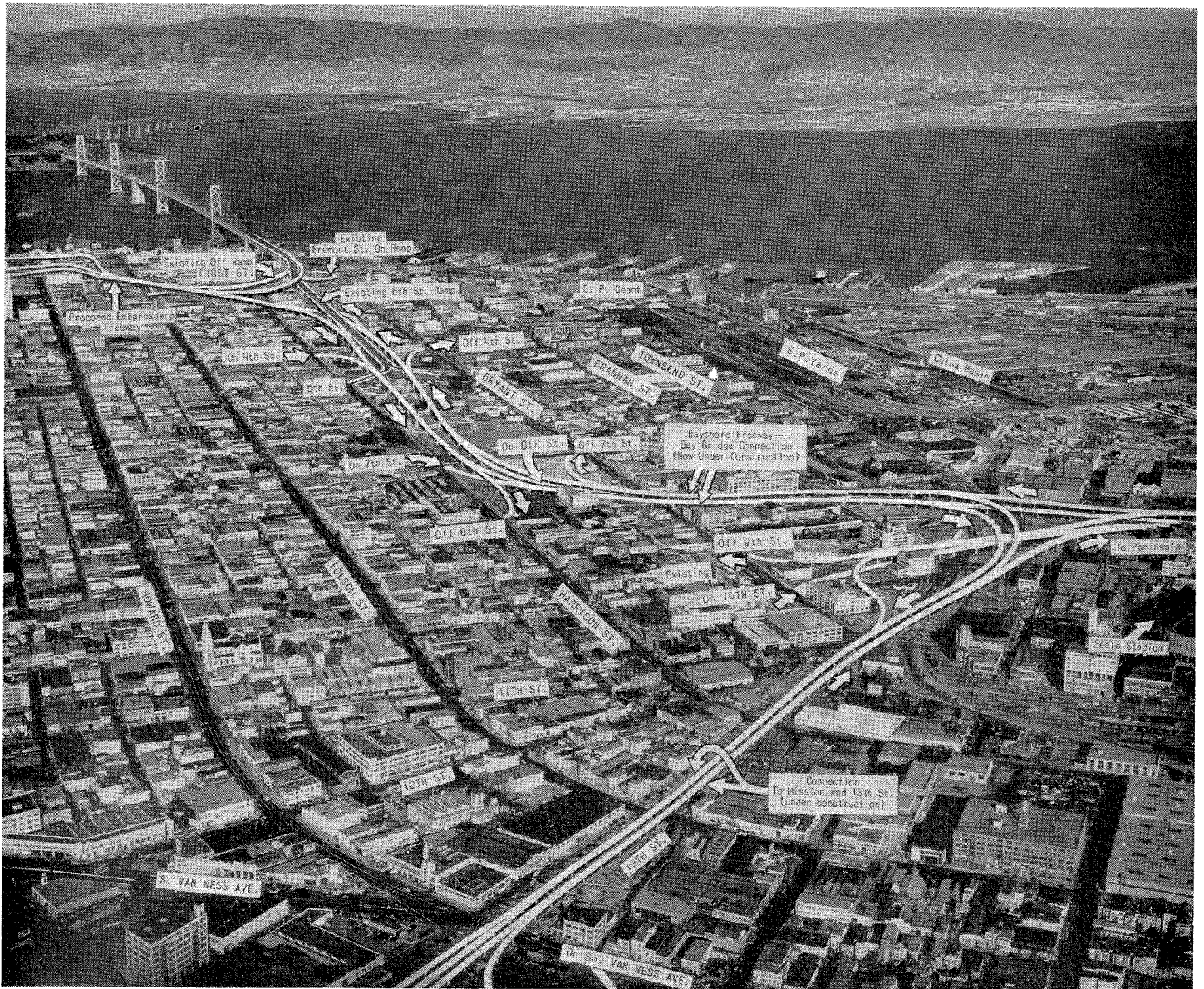
Projects Completed

The years 1948 and 1949 witnessed the completion of two contracts involving the South San Francisco and the South San Francisco to Burlingame sections. This completed the full freeway in the vicinity of the San Francisco Municipal Airport, the expansion

of which necessitated major changes in highway alignment to the west.

At this point in the development of the Bayshore Freeway the scene shifts to the City of San Francisco where a \$6,000,000 mile-and-one-third was completed in June, 1951. In October, 1953, the northerly continuation of the original section was opened to traffic. Traversing a two-mile alignment, 0.7 miles of which is elevated structure, this link connects the Army Street interchange with the freeway off ramps at Bryant Street. This section and the acceptance of the Peninsular Avenue to 16th Avenue project in San Mateo represent the to-date

View of portion of San Francisco looking toward the Bay Bridge and the East Bay, showing freeway units under construction or yet to be constructed. The loop in the lower foreground shows where the 13th Street connection off-ramp will meet South Van Ness Avenue. On- and off-ramps at Eighth Street are shown in the left center of the picture.





Central portion of San Francisco, showing Bayshore Freeway construction extending toward connection with Bay Bridge

completion of the Bayshore Freeway, totaling 14.4 miles in length.

As in all such construction the early stages appear to be a disjointed approach to the problem, but with passage of time a positive pattern appears. Under way and scheduled for early completion are projects which will provide further continuity to the freeway, creating an uninterrupted full freeway facility from San Carlos to the San Francisco-Oakland Bay Bridge, a Bay fill operation between Candlestick and Sierra Points, with the exception of the "Open Water Project."

Projects Now Under Way

The projects now in various stages of construction briefly listed are the Alemany-Third Street section in San

Francisco, 1.7 miles in length and scheduled for completion early in 1955; the 16th Avenue, San Mateo, to San Carlos section to be completed late in 1954; and four contracts in San Francisco extending the elevated freeway from the Division Street Wye easterly to Fourth Street and westerly to Mission Street via 13th Street. Bids are now being called for the connecting link to the Bay Bridge, including integrated structures which will provide a take-off for the Embarcadero Freeway.

Construction on the remaining unit on this route in San Francisco, a 0.7-mile section from Third Street to the San Mateo County line, which will connect with the open water fill, will also be started this year.

The total cost of the 6.4 miles of the Bayshore Freeway in San Francisco will amount to \$44,000,000, while the entire facility from San Francisco to San Jose, some 48.8 miles in length, will represent an expenditure of approximately \$111,000,000 when completed. Traffic count on the route near the San Francisco end is 61,000 vehicles per day.

EASTSHORE FREEWAY

Freeways have taken names, usually of local origin, and these are often lacking in full definition. The limits of the Eastshore Highway were Richmond on the north and San Jose on the south. As signed, the route was mainly State Sign Route 17, a section along the bay between Emeryville and

Richmond being US 40. In its transition to a freeway, Sign Route 17 has left most of its former locale, with a new alignment completely replacing its southerly meandering.

The first completed section of the southern portion of the freeway was opened in July, 1949. Starting at Fifth and Oak Streets, the six-lane full freeway carried traffic to the vicinity of 23d Street. By June, 1950, use of the freeway was available to 98th Street. In July of 1952, a further 4.2 miles carried the freeway to Lewelling Boulevard to San Lorenzo. One more year produced the 3.9-mile section to Jackson Street in Hayward.

While construction proceeded southerly from central Oakland, a 9.85-

mile unit was advancing northerly on a completely new alignment between San Jose and Warm Springs. The first section to Trimble Road was completed in August, 1953, and the second section, 8.1 miles to Warm Springs, is scheduled for completion in the summer of 1954.

Posey Tube Overcrossings

The opening of the Alameda (Posey) Tube Overcrossings in Oakland February, 1954, marks the initial step in connecting the completed portions of the freeway with the San Francisco-Oakland Bay Bridge and with the Eastshore through Oakland, Berkeley and beyond.

Currently under construction are the third level additions to the Bay

Bridge Distribution Structure and two adjoining sections along the Bay to the north. One, due for completion in July, 1954, falls within the limits between the distribution structure and Ashby Avenue, and the other continues this latter section to the Albany Overhead, to be completed next year.

Thus we have an unhampered flow of traffic through the congested 16-mile industrial section between Hayward and Oakland. The large volume of traffic formerly passing through the city streets of Oakland, San Leandro and Hayward which presently amounts to a maximum of 65,000 vehicles per average day, now rolls through the open freeway in a matter of minutes.

Bayshore Freeway in San Francisco; Army Street interchange at bottom; Alemany Boulevard interchange, center; with section presently under construction between Alemany Boulevard and Third Street extending to upper left





View of construction progress on Bayshore Freeway in San Francisco from Third Street looking toward Alemany Boulevard

The Eastshore Freeway when completed will be 55.7 miles in length. Expenditures on this route for right-of-way acquisition and for construction of the 30.1 miles which are built or under contract, total \$59,000,000.

**US 101-GOLDEN GATE BRIDGE
TO SANTA ROSA**

Pressing toward the immediate goal of a through freeway from the Golden Gate Bridge to Santa Rosa, a major job on the Waldo Grade is now in progress, and a bridge with approaches at Petaluma Creek is well under way.

The first section was built as a controlled access facility, being completed in August of 1947. This \$1,700,000 project provides for four lanes of

divided highway covering the 12 miles between Petaluma and Ignacio. In 1949 the 4.3-mile Santa Rosa Bypass was completed as an expressway.

Late in September, 1952, a unit 5.4 miles in length between the Forbes Overhead and Ignacio was added to the previous section, making a continuous 17-mile run of limited access freeway from Forbes to Petaluma.

In October of 1953 one further step was taken in the transition to freeway. The six-lane divided highway between California Park and the San Rafael Viaduct was completed as a full freeway, with frontage roads, and an interchange structure at San Quentin Wye designed to serve the building San Rafael-Richmond Bridge. This

section, together with the completion of the San Pedro Road undercrossing at Puerto Suello Hill, extends freeway continuity through the 22 miles between San Rafael and Petaluma.

Currently building, the four-mile section of full freeway between Golden Gate Bridge and Manzanita is scheduled for completion late in 1954 or early in 1955. The Golden Gate Bridge and Highway District is contributing \$5,000,000 to this project. This six-lane facility involving a 1,000-foot tunnel, two side-hill structures each approximately 300 feet and four vehicular interchanges, will provide smooth flow for upwards of 30,000 per day load which traverses the grade.

Further progress toward Santa Rosa is indicated by the advertising for bids for the Petaluma-Stony Point job, an 8.2-mile section extending northerly from Petaluma Creek which includes four complete interchange structures. The outstanding feature of the job for which \$4,713,000 has been budgeted, is the bypassing of traffic around Petaluma, whose citizens 20 years ago little dreamed that they would look toward this.

In Marin County another link in the freeway will be a new six-lane divided bridge across Richardson Bay for which \$3,000,000 has been provided in the 1954-1955 budget by the California Highway Commission. Thus with a cost of \$17,500,000 for sections al-

ready completed and under contract, a total in excess of \$24,000,000 has been spent or obligated for this freeway.

BLACK POINT CUTOFF

Except for improved alignment through a hill at Black Point and another at Sears Point, this freeway follows the location of the original Black Point cutoff which was completed in 1918 to provide a direct route from the Bay area to Sonoma and Napa Valleys.

Extending from Ignacio to Sears Point, the grading has already been completed and the cut sections have been paved to eliminate the deficient portions of the alignment. At Sears

Point a section 0.7 mile in length was completed in 1950 as a four-lane divided facility.

Finishing of the full facility which will require a new bridge across Petaluma Creek at Black Point as well as other structures and paving await the availability of funds. In the meanwhile, the embankments across marsh lands for the future additional lanes which were overloaded to accelerate settlement, have subsided approximately two feet. It is expected that further settlement will be only nominal, thus insuring a stable roadbed when final construction is undertaken.

The amount expended for right of way for this 7.3-mile freeway and for the initial work is \$1,200,000.

View showing progress of grading operations for Skyline Boulevard from Edgemar Road to junction of Routes 55 and 56 in Daly City





UPPER—Bayshore Freeway in San Mateo, looking south from vicinity of Third Avenue interchange. LOWER—Bayshore Freeway through Burlingame, looking north from vicinity of Peninsular Avenue interchange.



NAPA AREA

The City of Napa is served by two major highways, one Sign Route 29, generally north and south, and Sign Route 37, generally east and west. Both routes traversed narrow and irregularly patterned streets in passing through the city. The impetus on traffic of the wartime activity at Mare Island necessitated the improvement of the route from Vallejo to Napa as an emergency measure. The most critical section was developed as an expressway in 1944 and the remaining portions were finished in 1949 to pro-

vide a continuous facility 12 miles in length through Napa County.

In September, 1950, two lanes constituting stage construction of a three-mile section of controlled access freeway was completed joining Routes 37 and 29 on an alignment westerly from the city. It is interesting to note that the 1953 count during 16 hours on Sunday, July 12th, shows 9,562 vehicles using the freeway. In the absence of this facility these vehicles would have saturated the streets of Napa, formerly included in the highway system.

To date \$2,150,000 has been expended on stage construction of 14.6 miles of this rural type of expressway.

US 40-RICHMOND TO CARQUINEZ

This freeway has been laid out to bypass the built-up communities between Richmond and the Carquinez Bridge. Located generally easterly of existing US 40 on a more direct alignment the 13.8 miles which comprise this route is largely in the design stage. The planned improvement contemplates elimination of the sharp curve at the south end of the bridge and makes provision for a connection to a parallel structure which is proposed for construction 200 feet upstream from the present crossing.

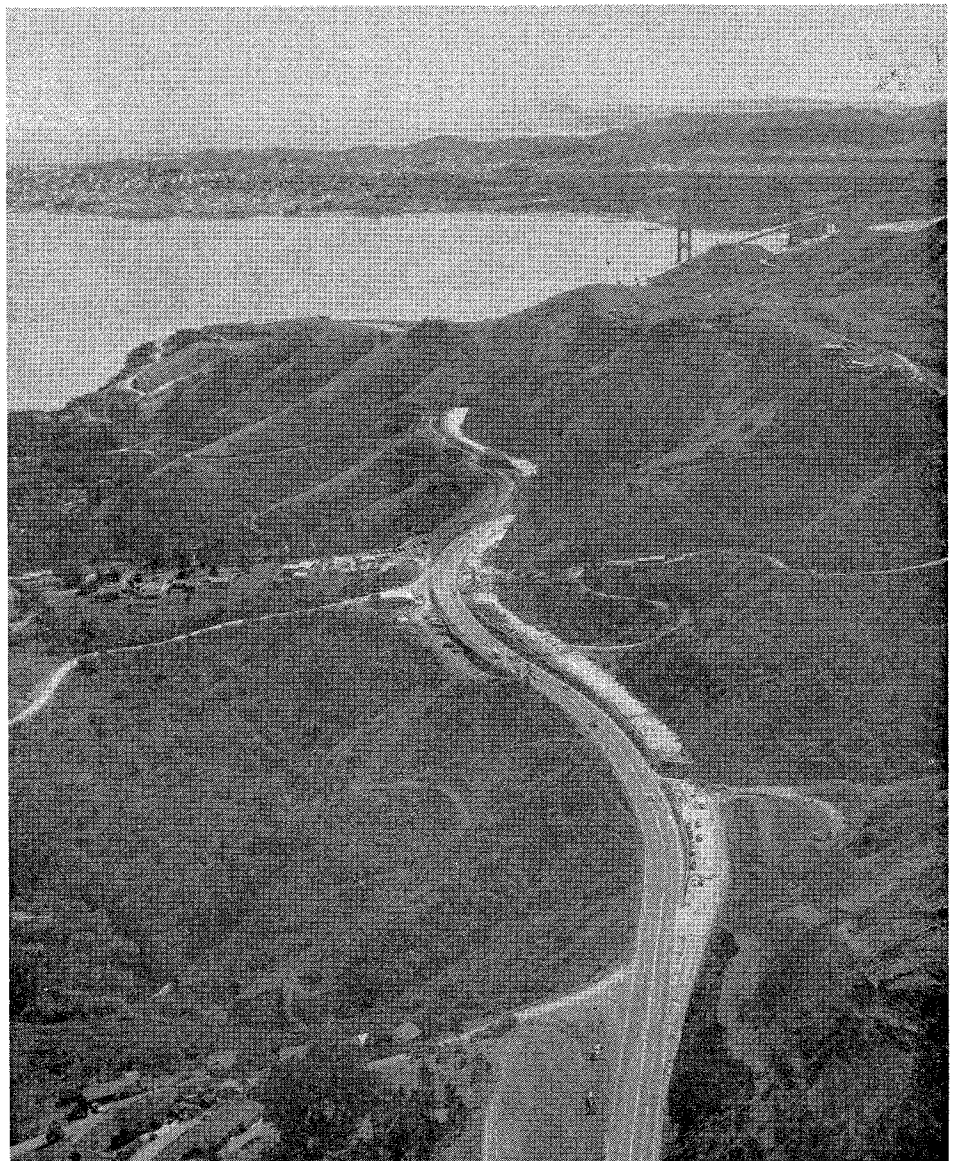
At the Richmond end of the freeway, two structures for the initial unit are now being built, one over the Santa Fe tracks at 47th Street and one over San Pablo Creek. A contract to complete the 4.7-mile initial section is due for advertising this year, which will involve an expenditure of approximately \$6,000,000.

The cost of the structure contract and right of way that has already been acquired represents another \$4,000,000.

ARNOLD INDUSTRIAL FREEWAY

The Arnold Industrial Highway in Contra Costa County, as an east-west thoroughfare which is signed as Route 4, originates in a junction with Route US 40 at Hercules. After traversing the low hills of western Contra Costa County it serves the industrial centers of Martinez, Port Chicago, Pittsburg, Antioch and proceeds easterly toward Stockton.

Its development as a freeway followed the dictates of the traffic pat-



Construction operations showing widening of Waldo Grade, looking south toward Golden Gate Bridge

tern, the first section resolving the congestion in Willow Pass, where the vehicular flow from the south and from the west merges on its way to the industrial area and beyond. This original section was completed in 1947, its easterly limit being Port Chicago Road.

Similar construction, permitting controlled access, continued the freeway to Railroad Avenue in Pittsburg, this 4.5-mile section assuming a completely new alignment immediately south of the congested industrial area. Following this new alignment, a five-mile section which carries the freeway from Pittsburg to "A" Street in Antioch was opened July 1, 1953. The

Barry Hill line change from Christie Underpass to Glen Frazer which was finished in 1949 completes the current development, which includes 13.8 miles of the 53.2 miles which have been declared a freeway. The expenditures for the finished sections of four-lane expressway total \$5,800,000.

OAKLAND-WALNUT CREEK-CONCORD

The main approach to the East Bay metropolitan area is Sign Route 24. This facility, known as Tunnel Road from its passage through the Broadway Low Level Tunnel, carries a daily traffic load of over 38,000 vehicles. In addition to accumulating traffic from through easterly routes in Contra Costa and Alameda Counties, the



Redwood Highway looking north toward San Rafael from vicinity of California Park Wye

road serves a vast area of suburban population employed in the business and industrial centers of the East Bay.

The Tunnel Road, running easterly from the Broadway Tunnel and turning northerly at Walnut Creek to merge with the Arnold Highway, has been declared a freeway in its entirety. The present road has been confined by a strip development requiring practically complete realignment and an unusually large number of grade separations.

One section 2.3 miles long, from Concord to the Arnold Industrial Freeway, was completed in January, 1947. Work was recently assumed at Orinda Junction on a 1.2-mile unit,

where Moraga Road makes a direct crossing of Route 24. This project which includes a complete interchange with a construction cost of \$1,570,000 is scheduled for completion in May, 1955. While \$2,700,000 has been spent for right of way, with considerable acquisition for future units, the construction of additional sections of the freeway awaits the availability of funds.

MOUNTAIN BOULEVARD

The improvement of Mountain Boulevard to freeway standards has been planned to provide better accessibility for the residents of a large section of Oakland lying on the west

slope of the range which separates the Counties of Alameda and Contra Costa. The 9.3 miles which comprise the total length of this route from Lake Temescal to San Leandro are covered by freeway resolution.

A 1.1-mile section near Lake Temescal was completed in January, 1952, at a cost of \$1,800,000 and an additional one-mile unit will soon be scheduled for construction.

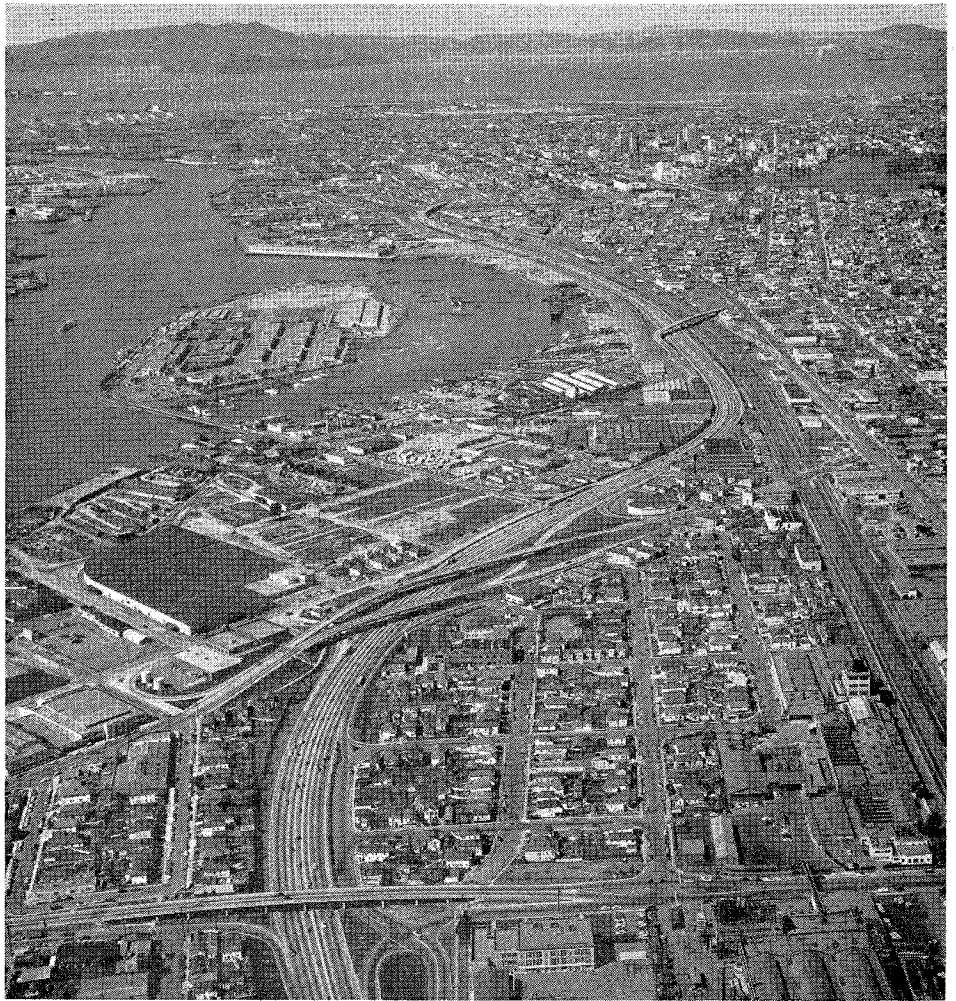
Joint Highway District 26 was organized in 1938 to accomplish the construction of this road, with Alameda and Contra Costa Counties joining with the Division of Highways as members, and with the City of Oakland also participating in the cost. The

annual contributions are made by these parties with 50 percent of the amount coming from state highway funds. The contributions for the 1953-1954 Fiscal Year totaled \$900,000.

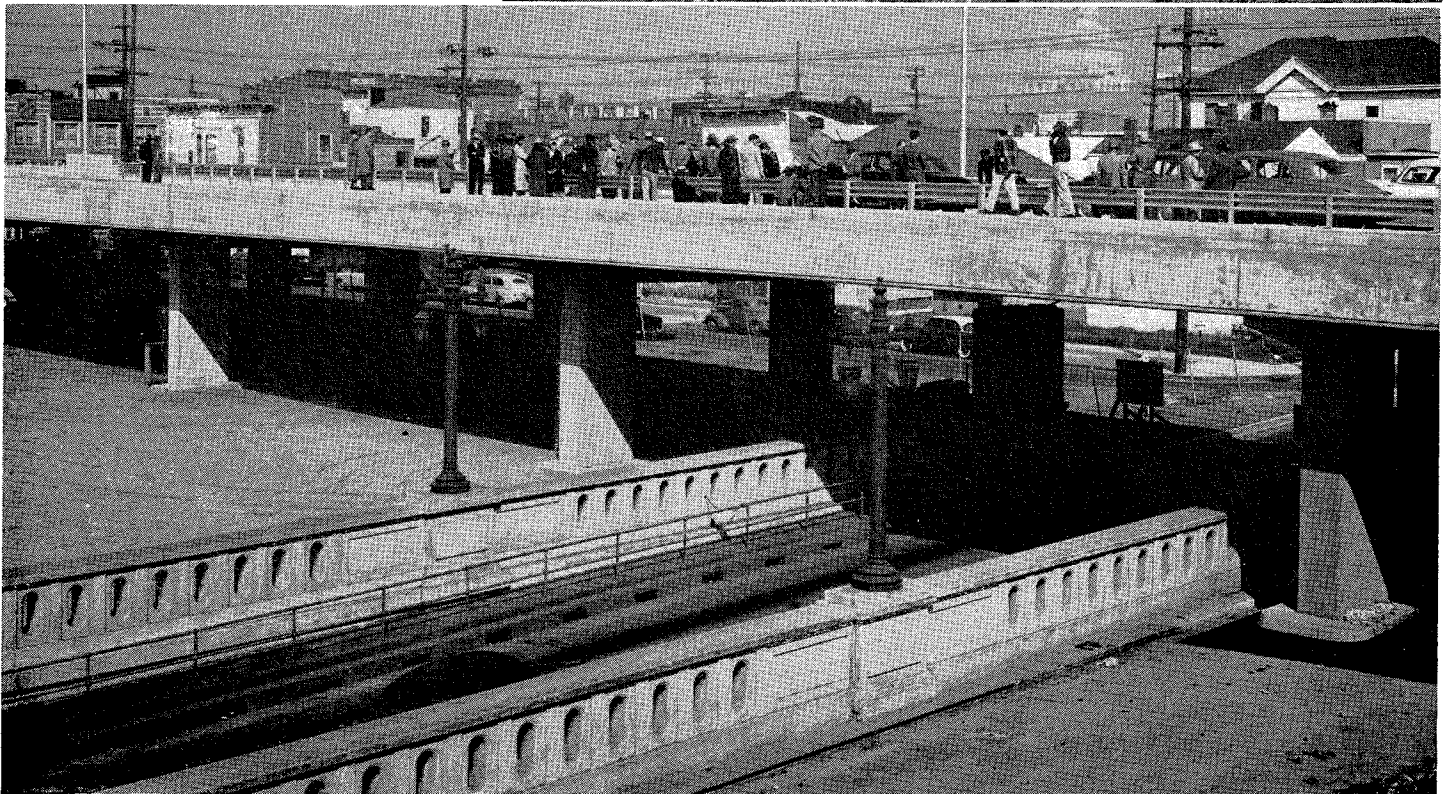
ALTAMONT PASS

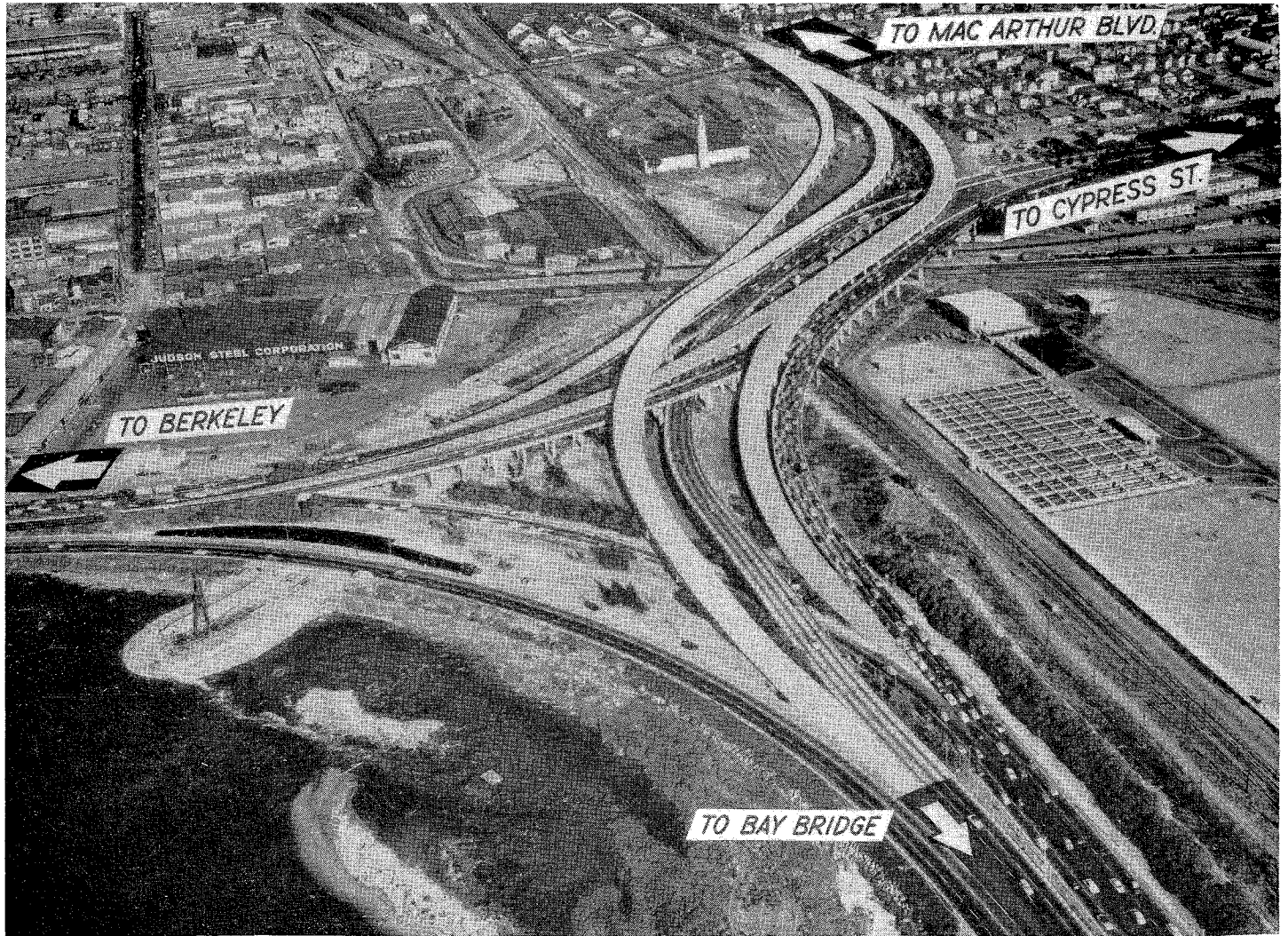
The Altamont Pass Freeway is a part of Route US 50, one of the two primary east-west routes originating in District IV. While the start of this route is on the San Francisco approach to the Bay Bridge, only the portion lying easterly of Hayward has been declared a freeway. However, the continuity of an east-west freeway facility from the Bay area to the Central Valley will be accomplished with a link from the Eastshore Freeway at San Lorenzo which will connect with this route near Castro Valley.

The development of this highway into a freeway may be considered to antedate the Freeway Law of 1939. A four-lane divided highway replacing the old Altamont Pass between Greenville and Mountain House was completed in 1938. It reflects the thinking of the time, the completed



UPPER—Eastshore Freeway in Oakland, looking north from vicinity of 29th Avenue. LOWER—Recently completed Posey Tube overhead.





Engineers drawing of improved East Bay traffic distribution structure in Oakland. A third-level ramp is being built over existing traffic lanes connecting the San Francisco-Oakland Bay Bridge with MacArthur Boulevard. A curved ramp will be added from MacArthur Boulevard to the Eastshore Freeway. The improvements will double traffic capacity and are designed to eliminate cross-weaving traffic.

job carrying many features of present freeway design.

The second section, 5.8 miles from the foot of Altamont Pass to 1.5 miles west of Livermore, was completed in September, 1950. In addition to increasing the carrying capacity of the outmoded two-lane road, this four-lane section incorporates controlled access with frontage roads, and provides a channelized connection with State Route 108 from Livermore.

CASTRO VALLEY BY-PASS

Continuing westerly, a 5.9-mile section to Hopyard Road was completed in the summer of 1951, and another from Hopyard Road to 2.5 miles west of Dublin was opened in November, 1953.

Currently under construction and scheduled for completion in September, 1954, is the 2.1-mile Castro Valley Bypass from Crow Canyon to a point near the present Foothill Boulevard. From this point construction will soon start on the 2.6-mile connecting link to the Eastshore Freeway. Work is also in progress on the most easterly 1.7-mile section in Alameda County, which is included in a District X project terminating in Tracy.

Thus with the exception of a 5.3-mile section now in the design stage extending easterly from Crow Canyon Road toward Dublin, we have a virtually completed Freeway and Expressway from Oakland to the San Joaquin County line. Typical of the rise in traffic volume on Route US 50

through the long Livermore Valley section is the daily traffic count at Greenville; in 1939, 12,000 vehicles, and in 1953, 21,000 vehicles.

The total length of the Altamont Pass Freeway is 33.9 miles, and to date \$17,700,000 has been spent or obligated for this facility.

PACHECO PASS

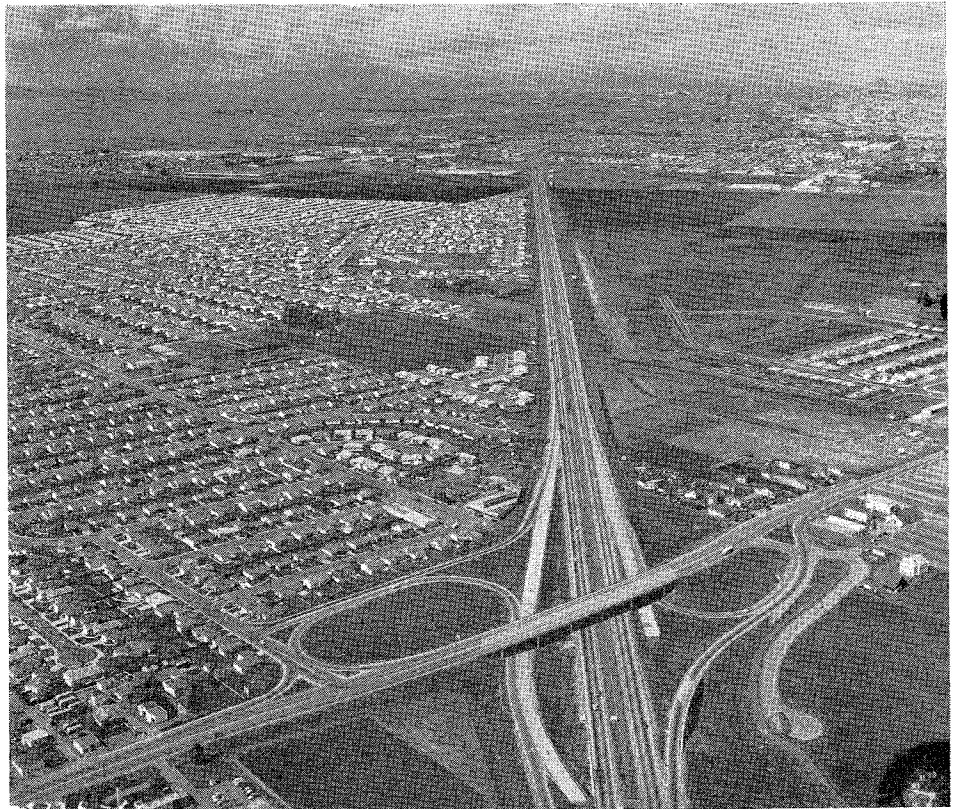
The Pacheco Pass Road, signed as Route 152, is the only connecting link between the Santa Clara and the San Joaquin Valleys. Now, heavily traveled, it developed from a toll road, and later as a transcontinental stage road, into a vital artery of transport particularly with respect to industrial service.

Replacing the alignment of convenience as it took shape through the years, a 3.25-mile section of controlled access freeway from Cape Horn to the Merced County Line was completed in December, 1950. Sustained alignment and grade on either side of the summit, compatible with heavy vehicle travel, have replaced the former sharp curves and gradients as steep as 7 percent.

A two-mile unit extending westerly from Cape Horn which was previously constructed is included in the section covered by freeway resolution. The cost of improving the 5.7 miles leading to the summit of Pacheco Pass totaled \$1,300,000.

US 101-EL CAMINO REAL

Two sections of freeway forming part of the Coast Route, US 101, in Santa Clara County, the San Jose Bypass and the Gilroy to Sargent project, were completed early in the post-war program.



UPPER—Eastshore Freeway near San Lorenzo; Washington Avenue interchange in foreground, looking north toward San Leandro and Oakland. LOWER—Southern terminus of Eastshore Freeway, showing connection to Bayshore Highway.



The two sections are considerable distance apart, funds then available limiting construction to the most critical areas.

Prior to the opening of the eight-mile bypass in June, 1947, all traffic in the Coast Highway passed through the heart of the San Jose business district. Here traffic from the Eastshore and Bayshore Highways merged on its way south, and likewise traffic from the south dispersed on its way northerly to San Francisco or Oakland.

Midcity congestion forced the building of a controlled access freeway immediately easterly from central San Jose. Continuing the Bayshore Extension which skirts the city, the freeway starts at the Santa Clara Street underpass, meeting the old Monterey Highway at Ford Road, eight miles southerly from San Jose.

It is interesting to note that upon its opening, traffic split evenly at Ford Road, one half using the old road into San Jose and one half using the by-

pass. On the succeeding years as the through traffic volume increased, substantial gains have been made on the new leg, thus sparing the city street from traffic in no manner connected with San Jose.

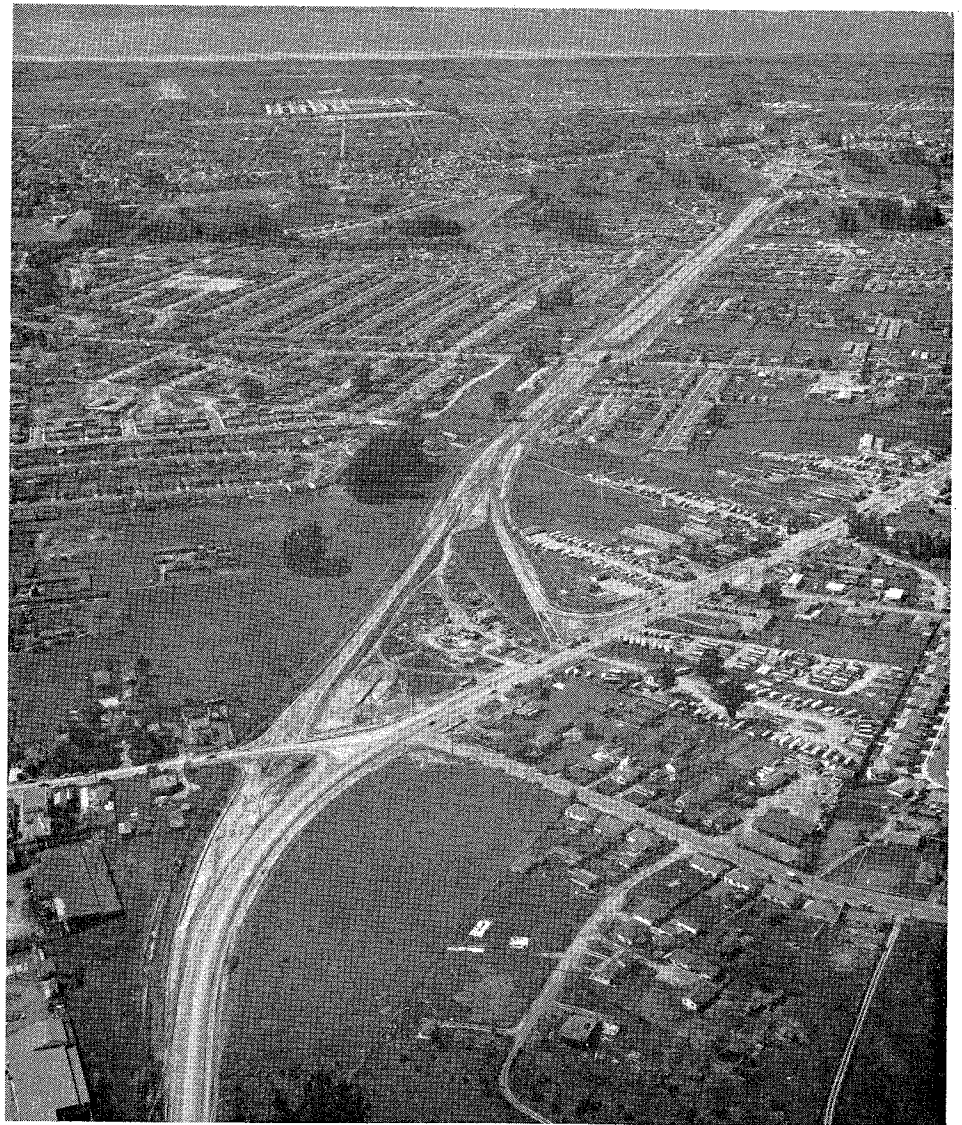
The Gilroy section, a 5.7-mile controlled access highway from Gilroy to a point 0.5 miles north of the San Benito County Line, was completed in February, 1951. This four-lane section was constructed in two units, partly as a widening of the Coast Highway, locally known as Monterey Road, and partly a new alignment. It forms an additional link in the ultimate El Camino Real Freeway presently signed as US 101.

The 14.4 miles which have been completed include all of the mileage which has been declared a freeway to date. The cost of developing these portions as a divided four-lane expressway was \$4,100,000.

WATSONVILLE-SANTA CRUZ

As early as 1936 the Division of Highways began studies to determine the best means of providing adequate facilities for the growing volume of traffic between Watsonville and Santa Cruz. The first step in the development of a new route was the completion in 1942 of a three-lane highway, with four-lane transitions where needed, between Watsonville and Rob Roy. While no extensive provisions were made for the purchase of access rights, moderate success in controlled access was maintained with the help of the adjacent hilly terrain and persuasion against indiscriminate entrance. In consequence the facility provided a reasonable facsimile of freeway features.

The growth of Santa Cruz farming, industrial and resort area soon provided a demand for an extension of the improvement to include the Rob Roy-Santa Cruz section, and resulted in the completion of a controlled access freeway in November, 1949. The cost of this project, 7.7 miles in length, was \$3,769,000 including construction and right of way, or \$490,000 per mile, reflecting the effect of eight major structures required for railroad and vehicular crossings.



Construction on US 50 in Castro Valley; Castro Valley Boulevard, the existing highway route, is shown to the right of the direct alignment of the freeway bypass

LOS GATOS-SANTA CRUZ

The highway between San Jose and Santa Cruz, in addition to serving the agricultural area through which it travels, has been subject to sizable surges in its traffic pattern due to tourist and vacation traffic utilizing the extensive resort area. The route has undergone extensive stage development and is now entering a transition to controlled access freeway.

The route in its entirety has not yet been adopted as a freeway. Precipitated by the building of the Lexington Dam, a 1.8-mile section of freeway has been completed at a cost of \$1,500,000 at a location south of Los Gatos which bypasses the dam site. Scheduled for advertising in the

summer of 1954 is the Los Gatos Bypass which connects with the Lexington section and includes an interchange dividing Saratoga traffic and that en route to San Jose. The amount of \$2,263,000 is included in the 1954-1955 budget for the construction of this project.

In the design stage as declared freeway with route adoption approved are the Los Gatos-San Jose section and the Scott Valley-Santa Cruz section.

SKYLINE BOULEVARD

The use of Skyline Boulevard as an entrance to San Francisco has grown with the development of the peninsula residential areas. Heavy grades and

short radius curves have seriously reduced the utility of the road.

Currently under construction and scheduled for completion in September is a 2.3-mile section of freeway from Edgemar Road to Alemany Boulevard. This \$1,000,000 project will facilitate funneling traffic into San Francisco dispersal routes. A connection from Skyline to the Coast Highway at Edgemar has been declared a freeway and is presently under design. This unit will provide a bypass for the Thornton Bluffs section on the coast alignment which is subject to severe punishment by the elements and from movement on the San Andreas fault which traverses this area. To the north, two additional

units are scheduled for construction this year which will extend this facility to Lake Merced Boulevard in San Francisco. The amount budgeted for the 1.7 miles included in these two units is \$1,092,000.

EMBARCADERO FREEWAY

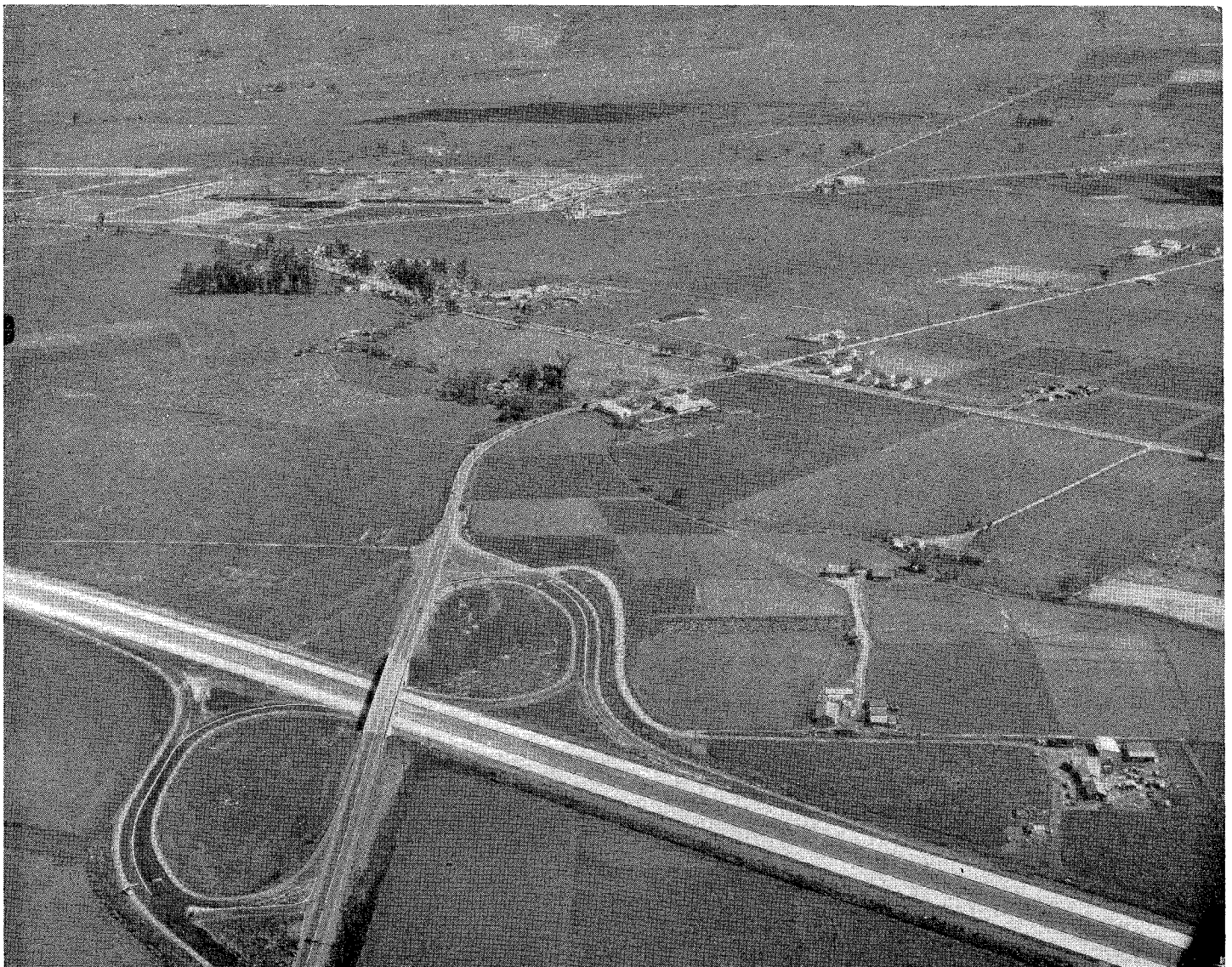
Funds in the amount of \$5,000,000 have been budgeted for the initial construction of the Embarcadero Freeway. The creation of this facility is an outstanding milestone in the development of transportation within the City of San Francisco. Crossing Market Street at the Ferry Building, it is the first freeway outlet offered to centers of employment, largely concentrated north of Market Street,

connecting with the Bay Bridge and the peninsula.

Originating in the structure which connects the Bayshore Freeway with the Bay Bridge, the freeway proceeds generally parallel to Folsom Street, curving into the Embarcadero at Howard Street. Entirely an elevated structure in order to clear the approaches to piers and sheds, the planned units will run to Broadway, where ramps will come to grade at Sansome Street.

An eight-lane divided highway, the division is in a vertical plane rather than a horizontal. The lower deck will carry eastbound traffic toward the Embarcadero and thence north-erly along the waterfront, while the

Trimble Road interchange on Eastshore Freeway. New Ford plant at Milpitas is visible to left of upper center.



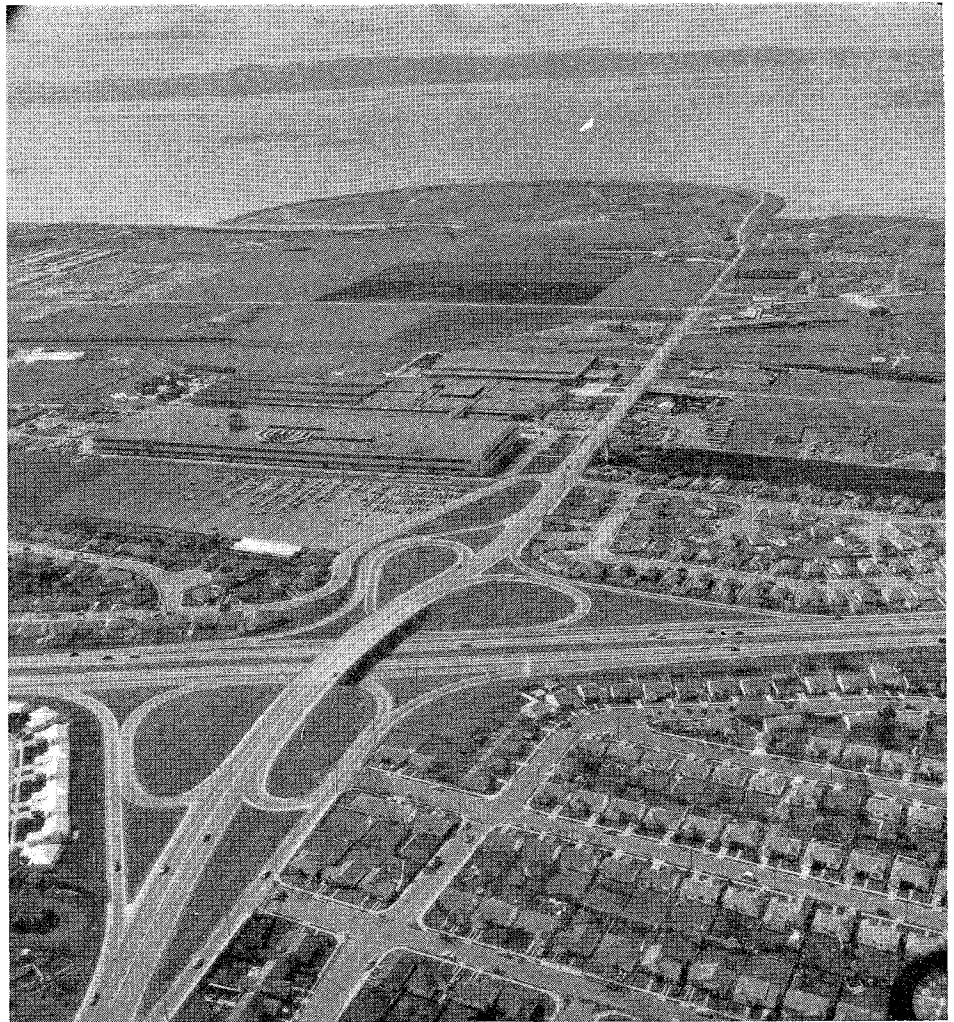
upper deck will carry traffic in the opposite direction. This unusual construction, first of its type in the State, is, of course, predicated on space limitations.

Acquisition of right of way for the first one-mile unit is nearing completion at a cost in excess of \$5,000,000.

PARK-PRESIDIO FREEWAY

The Park-Presidio Highway was built to provide an alternate route to the Golden Gate Bridge as well as to furnish a circumferential bypass from the western section of San Francisco and the Marina. While the planning of this facility predated the Freeway Law of 1939, when the 1.1-mile unit from Lake Street to the Golden Gate Bridge Approach was completed in 1940, it contained most of the essential features of a controlled access freeway, and provided an example for the people of the Bay area of what was to come in highway development. Built at a cost of \$1,200,000 this four-lane facility has served well until recent congestion has made it necessary to commence planning for increasing its capacity.

Present studies include the improvement of all of the two-mile section



Davis Street interchange on Eastshore Freeway in San Leandro

STATUS OF DISTRICT IV FREEWAY PROJECTS

March 1, 1954

	Total miles	Completed projects		Under contract		Right-of-way costs
		Miles	Construction costs	Miles	Construction costs	
Bayshore Freeway; Bay Bridge to San Jose.....	48.8	14.4	\$19,030,000	9.4	\$18,259,000	\$28,534,000
Eastshore Freeway; Richmond to San Jose.....	55.7	14.7	19,672,000	15.4	20,375,000	18,925,000
U. S. 101—Golden Gate Bridge to Santa Rosa.....	51.1	26.0	5,298,000	4.4	7,066,000	4,085,000
Black Point Cutoff; Ignacio to Sears Point.....	7.3	0.7	1,004,000			222,000
Napa area; Solano County Line to Union Station.....	22.4	14.6	1,441,000			712,000
U. S. 40—Richmond to Carquinez Bridge.....	13.8			0.1	388,000	3,500,000
Arnold Industrial Freeway; Hercules to Bridgehead Ave.....	53.2	13.8	4,400,000			1,358,000
Oakland to Arnold Industrial Freeway near Ohmer.....	19.4	2.3	226,000	1.2	1,570,000	2,700,000
Mountain Boulevard; Tunnel Freeway near Lake Temescal to San Leandro.....	9.3	1.1	1,297,000			540,000
Altamont Pass; San Lorenzo to San Joaquin County Line.....	33.9	22.6	4,720,000	3.8	2,374,000	6,263,000
Pacheco Pass; 1 Mi. east of Bell's Station to Merced County Line.....	5.3	5.3	1,285,000			20,000
El Camino Real Freeway; San Jose to San Benito County Line, portions.....	14.4	14.4	2,856,000			1,269,000
Watsonville-Santa Cruz; Santa Cruz to Watsonville.....	15.3	7.7	2,740,000			1,029,000
Los Gatos-Santa Cruz; San Jose to Santa Cruz.....	21.1	1.8	1,337,000			1,827,000
Skyline Boulevard; San Francisco County Line to Edgemar Road.....	3.4			2.2	640,000	593,000
Embarcadero Freeway; Bay Bridge to Broadway.....	1.5					5,450,000
Park-Presidio Freeway; Golden Gate Bridge to Fulton Street.....	2.0	1.1	1,172,000			50,000
Totals.....	377.9	140.5	\$67,018,000	36.5	\$50,672,000	\$77,077,000

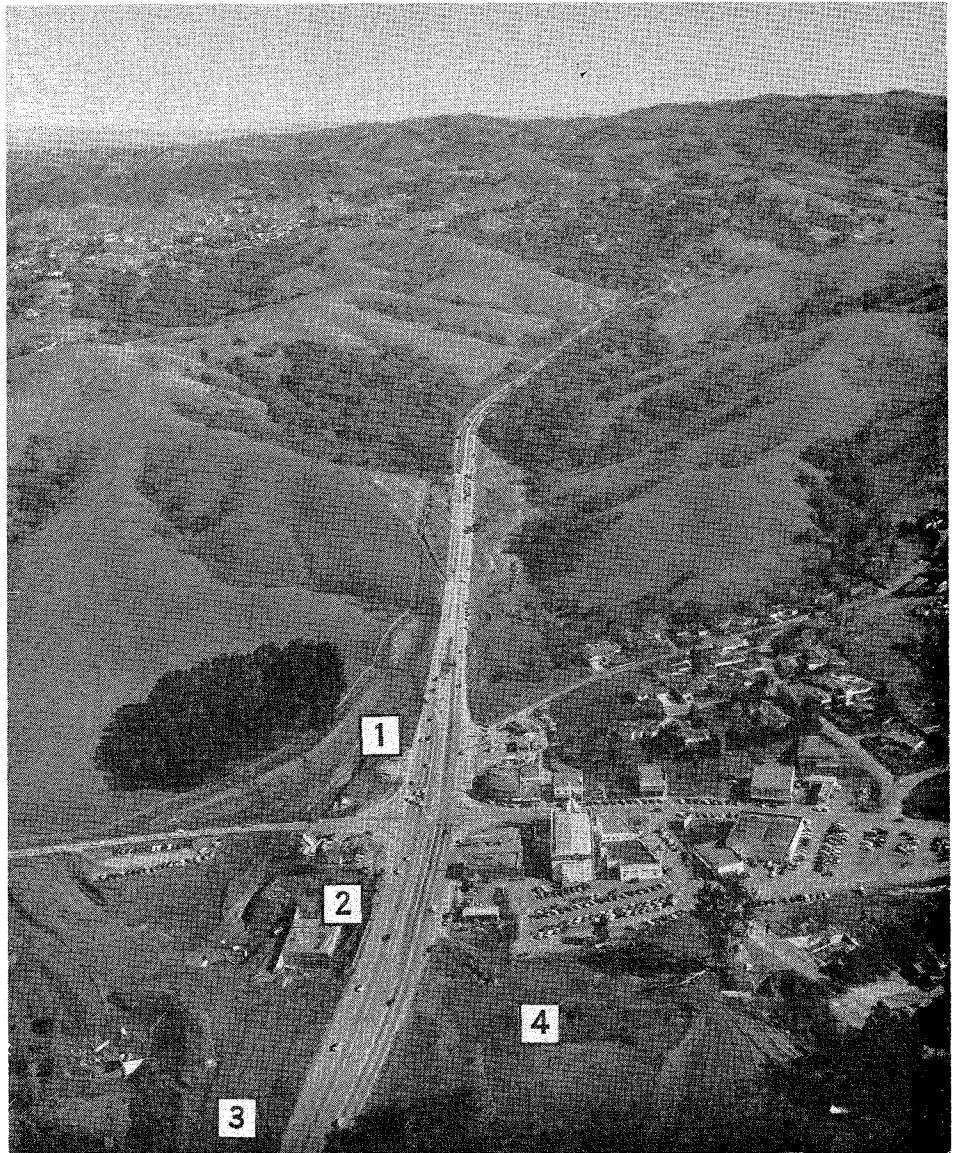
covered by freeway resolution from Fulton Street to the Marina approach to the Golden Gate Bridge.

CONCLUSION

In discussing the development of the various routes we have used the word freeway in a very general sense. Technically there are but two full freeways presently in the process of construction, the Bayshore and the Eastshore, these routes sustaining no crossings at grade.

Except for isolated sections built through expedience to the technical requirements of freeways, the remaining routes are expressways, built to freeway standards with the exception of permitted crossings at grade. They are so designed as to be converted to the higher standard when funds are available and where traffic warrants. However, the impact of the tremendous growth of the Bay region on highway transportation has made it necessary to plan initial construction as full freeways for nearly all of the projects in the metropolitan area which are now in the design stage.

Without going into details of an accident - per - million - vehicle - miles comparison, a recent survey showed a rate of 2.14 for full freeways and 3.41 for expressway types of construction. Since approximately 70 percent of all accidents occur at intersections it is evident that the true freeway with intersections at grade eliminated is the goal toward which we point. Since the tremendous cost of the full freeways restricts complete application of their desirable principles, we have of necessity limited them to the most critical areas. As funds become available and as the need becomes more pressing, our present expressways will undoubtedly enter a stage development toward full freeways.



Aerial photo of \$1,500,000 freeway project at Orinda Crossroads, looking toward Lafayette, showing progress made to eliminate congestion. Point 1 marks wider Pine Grove turn for Lafayette-to-Orinda traffic. Point 2 shows part of underpass structure and side of Orinda Village-to-Moraga route under the highway. Point 3 marks widening of State Sign Route 24 to six lanes. Point 4 is site of cloverleaf ramp routing traffic from Orinda Village into Lafayette lanes.

HAZARDS ON STRAIGHT ROADS

The mere fact that a motorist is driving on a straight road is no surety against accident. The California State Automobile Association points out that 77 percent of all accidents occur on straight roads. Driving is a full-time job and anyone operating a motor vehicle should remain alert at all times.

STABILIZING LANDSLIDES

During the 1952-53 Fiscal Year the Division of Highways installed more than 23,000 lineal feet of horizontal drains as stabilization treatment of landslides and slipouts where the highways were being seriously affected. Development and improvement of horizontal drilling equipment made it possible to drill in areas considered impossible before.

Repair and painting of bridges and structures on the State Highway System cost a total of \$592,849 during the 1952-53 Fiscal Year.

The Division of Highways spent \$78,000 to control noxious weeds along the State's highways during the 1952-53 Fiscal Year.

Bay Bridge

Improvements to Cost
\$4,000,000 Are Planned

PLANS and specifications are virtually completed for improvements to the San Francisco-Oakland Bay Bridge which will help alleviate congestion, increase safety and speed up collection of tolls.

The work is expected to cost approximately \$4,000,000, and will be financed out of bonds already issued by the California Toll Bridge Authority.

The improvements have been organized into five projects, the first three of which are due to be advertised for bids during the next three months. They are:

1. Revision of four connections to Yerba Buena and Treasure Islands.
2. Lane control signals on the lower deck.
3. Dredging and drainage structures for the widening of the toll plaza and its approaches north of the administration building and to provide for extension of the overhead structure carrying traffic to and from the Port of Oakland.

Port of Oakland Overhead

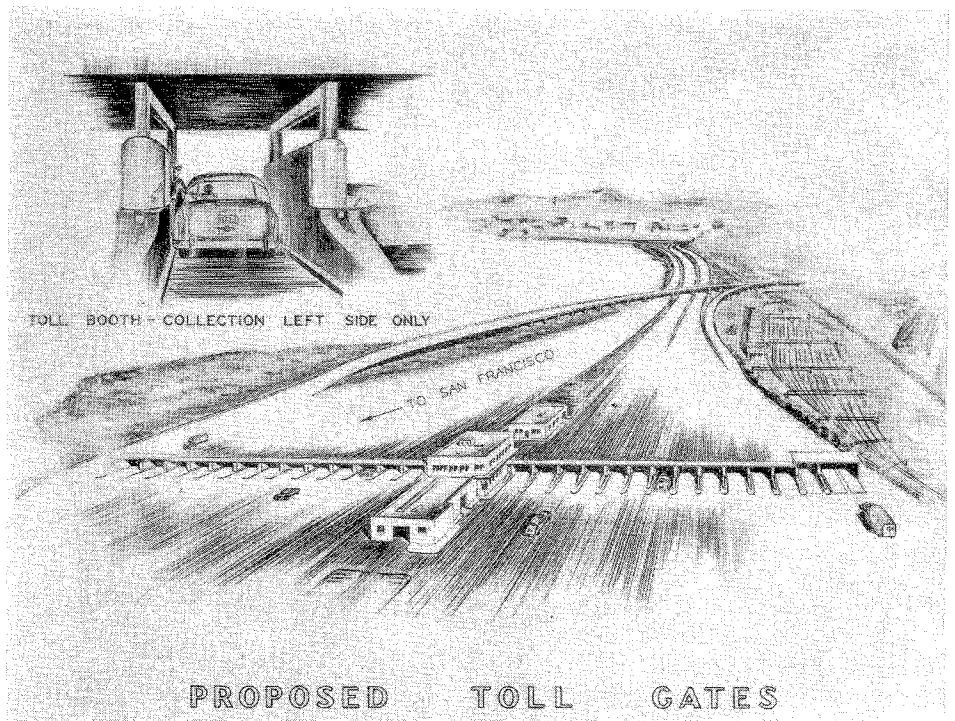
The two remaining contracts will cover the surfacing of the new toll lanes and alteration of the Port of Oakland overhead; and the revision of the existing toll lanes south of the administration building to provide for driver's-side-only collections.

Revision of the island connections will consist for the most part of easing the turns to and from the island ramps.

Automobiles entering Yerba Buena Island from the upper deck of the bridge must now slow down almost to a stop to make the right-angle turn. The new connections will permit island-bound cars to pull out of the main stream of bridge traffic and make their turns at normal speed.

Automobiles entering the bridge from the island will be able to merge into the traffic stream by means of an acceleration lane instead of having to enter at a right angle and from a full stop.

On the lower deck, trucks and buses turning from the bridge onto the



island will no longer have to swing wide, as they do at present, to avoid columns and other obstructions. These obstacles will be removed and the entrance widened.

Intersection Revision

The connections to the island were designed nearly 20 years ago. Two of the ramps were intended only for temporary use, to serve the World's Fair of 1939-40. The development of Treasure Island as a naval base made these temporary connections permanent, and the heavy postwar increase in the volume of traffic on the bridge has made revision of the intersections imperative.

The traffic signal system for the three-lane lower deck will expedite the flow of traffic by providing two lanes in one direction whenever called for by emergencies or periods of temporary congestion.

The installation will consist of signal heads placed at about 600-foot intervals above each traffic lane the

entire length of the lower deck. It is believed this system will be the longest and most complete of its kind in the world.

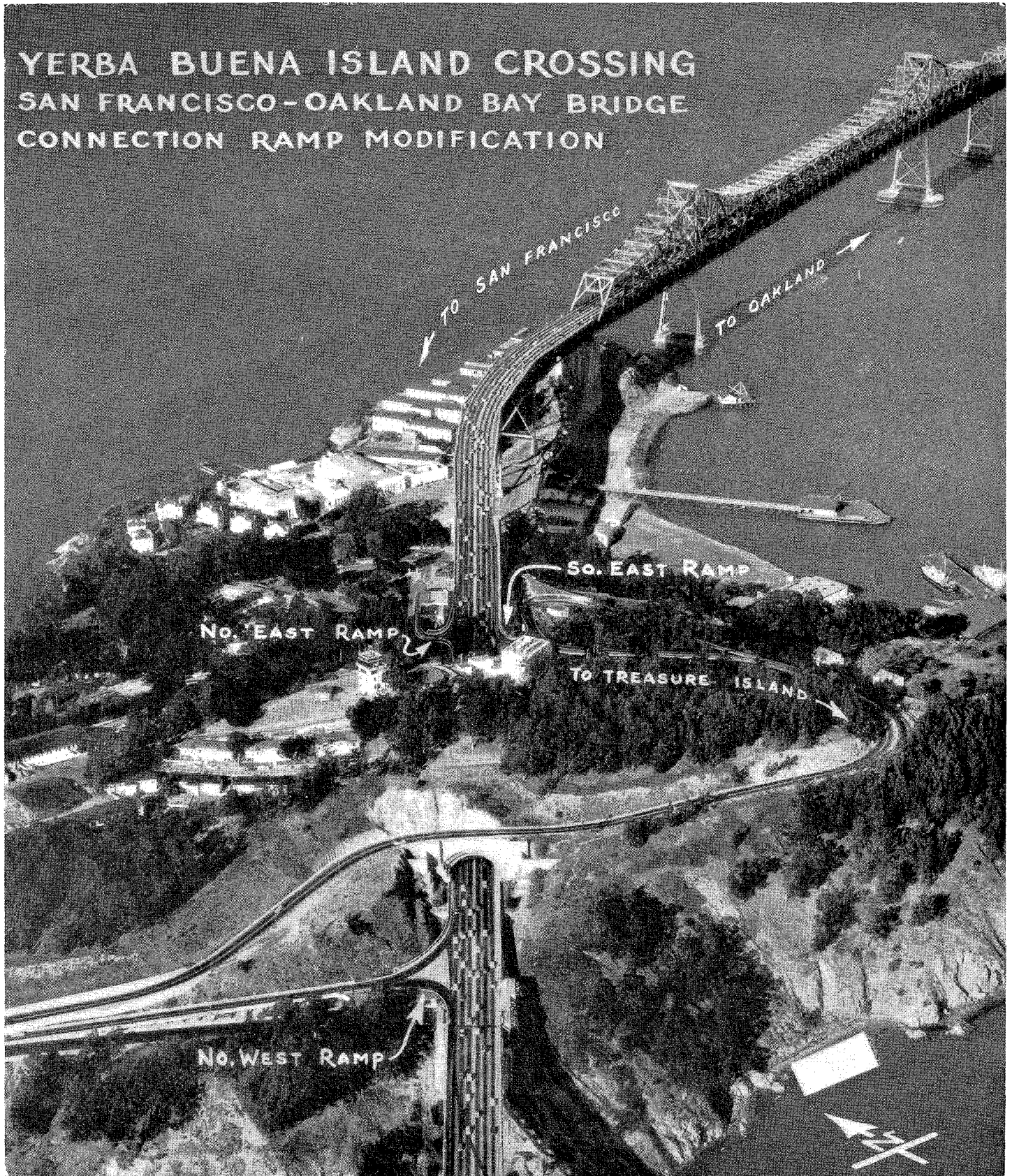
New System of Signals

An operator seated at a master switch panel in the administration building can change the signals at any time to conform to traffic conditions on any part of the lower deck, including emergency conditions as radioed or telephoned in by patrolmen or maintenance workers.

The signal system of lane control, by providing maximum flexibility in the routing of traffic, would also prove valuable in the event of any conditions making it necessary to use the lower deck for automobile traffic. During the Key System strike of 1953, when the lower deck was used by automobiles during peak periods, the adjustment of lane assignments had to be handled manually by bridge employees, placing and shifting portable signs and dividers.

... Continued on page 46

YERBA BUENA ISLAND CROSSING SAN FRANCISCO-OAKLAND BAY BRIDGE CONNECTION RAMP MODIFICATION



Artist's sketch superimposed on aerial photograph shows the three ramp connections between the upper deck of the San Francisco-Oakland Bay Bridge and Yerba Buena and Treasure Islands which will be improved to provide easier turns. A connection on the lower deck will also be improved.

Pier Construction

Rapid Progress on Richmond-San Rafael Bridge Project

By NORMAN A. RAAB, Projects Engineer, Division of San Francisco Bay Toll Crossings

IN THE November-December, 1953, issue of *California Highways and Public Works* an account was given of the early history and a general description of the work now in progress on the Richmond-San Rafael Bridge.

Since this writing, 2 of the 15 contracts to be awarded during the construction of this project have been completed, four are in various stages of completion and the other nine contracts are now being advertised for bids or awaiting the proper time for advertising.

Of the construction now in progress, probably the most interesting is the pier work being performed by the joint contracting venture, Ben C. Gerwick, Inc., and Peter Kiewit Sons' Co., under the contract for the substructure. The bid for this work amounted to \$14,500,000 and at present writing is 45 percent complete.

79 Substructure Piers

The substructure contract provides for the construction of 79 piers of reinforced concrete supported on steel H-piles to provide the foundations for the structural steel portion of the bridge crossing. During construction in the vicinity of Castro Rocks, bedrock was uncovered at higher elevations than indicated by the foundation explorations. It was necessary to raise the bottom elevations of bell piers Nos. 56 and 57.

All of the piers are of the same general class in that they are designed to be supported on steel H-piles driven to required bearing in hard strata, such as bedrock, or compacted sands and gravels. However, the methods of constructing the piers, for the conditions existing at the site, vary widely and may be classified as to construction under the headings of land piers; shallow water, or cofferdam piers; and bell-type piers for

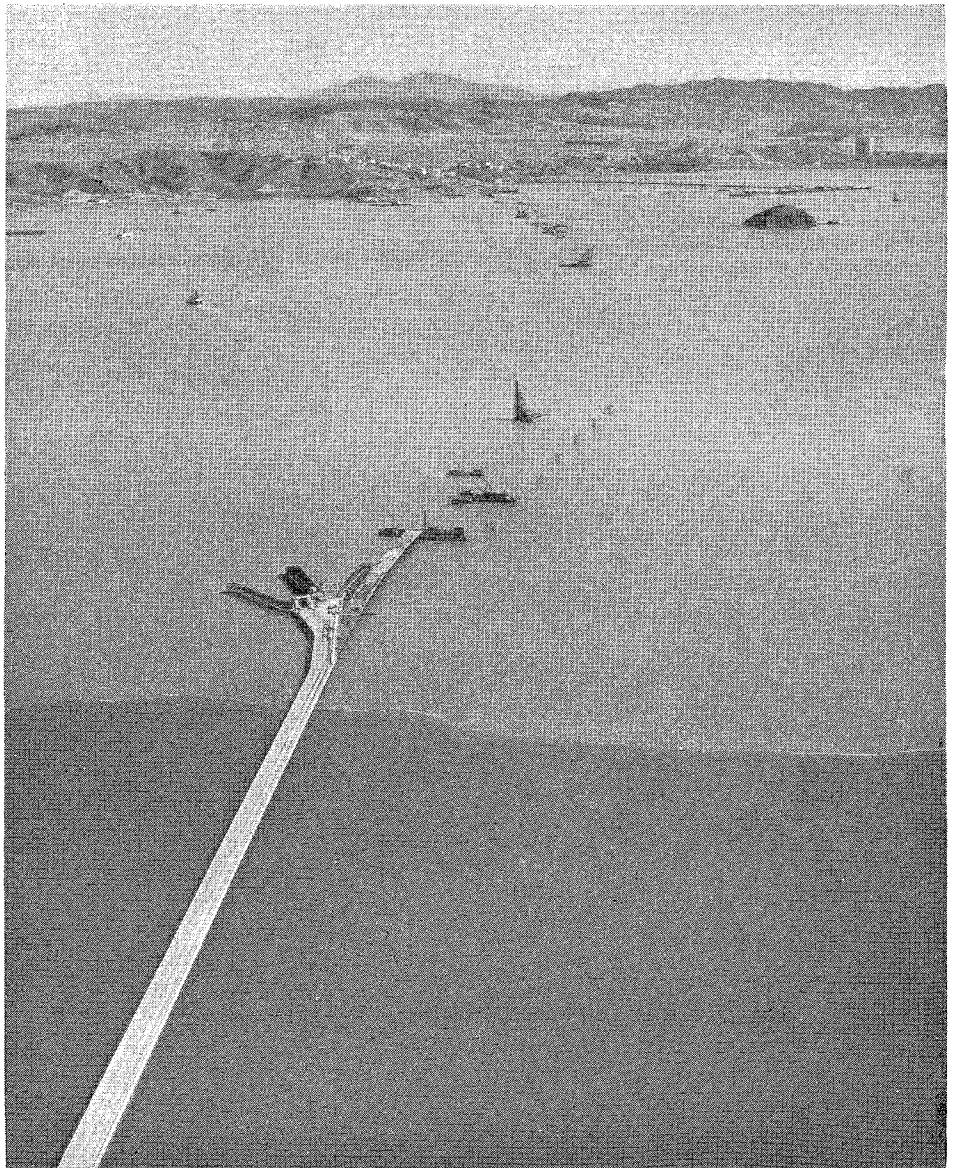
use where water and great depths of soft clay and silts overlie the firm materials.

Of the 79 piers, nine are built on land, eight are built in cofferdams in the shallow waters near the eastern bridge terminus, and the remaining 62 are of special construction for the bell-type pier designs.

Ready to Receive Steel

As of this period, the nine piers constructed on land and the eight cofferdam piers on the Richmond end of the contract have been completed. Several of the bell-type piers are now ready to receive steel and others on the west end of the bridge are nearing completion.

Trestle approach, Marin County. Trestle connecting present Richmond-San Rafael Ferry pier with permanent construction.





Completed piers Nos. 61-78 with start of steel construction, Contra Costa County

Specifications provided that the contractor develop and construct such stable temporary structures, or other devices, as would enable the engineer to establish thereon controlling centerlines and grades for the location and control of pier construction. The first of these control towers for the bell piers was placed opposite Pier No. 45 on April 14, 1953.

The contractor's procedure for substructure work was predicated on the plan that materials and equipment were immediately available to construct the land and the cofferdam piers and that special equipment and methods would be required for constructing the bell-type piers. Con-

struction of land and cofferdam piers began soon after the contract was awarded on February 26, 1953, which advanced the scheduled construction by almost six months.

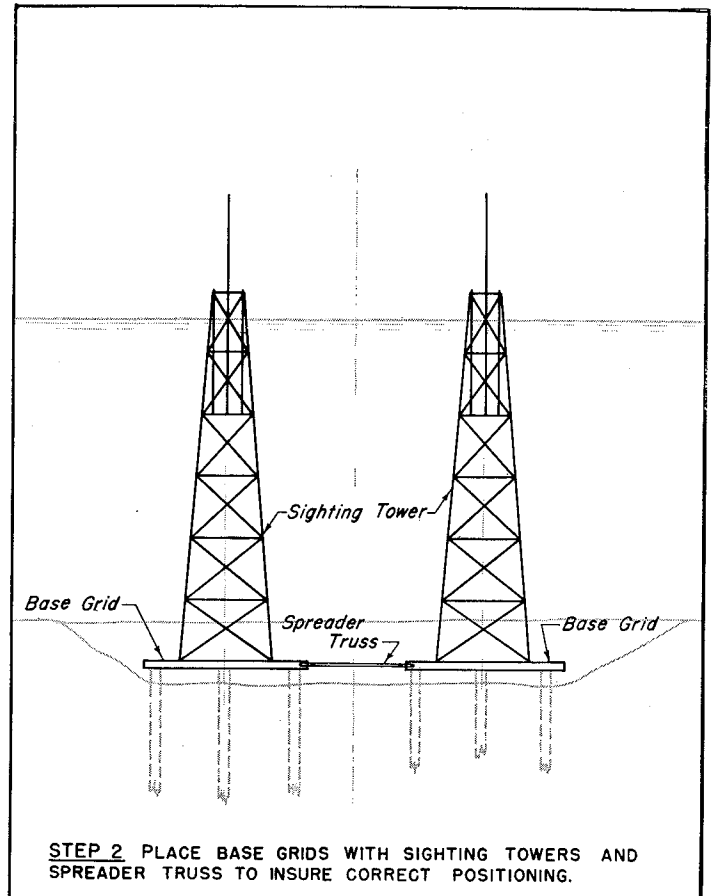
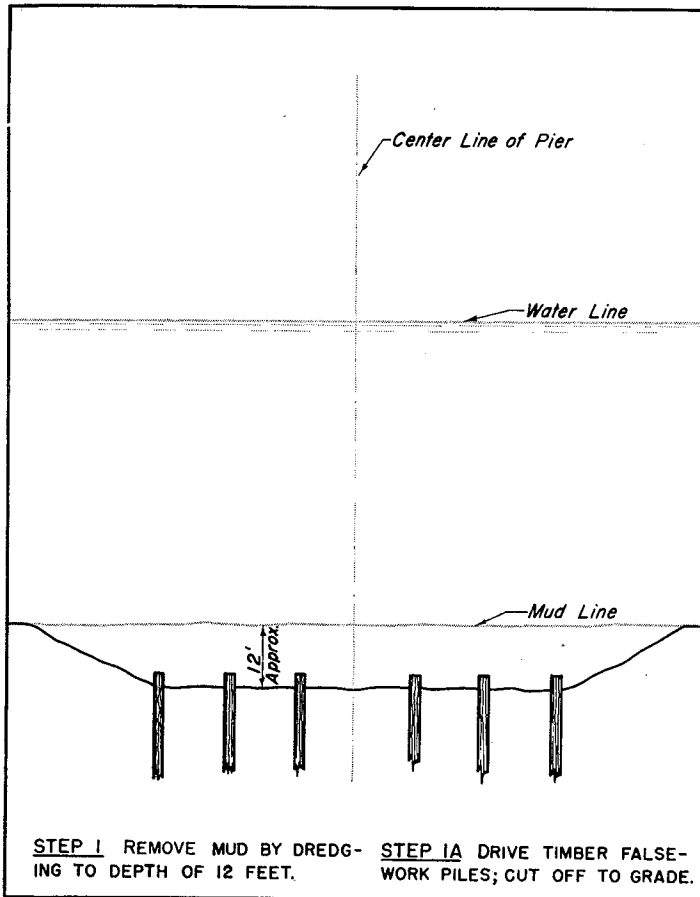
Bell-type Pier Designs

For the bell-type pier designs, the contractor elected, generally, to use precast concrete shell sections in lieu of steel plate reinforced with angle sections previously used for similar piers on several large eastern bridge projects. Completion schedules were established to come within the specified time allowances.

The contractor's choice of construction methods for the bell-type

pier designs was further predicated on: (1) fabrication of the pre-cast concrete shell sections in his Petaluma casting yard with planned barge delivery of elements to the bridge site; (2) construction of special floating equipment such as pile drivers, derricks, and a concrete plant for concrete placement at the site; and (3) shipment of steel H-piles from eastern mills to the yard of Gilmore Fabricators, Inc., Oakland, where they are spliced to proper lengths and barged to the site for driving.

Since most of the foundation cost and equipment requirements are for the bell-type piers, their construction



See photo below

is summarized in the following steps shown on accompanying drawings:

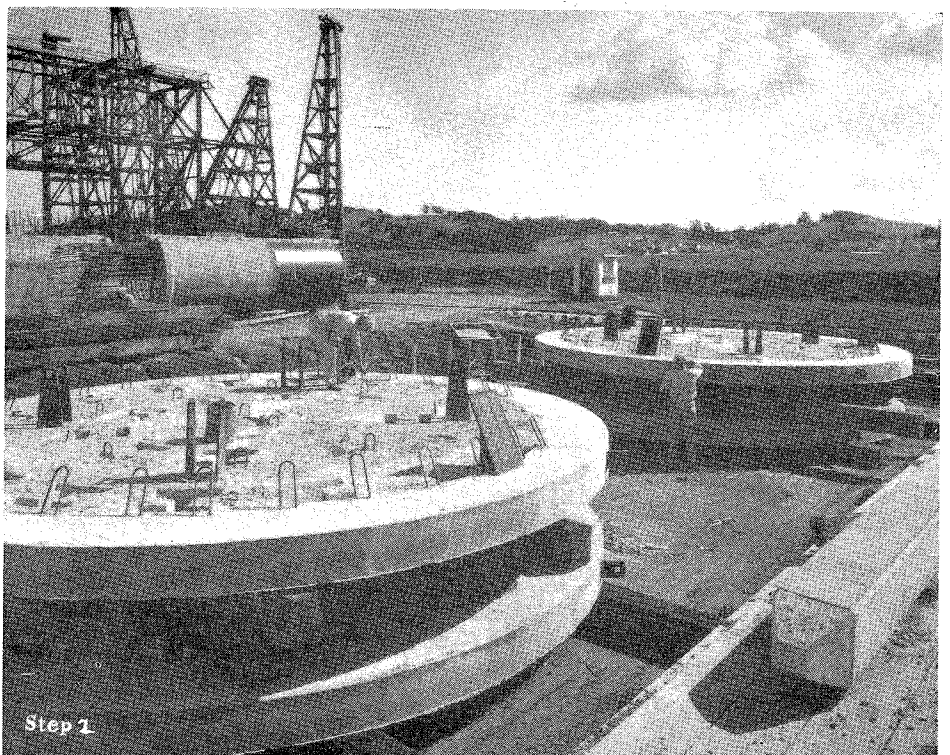
Various Steps

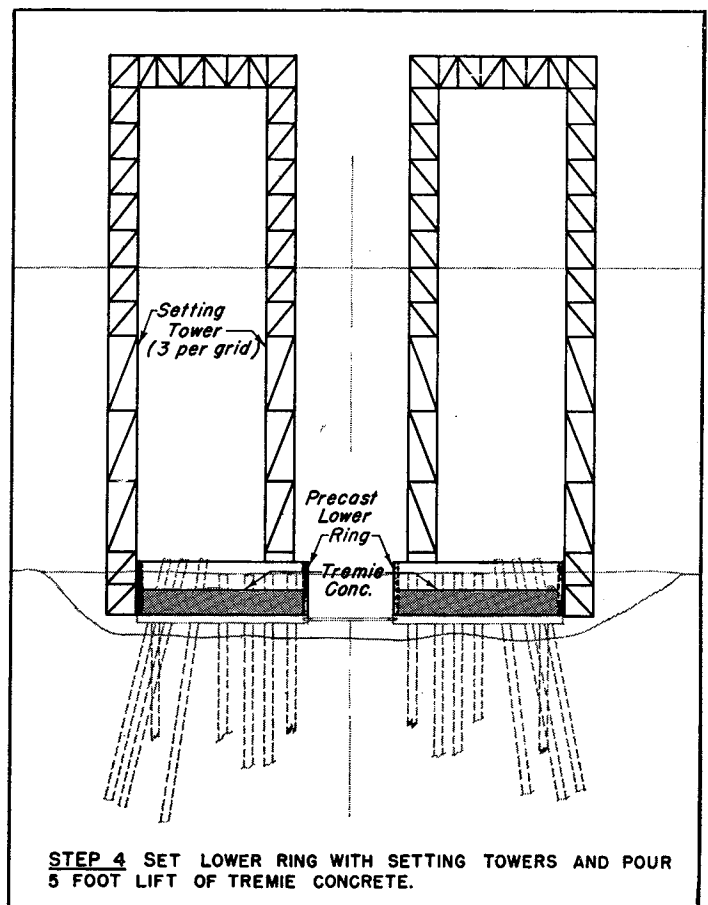
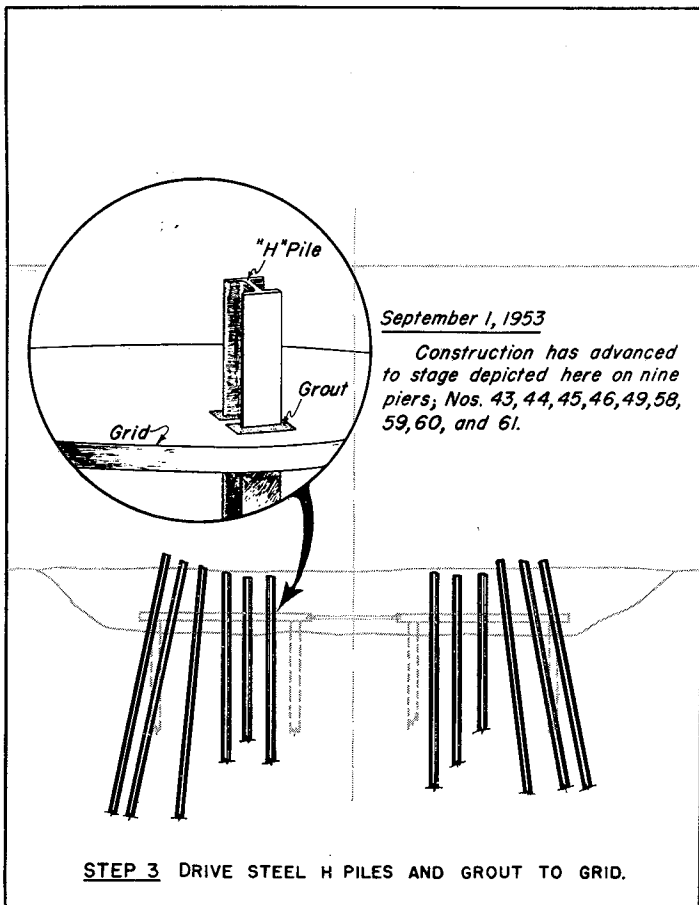
1. The soft material below the mud surface is excavated to a depth of approximately 12 feet at the site of the pier. Timber piles are then driven and the tops cut off, by an underwater saw, to an exact predetermined elevation ready to receive and support a precast concrete mat, or base grid, and the construction loads imposed thereon.

2. Each concrete mat is one foot in thickness, slightly larger in diameter than the base of the pier for which it is designed, and has cast in H-shaped slots to locate steel H-piles. The slots are in a geometric pattern and the number of piles in each varies according to type and location of the piers. The mat is placed by a derrick barge and is lowered by a cage with a centering mast. Survey controls to this mast serve in accurately placing the mat in its proper location.

3. The 14-inch 89-pound steel H-piles are threaded through the slots by divers and then driven to the required bearing

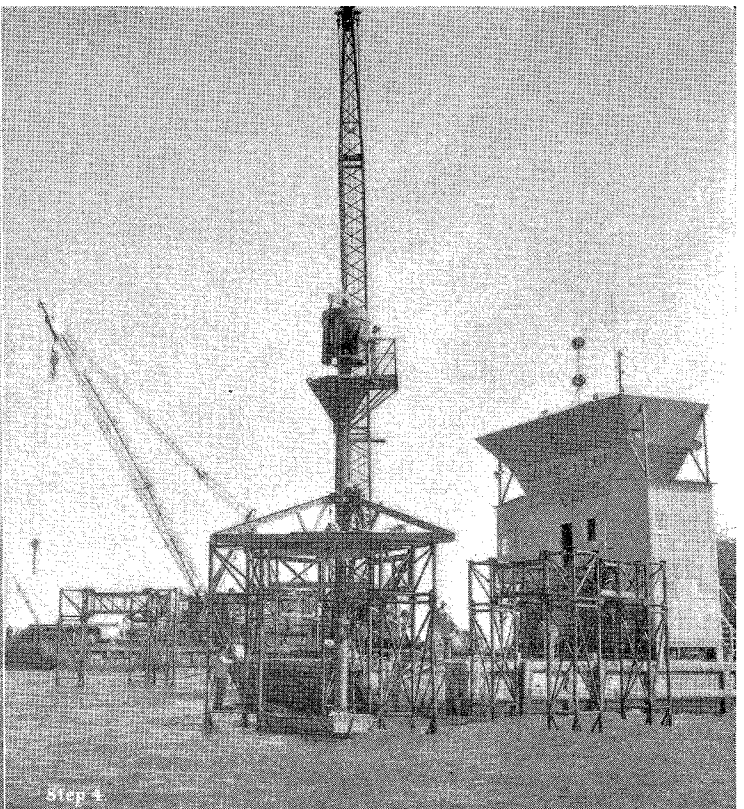
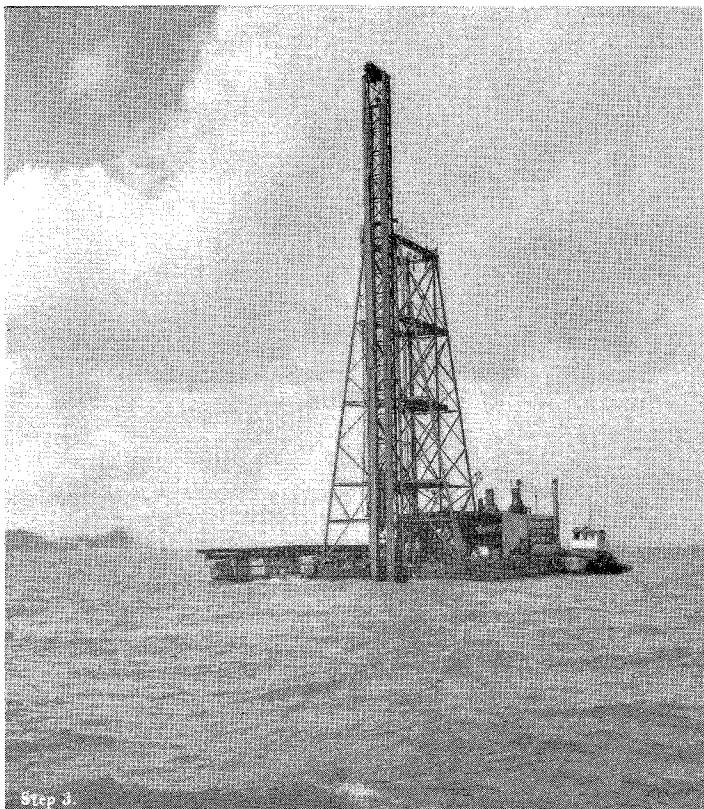
STEP 2—Precast base grid for Pier 54 in place on barge for transportation to bridge location

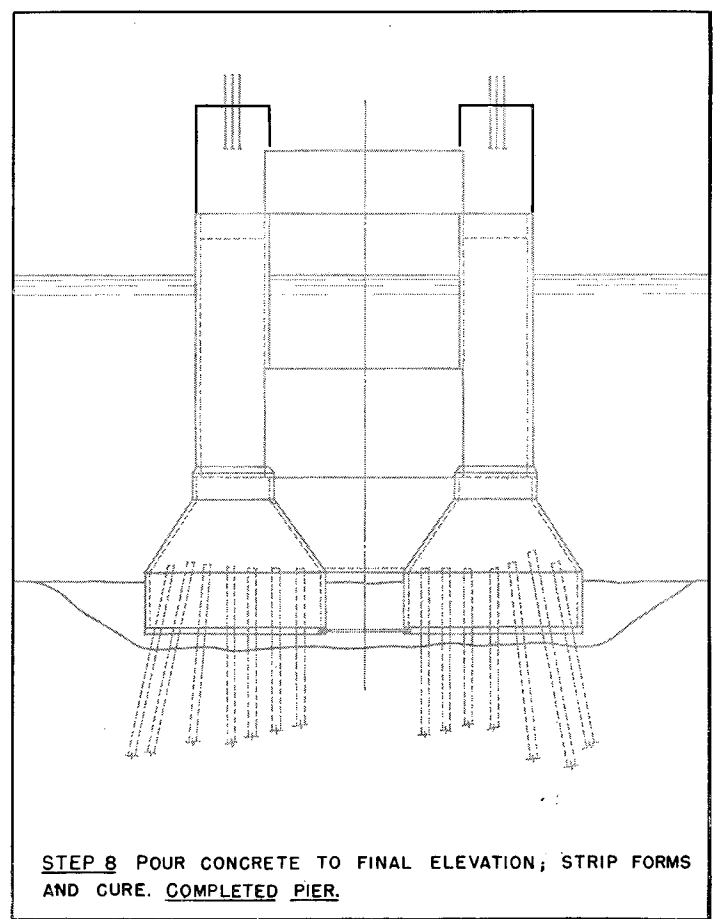
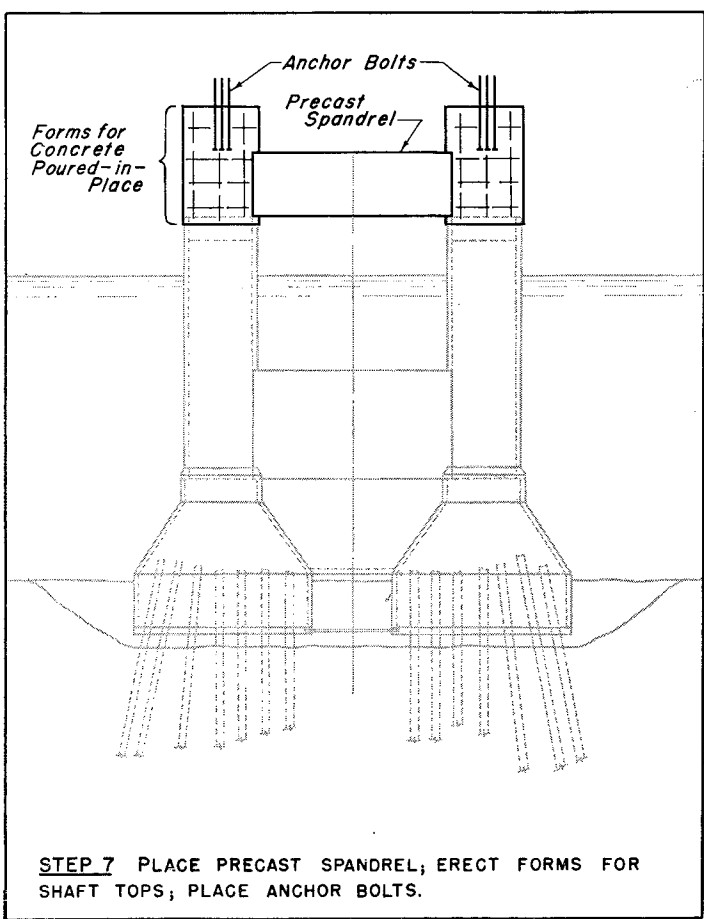
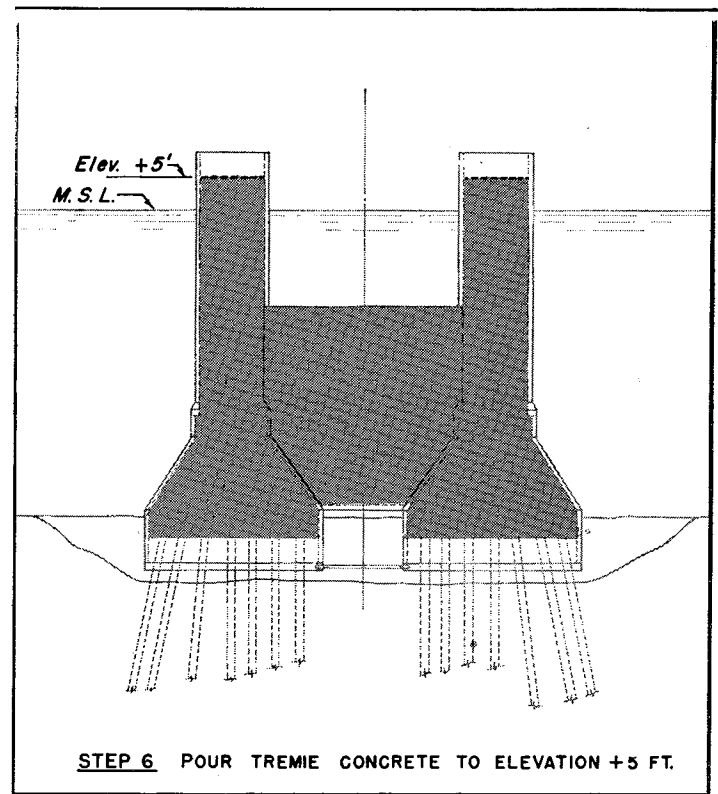
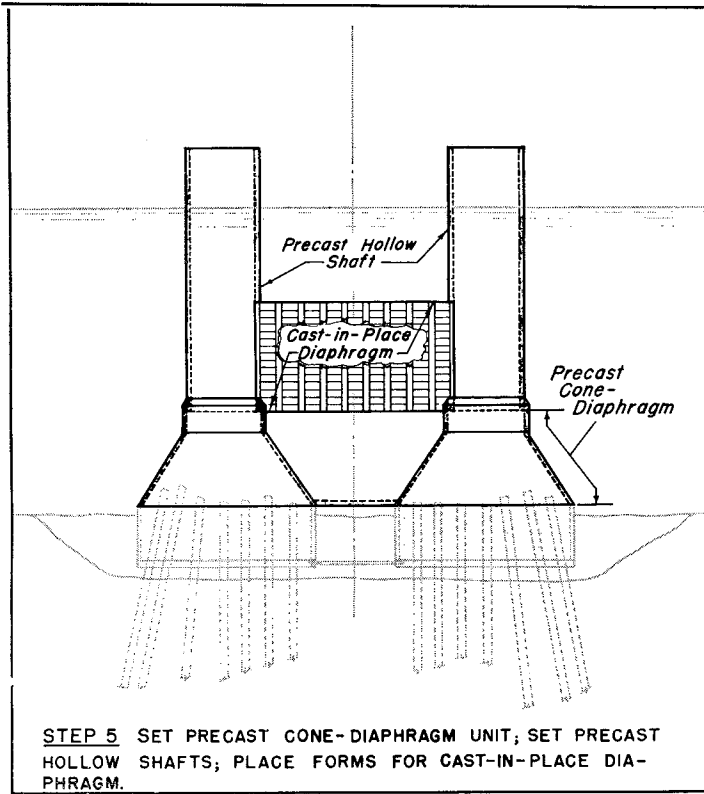




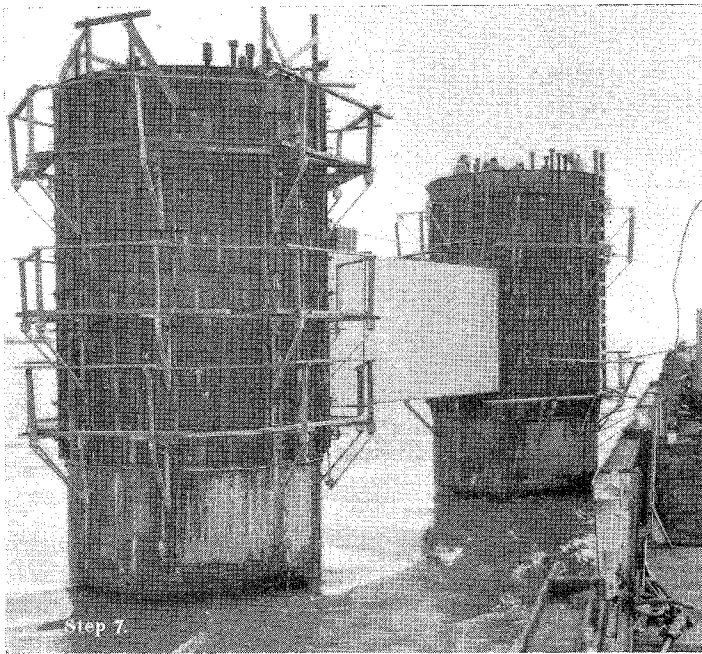
See photos below

STEP 3—Pile driver in operation on bridge location. STEP 4—Contractor's mixmaster.

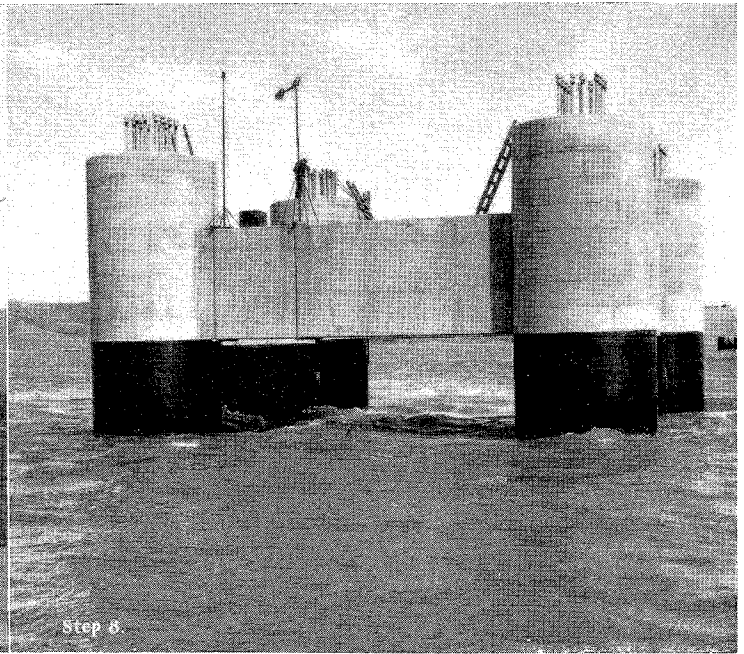




See photos page 25



Step 7



Step 8

STEP 7—Form barge preparing for final concrete pour on Pier 46. STEP 8—Deep-water four-bell pier, Pier 44.

in hard strata. After piles are driven, they are sealed in the grid slots by grout placed by divers.

4. The lower ring sections of the reinforced precast concrete shell is lowered onto the grid by a derrick barge utilizing a triangular-shaped lifting and setting tower. The shell is centered by steel

guides cast into the grid. After the shell is leveled, any open spaces between the shell and the grid are sealed. Then the grid, interior cylinder section walls, and pile surfaces are cleaned of all foreign material, and a five-foot lift of tremie concrete is placed to support further construction and design loads. The tremie

concrete placement operation includes the lowering of large tremie pipes through the shafts until their lower ends bear on the grid; and their tops, each with an attached funnel or hopper for fresh concrete, extend above water. These tremie pipes are then filled with concrete

... Continued on page 32

RICHARDSON BAY BRIDGE PLANS COMPLETED

BIDS FOR CONSTRUCTING a new six-lane bridge to carry US 101, the Redwood Highway, across Richardson Bay in Marin County will be called for within the next three months, it was announced by State Director of Public Works Frank B. Durkee.

The new 2,800-foot span will be located east of the present bridge. Construction will be financed by a \$3,000,000 allocation in the state highway budget for the 1954-55 Fiscal Year, and will take an estimated two years to complete.

The present bridge, a four-lane timber pile trestle built in 1931, will remain in service until the new bridge is finished. It has a 40-foot lift span to handle navigation.

The highway over the new structure will be 86 feet wide from curb to curb and will have a 10-foot dividing strip down the center between the

two three-lane roadways. The northern section, over open water, will be of prestressed concrete girder construction. The southern section, over the road to Mill Valley and the Northwestern Pacific Railroad tracks, will be of reinforced concrete box girders.

The bridge will provide vertical clearance of 35 feet above high water for navigation in and out of the bay, without stoppage of highway traffic. Horizontal clearance will be 56 feet.

When construction of a new Richardson Bay highway crossing first came under consideration, the possibility of building an earth fill rather than a bridge was investigated. The choice of a bridge was dictated by geological factors and other requirements, according to Division of Highways engineers.

The mud and muck at the bottom of Richardson Bay are very unstable

and wholly unsuitable for a highway fill foundation, according to engineers of the Division of Highways. In some spots the unstable material is 100 feet deep. Construction of a fill would require removal of all of this mud and replacing it with sand or other stable material, at great expense.

Engineers also point out that the permit issued to the State by the Department of the Army specifies that any structure crossing Richardson Bay must have a vertical clearance of at least 35 feet. A fill would therefore require locks and drainage structures to provide for navigation, which are costly both to construct and to maintain.

The new bridge, for which plans and specifications are nearly complete, complies with all requirements of the Army.

THE EFFICIENT SELECTION OF A CALCULATING MACHINE

By G. G. McGINNESS, Acting Engineer, Service of Supply

IN THE PAST five years, the Service and Supply Department has procured for the California Division of Highways 438 calculating machines at a cost of almost \$180,000.

The need for calculators is rarely disputed but there is sometimes a difference of opinion on which make and model should be purchased. Controversies arise regarding the necessity of special features and gadgets. With so much money involved in purchase price, and a great deal more for salaries of operators, it is almost imperative that a thorough engineering analysis be the basis for selection.

If the prospective buyer and user of a calculating machine was thoroughly familiar with all the makes, models, and special features of the machines available, and if he knew all of the problems the machine would be called upon to figure in the next 10 or 20 years, he would be able to select the best model for the job with little effort.

Selection of Efficient Machine

No man, however, is so fortunate as to possess all of this knowledge. He must have help. The user knows what his present problems are and he should have a very good idea of what his problems will be in the future.

Good sales representatives know what their machines will do. The two must work together in the selection of the most efficient machine.

The prospective buyer should prepare a complete example of each problem that the machine will be expected to figure repeatedly over a period of years. These examples he should submit to the sales representatives of the various makes of machines who in turn will work the problems on their several models, detailing procedures, until they find the model and procedures which will handle the majority of the problems most efficiently.

When this has been done, the sales representative should submit to the user a proposal fully describing the machine, stating its price, and giving a step by step outline of the procedure for figuring each problem.

Tests Must Be Made

The user should then borrow one of each of the proposed machines and place them in actual use for two or three weeks to test the proposed figuring procedures, make time studies, and observe incidental features of the machines.

Incidental features to be considered are ease of operation, size of machine, quietness, and availability of service.

The highest priced fully automatic electric machine might prove to be most efficient as it should last 20 years and cost about 30 cents per working day, including regular maintenance, but there are many cases where the lowest priced hand machine costing 10 cents per working day will do the necessary work even more efficiently.

If the prospective buyer and user of a calculating machine does a good job in the preparation of examples and follows up with a thorough testing of machines and procedures, he cannot fail to make a good investment. The sales representatives must prepare their proposals accurately as they are in competition and any carelessness on their part would in all probability result in the loss of a sale.

Clearing House

Service and supply engineers of the California Division of Highways have urged the use of this method of selection for many years and they believe that machines purchased for the Division of Highways are the most efficient and economical for the intended use.

Corollary to the efficient selection of a calculating machine, the detailed procedure for figuring each problem will serve as an instruction sheet for

new operators. With step by step instructions, a new operator should be calculating efficiently with a minimum of time and supervisory effort expended.

It is quite probable that a person figuring on a machine day after day will discover new and better procedures or short cuts in adopted procedures. Such improvements in methods should be passed on to other operators to improve their efficiency. For this purpose, the Headquarters Service and Supply Department is willing to act as a clearing house for the Division of Highways and will disseminate this information throughout the division.

STREET LIGHTING SESSION

A conference on street lighting will be held in San Francisco Tuesday morning, April 20th, as a parallel session to the eighth annual regional conference of the South Pacific Coast region of the Illuminating Engineering Society. A demonstration of street lighting research problems at the University of California's field test laboratory at Richmond the same evening will be a second event of special interest to all who are concerned with traffic lighting problems.

The regional lighting conference will open at 9 a.m. on Monday, April 19th, at the San Francisco Museum of Art, under the joint sponsorship of the Northern California Section of the I. E. S. and the Northern California Chapter of the American Institute of Architects. The two-day program will be devoted to lighting as an element in architecture and interior design. Numerous nationally-known speakers from the East are expected to attract attendance from many parts of the region, which includes California, Nevada and Hawaii. The parallel session on street lighting the next day will open at 9 a.m. at the Western Merchandise Mart.

Cooperation

Bay Area Meets Traffic Crisis on San Francisco-Oakland Bay Bridge

By B. J. TALVACCHIA, Traffic Engineer, San Francisco-Oakland Bay Bridge

OPERATION COOPERATION might be considered an appropriate term to describe the 11-week period of unusual traffic conditions on the San Francisco-Oakland Bay Bridge during the 1953 Key System strike. This article is an account of how the driving public and the traffic authorities of an entire metropolitan community banded together to enhance traffic safety and expedite the movement of peak-hour traffic during a transportation emergency.

Cooperation by Public

Cooperation by the driving public and among public agencies in the Bay area always has been an important factor in meeting the normal traffic problems on the Bay Bridge in the past, just as in any metropolitan area in the State, or Nation, where existing facilities are carrying an overburden of vehicles beyond their practical capacities. However, the cooperative movement during the strike is noteworthy for the unusual amount of coordinated effort contributed by the several agencies directly connected with handling bridge traffic, together with the excellent assistance supplied by the driving public.

Vehicular traffic on the bridge during this period increased with a sudden impact due to the public transit shutdown affecting about 54,000 passengers per day normally using the transbay train and bus facilities of the Key System Transit Lines. Inasmuch as the bridge vehicular capacity is overtaxed under normal conditions, potential congestion of traffic under these abnormal circumstances presented a problem of major proportions.

Advance Plans

Plans began to take shape to meet the anticipated problem about a month prior to the beginning of the strike. As early as June 26, 1953, when Key System employees threatened to walk out, a meeting was held at the

Bay Bridge office, attended by representatives of the California Highway Patrol, San Francisco City Police, and the Bay Bridge staff. In general the experience gained during the strike of 1947 served as a guide, and the meeting succeeded in laying the groundwork for coordination among the organizations present in the event that the strike did occur.

When the decision to strike was announced a few days prior to the effective date, another meeting was held in San Francisco at which time plans were completed in order to meet the anticipated transportation emergency. Other organizations contacted prior to the beginning of the strike included the City of Oakland Police Department, military authorities at U. S. Naval Station on Treasure Island and the Oakland Army Base, and Bay area trucking and draying associations. In addition, press releases were sent out to the major Bay area newspapers, radio and television stations, all of whom willingly served to contact the driving public. These organizations joined together in coordinating activities involving bridge traffic during the strike in order to minimize bridge traffic congestion.

Some Statistics

Statistical records of bridge traffic during the strike, when compared to a similar period of the previous year, reflect the amount of public cooperation and the favorable results obtained throughout the strike period. Some of the more significant statistics are listed below:

	Non-strike period 7/25 to 10/10/52	Strike period 7/24 to 10/9/53	Percent change
Traffic			
Total traffic	6,809,373	7,467,503	+ 9.7
Daily average	87,300	95,737	
Number of passengers per car	1.7	2.0	
Accidents			
Total accident rate per MVM*	2.68	2.08	- 22.4
Property damage only per MVM	2.08	1.55	- 25.5

	Non-strike period 7/25 to 10/10/52	Strike period 7/24 to 10/9/53	Percent change
Personal injury rate per MVM	0.58	0.53	- 8.6
Fatal accident rate per 100 MVM	2.51	0	-100.0
Emergency Services			
Number of vehicles serviced	2,130	2,271	+ 6.6
Daily average	27.3	29.1	
Number of vehicles crossing bridge per vehicle serviced	3,197	3,288	+ 2.9

* MVM = million vehicle miles.

No Major Traffic Jams

The strike began at 12.01 a.m. on Friday, July 24, 1953. Over 100,000 vehicles crossed the bridge on the first day and traffic moved with little or no delay, even during the morning and afternoon peak periods. The first week the average daily traffic was up to 93,000, or approximately 6,000 vehicles above normal. The heavy traffic failed to develop any major traffic jams on the bridge proper and delays to commuters were few during the first week. Traffic flow, especially on the San Francisco approach ramps, was noticeably smoother than normal.

During the second week the average daily traffic jumped to 94,000, the third week to 96,000. Bridge traffic continued to move with surprisingly little delay. By the end of the eighth week the average daily traffic had soared to 98,500 vehicles. And, by eliminating the week-end totals, the average weekday traffic during the eighth week had reached 102,815 vehicles per weekday.

The ninth week began on Friday, September 18th, with 109,035 vehicles crossing the span, thereby establishing a record high volume for a 24-hour period throughout the 17-year history of bridge traffic. A few days later, on September 23d, the sixty-second day of the strike, the Department of Public Works' staff photographer was on hand to snap a series of aerial photos

showing traffic moving along the bridge roadway relatively free of congestion. On this sixty-second day, the official count for the 24-hour period was 100,148. Peak-hour traffic was close to 10,000 vehicles per hour in both directions.

Six Factors

There were at least six factors which contributed to the safe and expeditious movement of bridge traffic, especially during peak hours:

1. Careful, courteous, and comparatively stall-free driving.
2. Spreading of normal commuter (peak-hour) traffic over a longer period on a voluntary basis.
3. Absence of commute busses on the lower deck.
4. Change in the normal pattern of truck traffic on the lower deck.
5. Car pooling.
6. Additional man power directing traffic in the areas immediately adjacent to bridge approaches on both sides of the bay and at strategic locations along the bridge roadway.

A remarkable degree of cooperation by the driving public under emergency conditions is indicated by an analysis of the statistical data, which shows a higher ratio of the vehicles crossing the bridge to vehicles requiring emergency service during the strike, in addition to a lower accident rate. The reduced accident rate is especially significant since the accident frequency decreased in spite of the substantial increase in traffic volume.

U. S. Navy Assists

Spreading of normal commute traffic, which made bridge space available for the additional automobiles required to transport the extra passenger load on the upper deck, was very helpful. For example, the U. S. Naval Station at Treasure Island changed employees' working schedule by one hour. The result was that several hundred cars which normally cross the bridge between 7.30 and 8 a.m. westbound, and 4.30 to 5 p.m. eastbound, actually cleared the Toll Plaza prior to 7 a.m. westbound, and before 4 p.m. eastbound, beginning with the first day of the strike.

Diversion of automobiles to the lower deck helped greatly in the handling of traffic during morning and afternoon peak periods. The success of this diversion was substantially assisted by the absence of the normal load of Key System busses and by the voluntary reduction of truck traffic during the peak traffic periods. A passenger count taken at the Toll Plaza by the bridge management indicated that, on an average, approximately one extra passenger was carried by every third car. This was in addition to the passengers usually carried by automobiles. Some passengers reverted to the use of Southern Pacific ferries to cross the bay.

Police Control Traffic

Traffic police in San Francisco and Oakland were concentrated in areas adjacent to bridge ramps to control and direct traffic approaching and leaving the bridge. They helped to

reduce, and often to eliminate, many bottlenecks which normally occur in the areas adjacent to the bridge approaches on both sides of the Bay. The Highway Patrol, in charge of the policing of the bridge and the East Shore Freeway, assigned personnel to maintain a maximum of cooperation with traffic police on both sides of the Bay.

Results of the combined efforts for the full strike period are indicated by the pictorial record shown on these pages. To be sure, there were many instances of minor congestion and even some major traffic jams during the 11 weeks of the strike. Generally, however, weekday peak traffic crossed the bridge with few delays that might be considered objectionable in the circumstances. And, of greater importance, the accident frequency continued at, or below, the favorable level existing prior to the strike.

Close-up of Toll Plaza looking easterly. Note the idle railway rolling stock in storage yard adjacent to toll gates. Vehicular traffic passed through the toll gates in record numbers. The toll collection staff did a remarkable job under difficult circumstances as evidenced by the fact that collectors handled daily, during peak hours, as many as 12 cars per minute, or one car every five seconds.





Close-up of the San Francisco ramp system looking southerly. In the center foreground, automobile traffic in the San Francisco city streets is being partially diverted to the lower deck (truck level) by the San Francisco city police. The absence of Key System buses, which normally use the lower deck, assisted materially in making it possible to divert a substantial amount of upper-deck traffic to the truck level, thereby relieving the potential bottleneck at the merging point of upper-deck ramps shown at center righthand portion of picture.

This interesting phase of San Francisco-Oakland Bay Bridge traffic history is a tribute to the cooperative

spirit that was displayed in the Bay area. It can be appropriately designated "Operation Cooperation."

LEBANON INTERESTED

BEIRUT, LEBANON
March 15, 1954

MR. KENNETH C. ADAMS, *Editor*

DEAR SIR, With great interest, I ran through your last January-February issue of *California Highways and Public Works*, the first number of that magazine I had the pleasure to discover during my short stay in Turkey on an official mission developing highway construction and maintenance.

It will be very much appreciated if you will be so kind as to put my name on your mailing list and send me, at home to the undermentioned address,

that January-February issue and the future publications which I hope will be of great value to my country, the Lebanon.

Sincerely yours,

M. A. ITANI, Engineer
Ministry of Public Works
Beirut, Lebanon

Maintenance forces of the Division of Highways straightened or erected 12,500 signs and cleaned or washed 27,746 during the 1952-53 Fiscal Year. The increasing volume of work of this type required development of a sign washing machine.

Initial Link of Sacramento-Lodi Freeway Planned

THE STATE Division of Highways has announced it expects to advertise in late spring for bids on the first stage of construction of a five-mile section of four-lane freeway on US 50-99 between Sacramento and Lodi.

Building of this section, extending along the existing highway between one-half mile south of Elk Grove Road and two miles south of Florin Road, will be the first step in the proposed development of US 50-99 between Lodi and Sacramento as a full freeway of four lanes, with provision for an ultimate six lanes.

An item of \$1,000,000 is set up in the 1954-55 State Highway Budget to start construction on the five-mile section. The work which will be under way this summer includes the separation structures, the drainage structures and grading incidental to the structures. Some frontage road grading and paving will be performed preparatory to a second contract, not yet budgeted, which will include the main grading and paving.

As the freeway is developed, frontage roads will be constructed along both sides of the highway to connect with overhead structures which will carry cross-traffic. The frontage roads will provide complete access to adjoining lands.

The unit on which construction is scheduled is south of the proposed South Sacramento Freeway, most of which is planned for an initial six lanes beginning at Elsie-Mack Road, 2.2 miles south of Florin Road.

Plans of the Division of Highways now call for ultimate development of US 50-99 as a full freeway, with no intersections at grade and separation structures for all cross traffic. State Highway Engineer G. T. McCoy explained that original plans called for an expressway with some intersections at grade, but that great increases in population and traffic have made development to the highest freeway standards necessary as soon as possible.

DETERMINING BITUMEN AND MOISTURE CONTENT OF BITUMINOUS MIXES BY A NEW FIELD TYPE EXTRACTOR

By ERNEST ZUBE, Supervising Materials and Research Engineer

INTRODUCTION

A PROBLEM of prime importance confronting the paving engineer is the accurate and positive control of the asphalt content in bituminous mixtures. The problem of control has become increasingly more complex in recent years with the advent of the continuous type mixing plants which proportion the ingredients of the mixture by synchronized volumetric measuring devices.

Since the successful paving mixture depends to a large degree on a uniformly controlled gradation of aggregates and a consistently proper amount of asphalt it becomes obvious that the engineer should be equipped with a simplified, rapid and dependable method for determining at the job site the day to day uniformity of these essential factors. Consequently, many engineers have felt that there has been a need for a bituminous extractor which will accomplish this objective.

Various Methods Studied

Various methods and equipment for the determination of the bitumen content have been studied and tested by the Materials and Research Department over a period of several years before developing the method described. These methods all had one or more of the following faults: Complicated manipulations, inflammable or toxic solvent, lengthy calculations, difficulty in extracting certain types of mixes (particularly fine mixes), excessive time required to complete extraction tests, and the reliability of results in many cases not too certain.

In developing a new type of bitumen extractor it was a requisite that the equipment meet the following requirements:

1. The apparatus must be portable and easy to assemble.
2. It must be comparatively simple to operate.
3. The results obtained must be dependable.

4. Test results, including bitumen content, moisture content and gradation of aggregate must be obtainable in less than four hours.

An extractor meeting the above requirements has now been developed by the Materials and Research Department of the California Division of Highways. This extractor although referred to as a field extractor, was originally designed for use in our district laboratories, however, it may be easily transported and quickly set up for use at the job site. The apparatus extracts both bitumen and moisture from the mixture in one operation. A specially designed companion drying unit permits rapid drying of the extracted sample.

Two Stages

Briefly, the extraction process consists of two stages. In the first, any free moisture present in the mix is removed by distillation and condensed in a moisture trap in a manner similar to that employed in the xylene reflux distillation apparatus except that Stoddard solvent is used instead of xylene. The second stage consists of removing the asphalt-laden solvent through filter paper by the use of compressed air. This is followed by flushing the sample with clean solvent. After removal of the solvent the sample is ready for drying and grading. The entire operation requires not more than three hours. It is possible to turn out five to six extractions per day if an additional source of heat is available so that an extraction may be carried on while the previously extracted sample is drying.

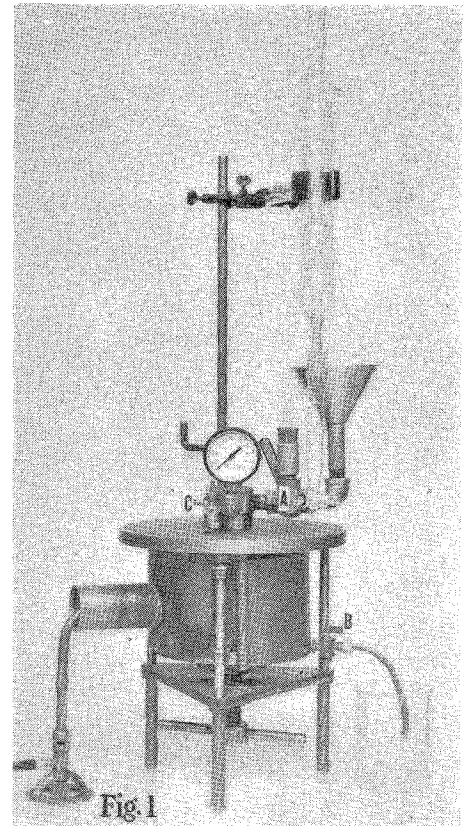
The extractor and drier are designed so that heat may be supplied either by a gasoline blowtorch or if available, gas may be used with a special burner. Compressed air for forcing the solvent out of the mix is supplied by an automobile tire foot pump or from a compressor if such

is available. The blowtorch and tire foot pump were included primarily to make the unit adaptable for field use.

EQUIPMENT REQUIRED

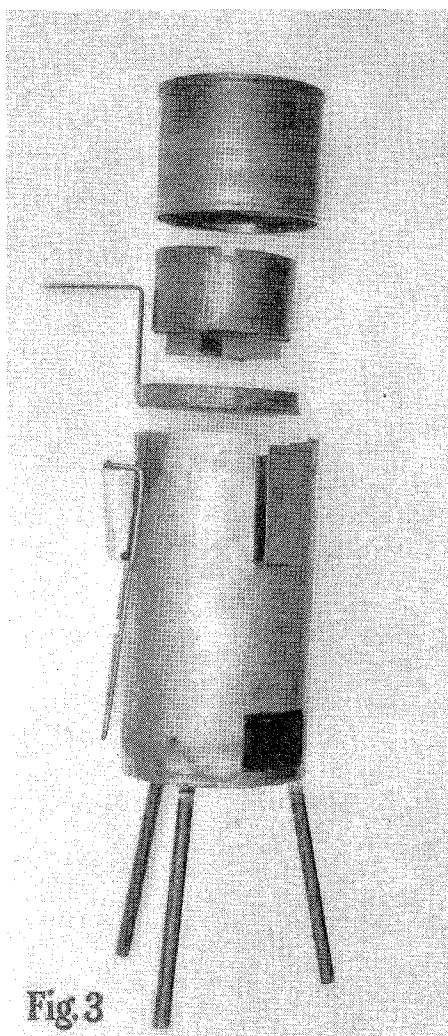
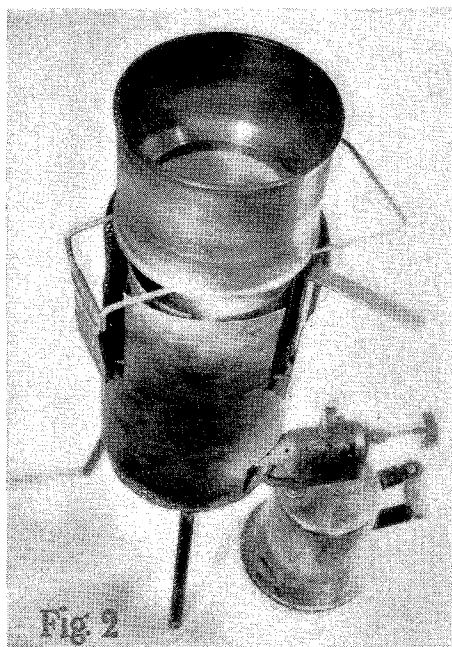
- Extractor.
- Sample drier.
- Blowtorch or a Johnson Auto-blast Bunsen Burner.
- Automobile tire pump (foot type preferred).
- Filter paper.
- Balance $2\frac{1}{2}$ kg. min. capacity 0.10 g. sensitivity.
- Stoddard solvent.
- Gasoline (white, used with blow torch).

The extractor assembly (Fig. 1) consists of a top and bottom plate between which the metal thimble (Fig. 4) is clamped. The top plate is



equipped with a solvent intake funnel, stirring crank, safety valve, pressure gauge, and a three-way valve for the control of the flow of solvent or air. The bottom plate is fitted with a valve and short length of copper tubing for exhausting the solvent.

The drier (Figs. 2 and 3) is a heavy sheet metal cylinder, closed at the bottom and open at the top and is mounted on three legs. An opening near the bottom permits the application of heat from either a Bunsen Burner or blowtorch.



The filter paper (Fig. 4) is of a heavy type that will withstand considerable abrasion and is about the thickness of a blotter.

The solvent is known as Stoddard solvent and can be readily obtained from most service stations by calling for cleaning solvent. The retail price is about \$0.30 per gallon. It is manufactured to specifications which require a minimum flash of 100 degrees F. and a maximum end point of 400 degrees F. This solvent is inflammable but not dangerously so. It closely resembles kerosene in this respect and should be handled in a similar manner.

The extractor should be set up in a well-ventilated place. If piped water is not available, two five-gallon containers are normally sufficient to provide ample cooling water for the condenser.

Fig. 3

PROCEDURE

The sample, consisting of approximately 750 gm. of the mix is placed in the inner basket of the thimble assembly and weighed. (See Fig. 4.) The thimble assembly is then clamped in position in the extractor and approximately 300 ml. of solvent poured through the funnel into the sample.

The cooling water is then turned through the condenser and heat is applied to the extractor at a rate sufficient to cause refluxing to start in 20 to 40 minutes.

Water contained in the mix is collected in the bottom of the trap since it is heavier than the solvent. Heating is continued until the moisture in the trap has reached a constant volume.

When this point is reached the heat is removed from the extractor and an additional 200 ml. of Stoddard solvent is poured through the top of the condenser into the sample. This will wash

down any moisture collected on the sides of the condenser, help to cool down the sample and dilute the asphalt-laden solvent already in the extractor.

Solvent Pumped Out

The valves on the extractor are now set to pump out the solvent by means of compressed air supplied by either the foot pump or a compressor. This forces the solvent carrying the asphalt through the filter paper leaving the aggregate clean. Average plant-mixed samples seldom require over 30 pounds air pressure.

Occasionally samples of bituminous mixes during the extraction process tend to plug the filter paper due either to a high percentage of fines or to the nature of the bitumen. It is necessary in these cases to use the stirring device. The stirring device serves as a scraper and provides a fresh filtering surface on the filter paper.

After the first charge of solvent has been pumped out additional charges of 500 ml. of solvent are placed in the extractor and pumped out. Usually a total of three or four charges are sufficient to flush all the extracted asphalt from the sample.

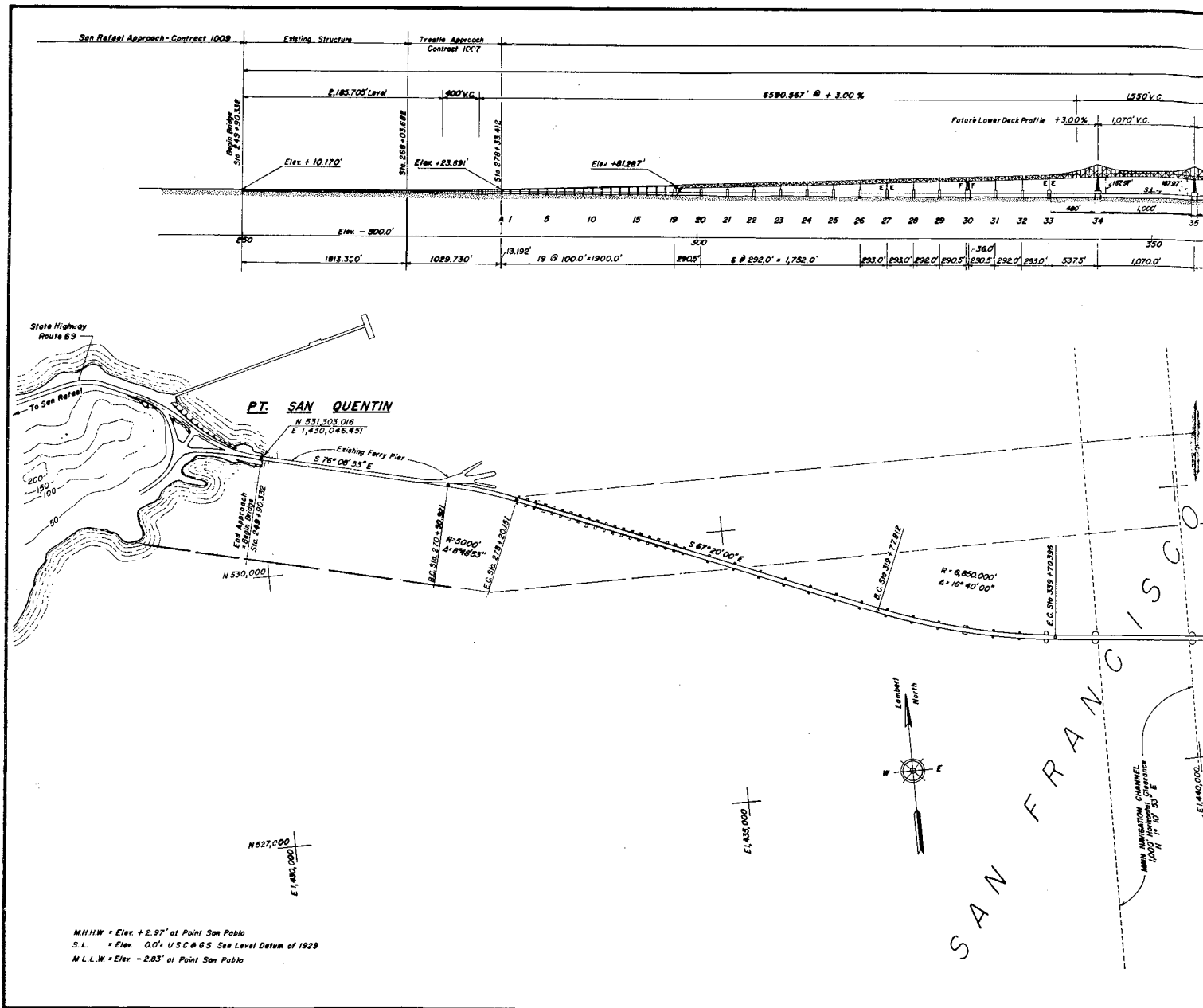
The next step consists of removing from the extractor the thimble and inner basket which are then placed in the drier. Heat from either a blowtorch or Bunsen Burner can be applied to the drier. Approximately 45 minutes is required to dry the sample. The sample is then cooled and weighed. If an oven is available the sample may be dried out in the oven with the temperature maintained at about 225 degrees F. However, oven drying is slow and the sample must be left in the oven about 15 hours. Drying the sample to remove the solvent can best be performed outside or under a hood to avoid breathing the hot solvent vapor which is somewhat irritating.

SAMPLE CALCULATIONS

To determine the percentage of bitumen, the loss in extraction less the ml. of water caught in the trap, is divided by the weight of the aggregate after extraction.

To determine the percentage of water, the ml. of water in the trap is divided by the weight of the mix (dry

... Continued on page 39



Richmond-San Rafael Bridge Pier Construction

Continued from page 25 . . .

and gradually raised, but with the lower ends always buried in fresh, or unset, concrete. This procedure allows the deposition of additional concrete into the mass without its coming into contact with the water.

5. The tapered shells, with diaphragms, are placed on the lower shell section and centered by matching rings in both sections. These are followed by the upper and smaller cylindrical sections, forming the pier shafts and their diaphragms. The pier shaft sections extend above the surface of the water.

6. The surfaces of the previously placed five-foot lift of tremie concrete, the shells, and the steel H-piles are cleaned of all deleterious material and marine growths. Large tremie pipes are then lowered through the shafts and diaphragms for placement of tremie concrete to elevation plus five feet in the manner described above.

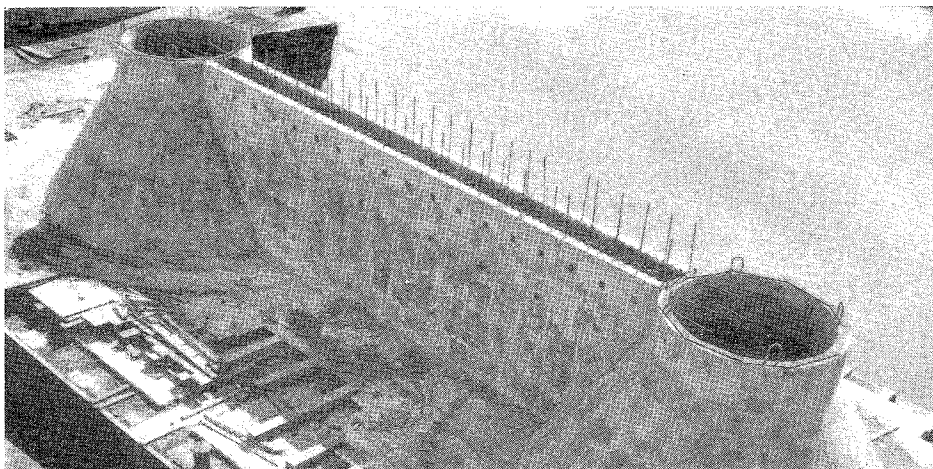
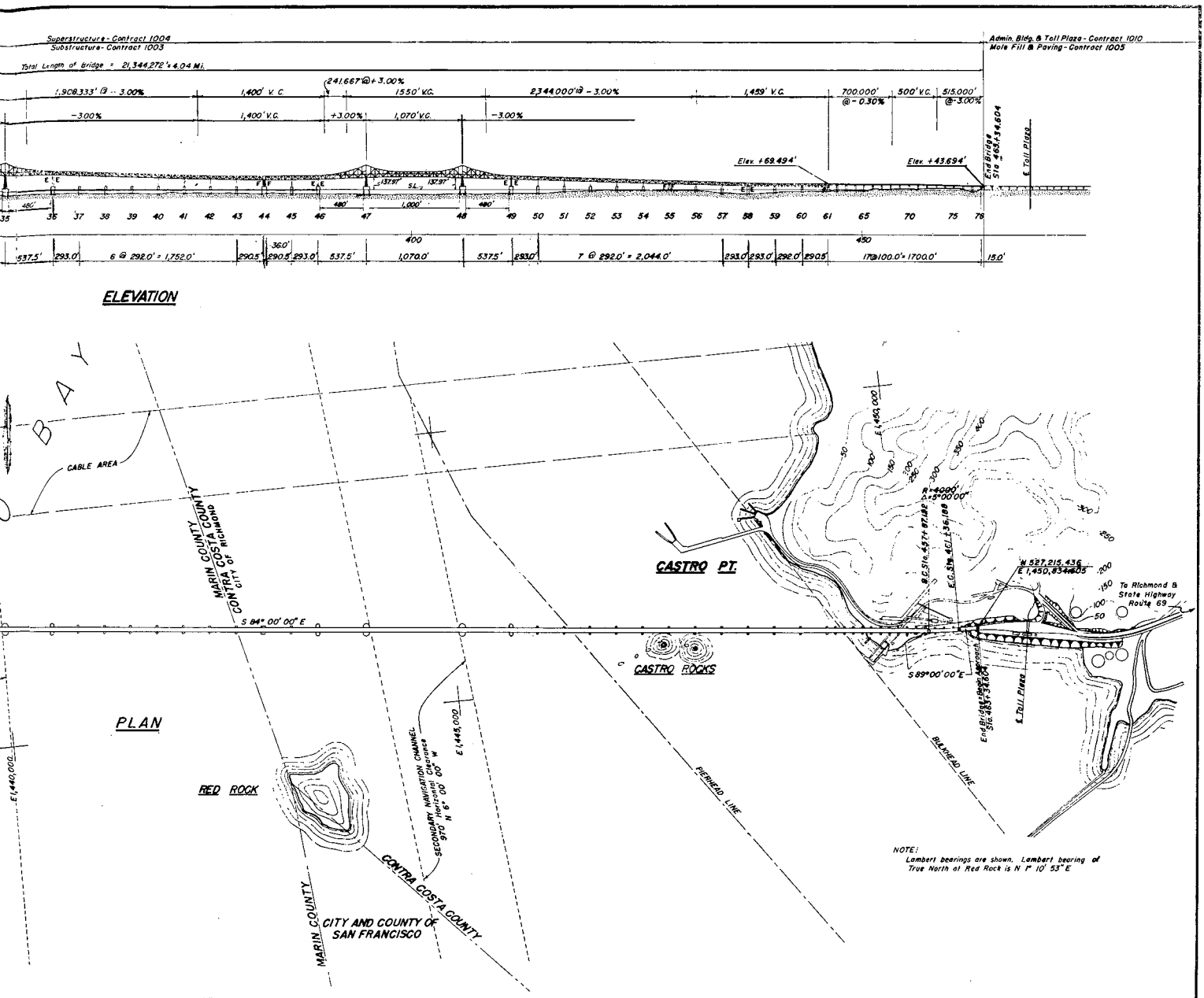
7. Concrete placement above elevation plus five feet and the setting of anchor bolts for the steel superstructure follow the more usual methods of pier construction by forming and placing concrete in the dry.

8. Tops of piers are accurately leveled to receive the steel tower bents supporting the truss spans.

Mats Used as Template

These concrete grids or mats are used first as a template for the driving of the permanent steel H-piles, as a platform to rest the bottom 9-foot concrete shell and as a bottom form for the first 5-foot lift of tremie concrete.

The mats are kept in their proper relative position by the placing of a removable strut between the two grids and in their final position by



Precast cone and diaphragm for section of Pier 8

first driving the center vertical pile in each grid to prevent any displacement while driving the battered piles: The center pile is generally from 5 to 10 feet longer than the length estimated by borings for the piles at the particular pier. After driving the vertical pile, the exact length of the other piles to be driven is thus established. As a result, very few piles have to be cut off by underwater burning.

... Continued on page 64

OCEANSIDE FREEWAY CUTS ACCIDENTS IN HALF

THE FOLLOWING news article appeared in the Oceanside *Daily Blade-Tribune* on February 26th:

TRAFFIC INJURY RATE SLASHED IN HALF SINCE O-C FREEWAY OPENING NOVEMBER 16

That the Oceanside-Carlsbad Freeway has been a major contribution to traffic safety was dramatically illustrated today by statistics released to the Oceanside Chamber of Commerce by the local hospital.

For the 90-day period prior to the freeway opening Nov. 16, there were 23 ambulance traffic cases handled by the hospital. Most of these cases from Aug. 16 to Nov. 16, the hospital informed Chamber Manager Zac Dunlap, involved major injuries and confinement periods extending into weeks and months.

From the freeway opening to Feb. 16, however, there were only 12 traffic ambulance cases—barely over half of the pre-freeway rate. Of the 12, all injuries were minor in nature and required only short periods of confinement.

WIDE AREA

The Oceanside Hospital usually receives traffic victim cases from San Clemente to Leucadia.

In commenting on the figures released by Wilma Taylor of the hospital, Dunlap declared:

“The freeway’s saving in human life and suffering has already become evident in a brief, 90-day period.

“This should be especially noted by local residents because the life which was saved or the injury which didn’t happen could well have been theirs or their loved ones.”

In its edition of March 1st the *Blade-Tribune* further reported:

Freeways are safe ways to travel, indeed. Oceanside’s city accident ratio which had been steadily climbing in recent years

has taken a sharp dip since the opening of the O-C Freeway, according to figures released today by Sgt. Cliff Haver of the local police department.

BIG ACCIDENT REDUCTION

The city decline substantiated the Oceanside Hospital report (in Friday’s *Blade-Tribune*) which showed a slightly less than 50 percent drop in ambulance cases during the three months since the Nov. 16 freeway opening in comparison with the 90-day period prior to the freeway opening. The hospital also reported a dramatic decline in the seriousness of the injuries and the length of hospitalization required.

Haver revealed that since the November freeway opening of 1953, only 85 traffic accidents

... Continued on page 64

Looking north along a portion of the Oceanside Freeway, showing some of the grade separations and interchange ramps which have contributed to a sharp reduction in accidents since opening of the freeway on November 16, 1953



Salinas Freeway

*First Unit, Market Street to
North Main Street, Opened*

By E. J. L. PETERSON, District Engineer

THE EXCEPTIONALLY splendid cooperation of the citizens in the Salinas area and the untiring efforts of the Salinas Highway Committee are bearing fruit as evidenced by the progress being made in the development of the Salinas Freeway on US 101.

The first unit of this freeway, a length of one mile, between Market Street and North Main Street, was completed in January and opened to local traffic.

The Salinas Freeway is 10 miles in length. Beginning at Hartnell Road near the Spence Underpass, about five miles south of Salinas, it joins the recently completed expressway and extends northerly on the east side of the Southern Pacific Railroad and parallel thereto, skirting the industrial development to the east and passing through a relatively undeveloped area near the easterly city limits of Salinas, then crosses the present state highway, US 101, at North Main Street just south of the Santa Lucia Inn, and extends northerly west of the existing state highway and the commercial development north of the rodeo grounds and the community of Santa Rita to a connection with the existing limited access highway at Espinosa Road. In addition to providing for through traffic it also gives excellent service to local traffic of the combined area of the City of Salinas and the unincorporated community of Alisal.

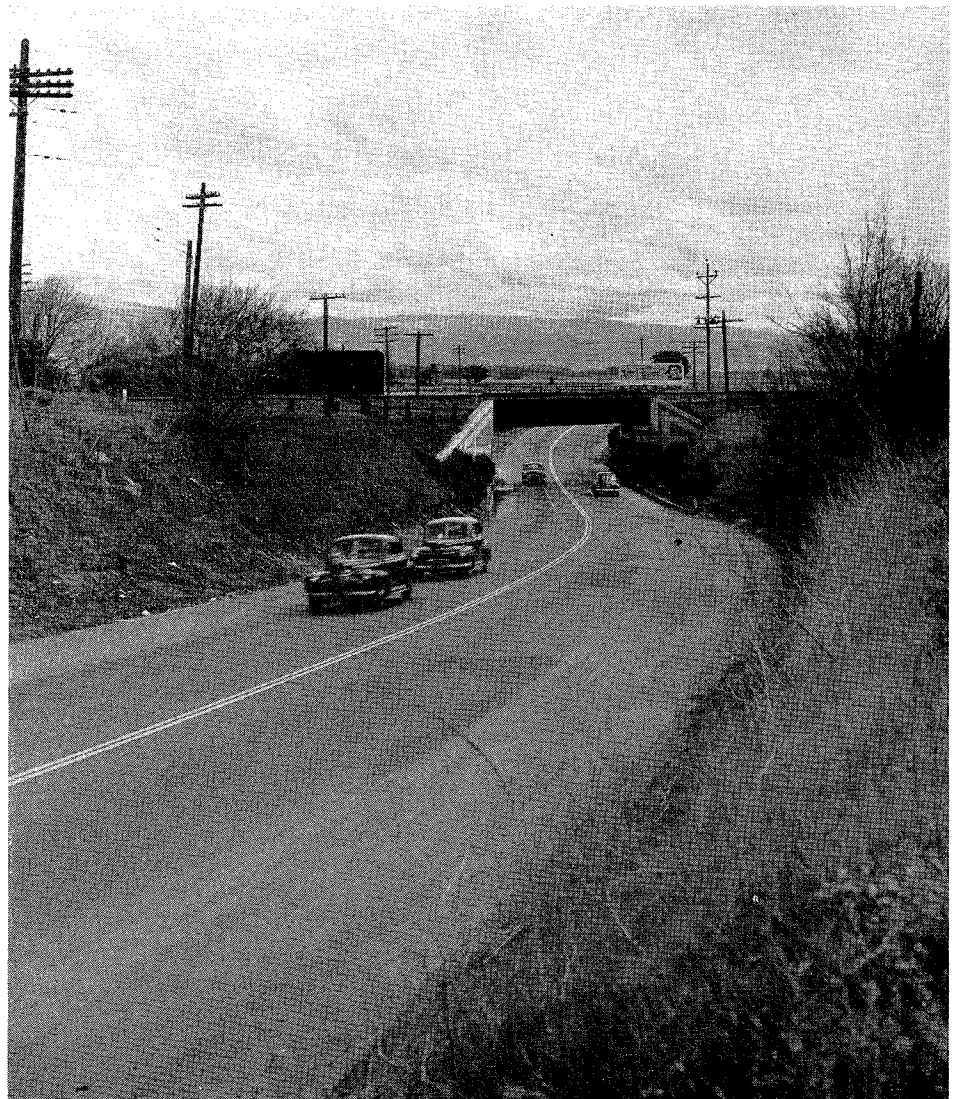
The planned improvement provides for a four-lane divided highway with the lanes so positioned that it can be developed into a six-lane facility when warranted by increased traffic. Separation structures are provided at all of the important cross roads and streets, namely, Spence Underpass, Bardin Road, Sanborn Road, John Street, Alisal Road, Market Street, North Main Street, Laurel Drive and Espinosa Road. A few cross-overs at grade are to be constructed to provide for access to adjacent farms. The design provides for portland cement

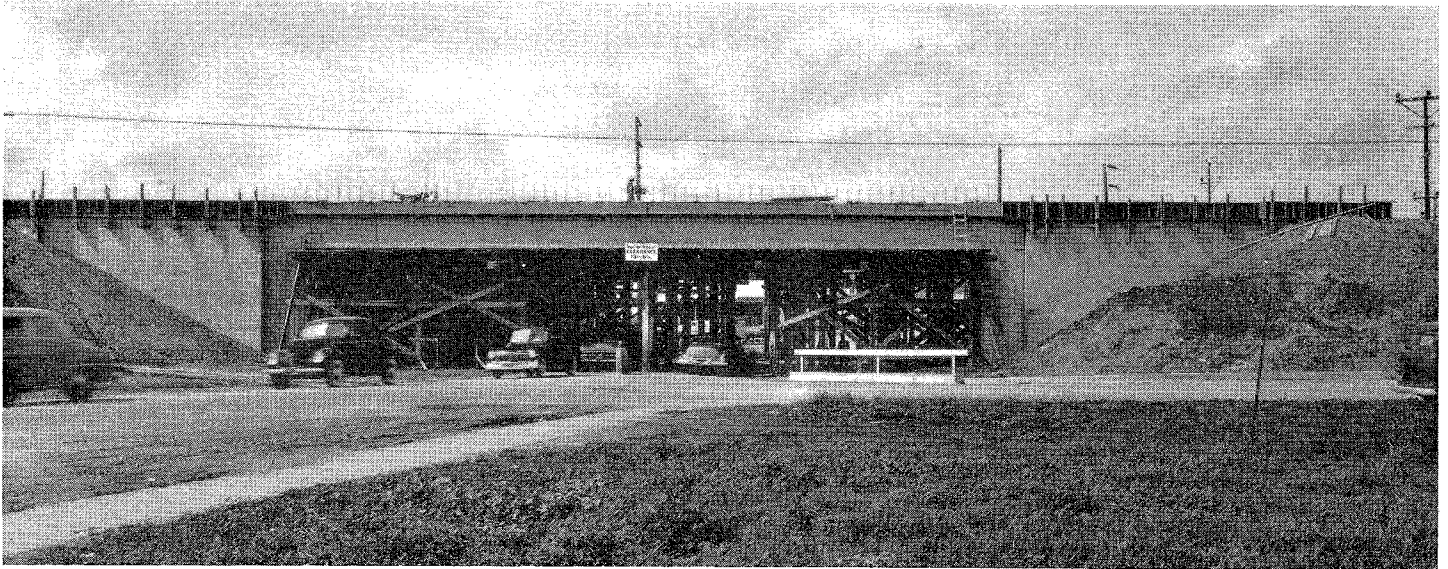
concrete traffic lanes with plant-mixed surfacing, ramps and shoulders.

Because of limited funds it was necessary to plan the construction so that usable portions of freeway would be available to the traveling public at the earliest possible date. In order to accomplish this program the section from the existing state highway at North Main Street to Hartnell Road, a distance of 6.2 miles, was scheduled

for construction in succeeding fiscal years, with the portion of the freeway from North Main Street to Espinosa Road being deferred until funds may become available. The southerly terminus of the project at Hartnell Road, just south of the Spence Underpass, joins the existing four-lane divided expressway which was completed in 1952. The separation structure at the Spence Underpass will be utilized as

Existing Spence Underpass looking westerly





Looking westerly, showing the Alisal Street Undercrossing during construction

a connection to the existing state highway. At the northerly terminus a temporary traffic interchange was constructed at North Main Street to provide for the orderly movement of traffic between the freeway and the existing US 101 to the north end for the northerly extension of the freeway with a minimum loss of investment.

The new location for the freeway traverses the Carr Lake area east of

North Main Street. While this area is normally dry, being drained by a canal, it is subject to ponding during periods of heavy rainfall. To guard against inundation the highway grade was maintained above the probable high water requiring a minimum embankment height of about four feet and adequate drainage structures were provided to meet ultimate requirements.

The alignment generally follows level terrain and, because of drainage difficulty, it was impractical to construct the highway below the prevailing elevation of the surrounding ground. The total excavation between Hartnell Road and North Main Street, including local and imported borrow, will be about 1,300,000 cubic yards, involving 36,500,000 station yards of overhaul.

View of North Main Street interchange looking north from Sherwood Drive Undercrossing





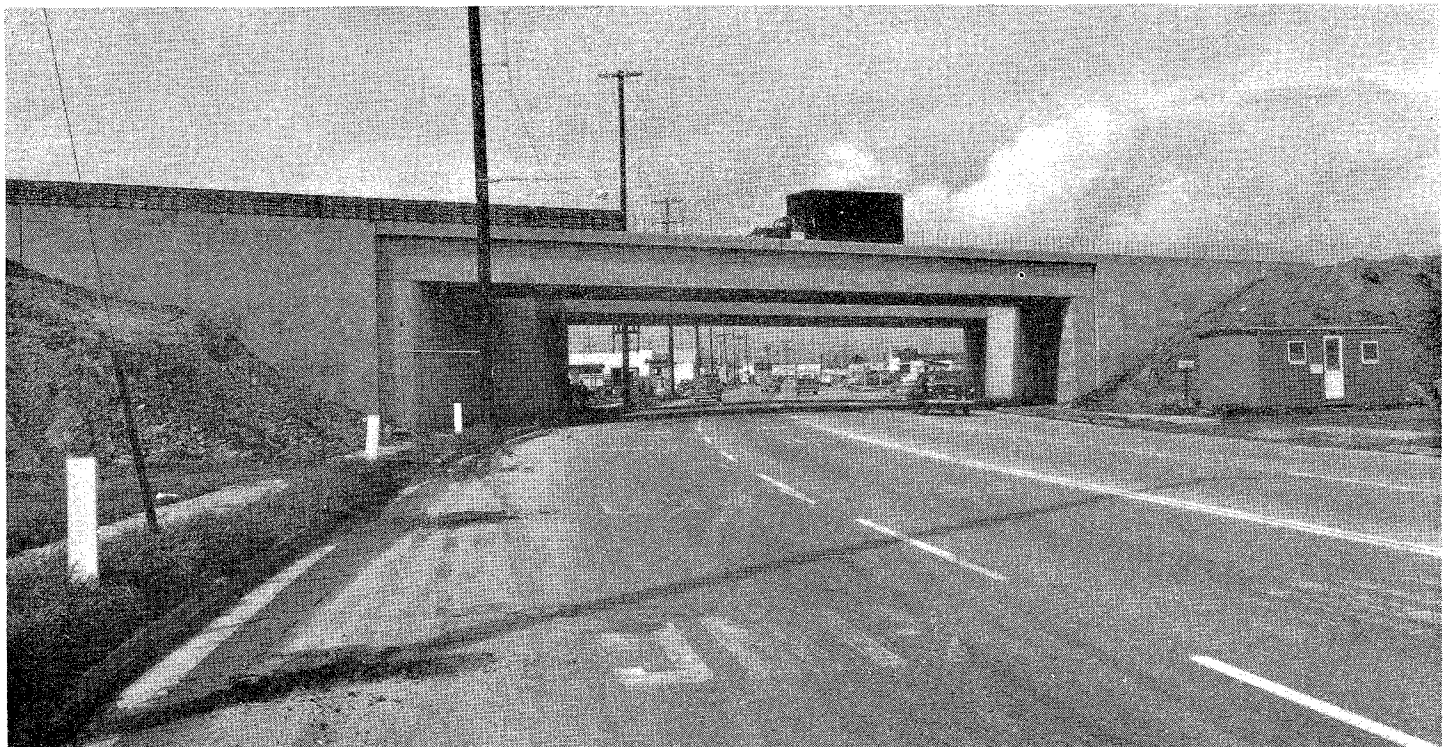
View of freeway looking southerly from Sherwood Drive Overcrossing showing Alisal community in background

The project was divided into four units to facilitate construction. The contract for the first unit between Market Street and North Main was awarded to Keeble and Caputo of San Jose, and consisted of the grading and

portland cement concrete pavement and two reinforced concrete overcrossings at North Main Street and Sherwood Drive, two double 12-foot box culverts and an 8- x 10- x 268-foot box culvert, together with numerous

drainage structures. Ramps and approaches were constructed in connection with the overcrossings and paved with plant-mixed surfacing on cement treated base, also short sections of city streets were connected

East Market Street separation structure under construction, looking westerly, now completed.



with the various crossings. This contract was completed in January, 1954, and is being used by local traffic.

The second unit between Market Street and John Street was awarded to Keeble and Caputo of San Jose. Work started in September, 1953, and provided for grading and the construction of two reinforced concrete overcrossings at Alisal Street and Market Street. The contract will be completed in April, 1954.

To accommodate the flow of the reclamation district drainage canal a double 12- x 13-foot reinforced concrete box was constructed under the freeway at Sherwood Drive. This culvert is skewed approximately 60 degrees and crosses directly beneath the Sherwood Drive overcrossing. Because a center bent would bear directly on top of the culvert it was omitted from the overcrossing structure as will be noted in the picture. This required a span of 108 feet between the two bents which are located outside of the shoulder lines.

During the investigation of foundation conditions for the grade separa-

tion structures, borings indicated compressible soils in the vicinity of Market Street and John Street which would not support the structures and embankments without excessive subsidence.

To accelerate the consolidation of the foundation soils at Market Street before building the structure and pavement, approximately 960 vertical sand drains were constructed, a 2-foot sand fill was placed over the area, and a 3-foot surcharge was placed on the embankment. The contractor elected to construct the vertical sand drains by driving a plugged mandrel. After withdrawing the core, the mandrel was filled with sand and pulled leaving the sand in place. During the pulling operation air pressure was applied to help prevent the sand from bridging and being withdrawn with the mandrel. Sand drains were constructed 18 inches in diameter and between 25 feet and 65 feet in depth. After some experimenting the vertical sand drains were constructed by back-filling the hole with sand after pulling the mandrel.

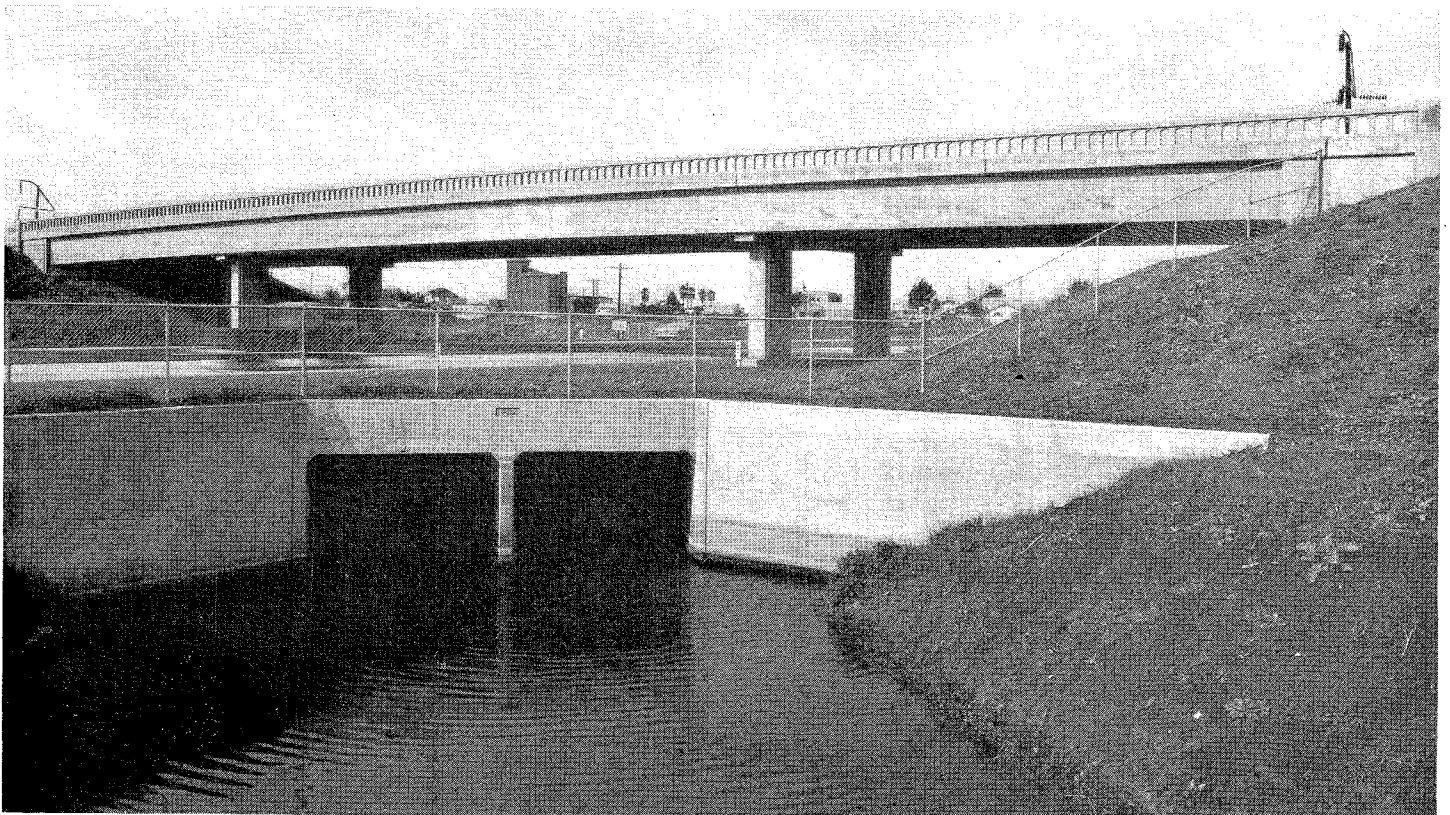
As an aid in determining the state of consolidation of the foundation soils and to provide information for use in future foundation studies, devices for measuring the pore water pressure in these soils were installed at the time the vertical sand drains were constructed. Platforms were placed on the original ground in advance of constructing the embankment and subsidence was measured by means of a steel rod extending through to the embankment of the platform.

Since the foundation was more stable at John Street and consolidation could be accomplished by placing surcharge only, the sand drains were omitted and an 8-foot surcharge was placed on the west approach and a 5-foot surcharge was placed on the east approach to equalize subsidence.

In order that ample time would be available for stabilization of the foundation soils, progress on the construction was planned to allow the surcharge to remain in place approximately one year at Market Street and six months at John Street before

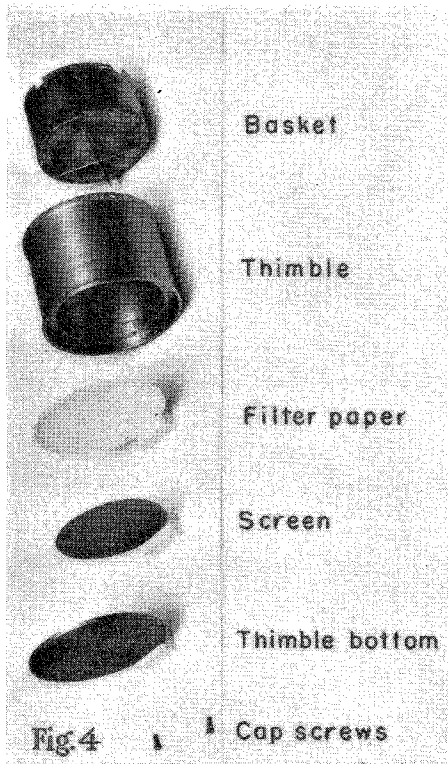
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Looking westerly along reclamation district drainage canal showing double 12- x 13-foot reinforced concrete box passing under the Sherwood Drive Overcrossing



New Extractor Determines Moisture

Continued from page 31 . . .



aggregate + bitumen) less the weight of water.

EXAMPLE

	Before extraction	After extraction
Total weight	2,793.1 grams	2,757.4 grams
Thimble	2,093.0	2,093.0
Sample	700.1 grams	664.4 grams

$$\text{Loss of wt.} = 700.1 - 664.4 = 35.7 \text{ grams}$$

Moisture caught in trap 7.5 ml.

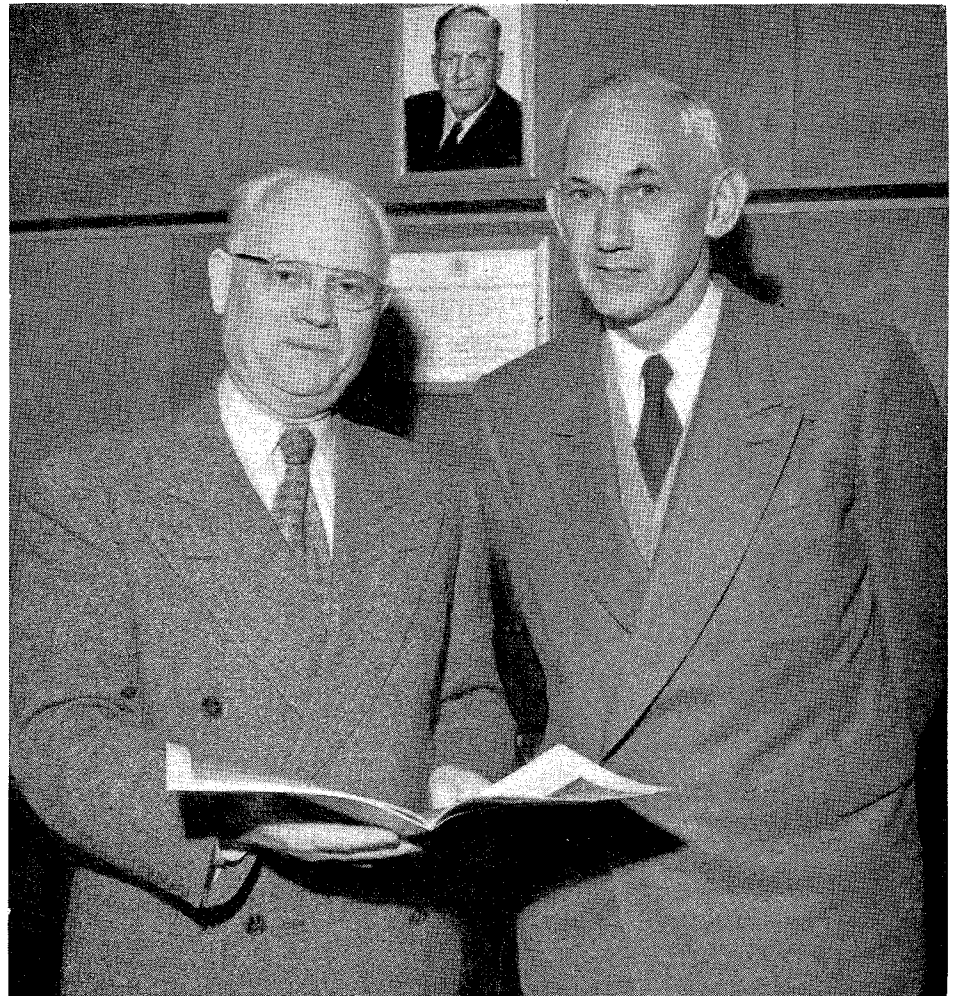
$$\text{Bitumen extracted} = 35.7 - 7.5 = 28.2 \text{ grams}$$

$$\frac{28.2}{664.4} \times 100 = 4.2\% \text{ bitumen}$$

$$\frac{7.5}{700.1 - 7.5} \times 100 = 1.1\% \text{ moisture}$$

A few extractors have been in operation in our District Laboratories for a period of about two years and additional units are being fabricated now. They have shown promise of providing an efficient and accurate extraction method for all types of bituminous mixes. On a few construction projects where continuous type bituminous paving plants were used in producing the bituminous surfacing material the portable extractor has proved useful in providing an accurate check within a two-hour

High Australian Official on Visit to State



Director of Public Works Frank B. Durkee (left) receives Dr. L. F. Loder in his Sacramento office

ON A SPECIAL visit to California to study highway and freeway construction, the State's public building program and water conservation plans, Dr. L. F. Loder, Director General of the Department of Works of the Australian Commonwealth, visited in Sacramento with Director of Public Works Frank B. Durkee. He will take back with him information on organizational, administrative and technical

procedures followed by California in its huge highway and public building construction programs.

Dr. Loder consulted with State Highway Engineer George T. McCoy and officials of the Divisions of Architecture and Water Resources. He will make an extensive field inspection of projects throughout the State before returning to Australia.

period on the bitumen content. This check is especially valuable at the start of mixing operations when some adjustment of the ingredients is necessary to produce a uniform and stable mix.

As mentioned in the beginning, the development of this type of extractor has been under way for some time.

The work has been carried out under the supervision of F. N. Hveem, materials and research engineer. The writer is indebted to several members of the laboratory staff for valuable suggestions and particularly to John Skog and Rufus Hammond, who carried on most of the development work.

Moving Along

San Mateo County Builds Fifth
Of Its FAS Road Projects

By S. H. CANTWELL, Resident Engineer

THE COMPLETION, on January 4, 1954, of two units of Federal Aid Secondary Route 1048 totaling 2.4 miles in southeastern San Mateo County marks another step forward in this county's program of road construction within the Federal Aid Secondary System.

The two units constructed complete a 10-mile loop of safe, moderate speed highway extending southerly from the intersection of the Menlo Park city limits and Santa Cruz Avenue along FAS Route 1048 (the Alpine-Portola Road), swinging westerly and northerly on this road to Searsville Lake, on to Sand Hill Road, FAS Route 1004, and finally on the Whiskey Hill Road, also FAS Route 1048, to the town of Woodside and

State Highway Route 107. This highway provides residents of the rapidly growing Woodside-Portola residential area with a route to the more established commute and commercial centers of San Mateo County.

Strike and Weather Delays

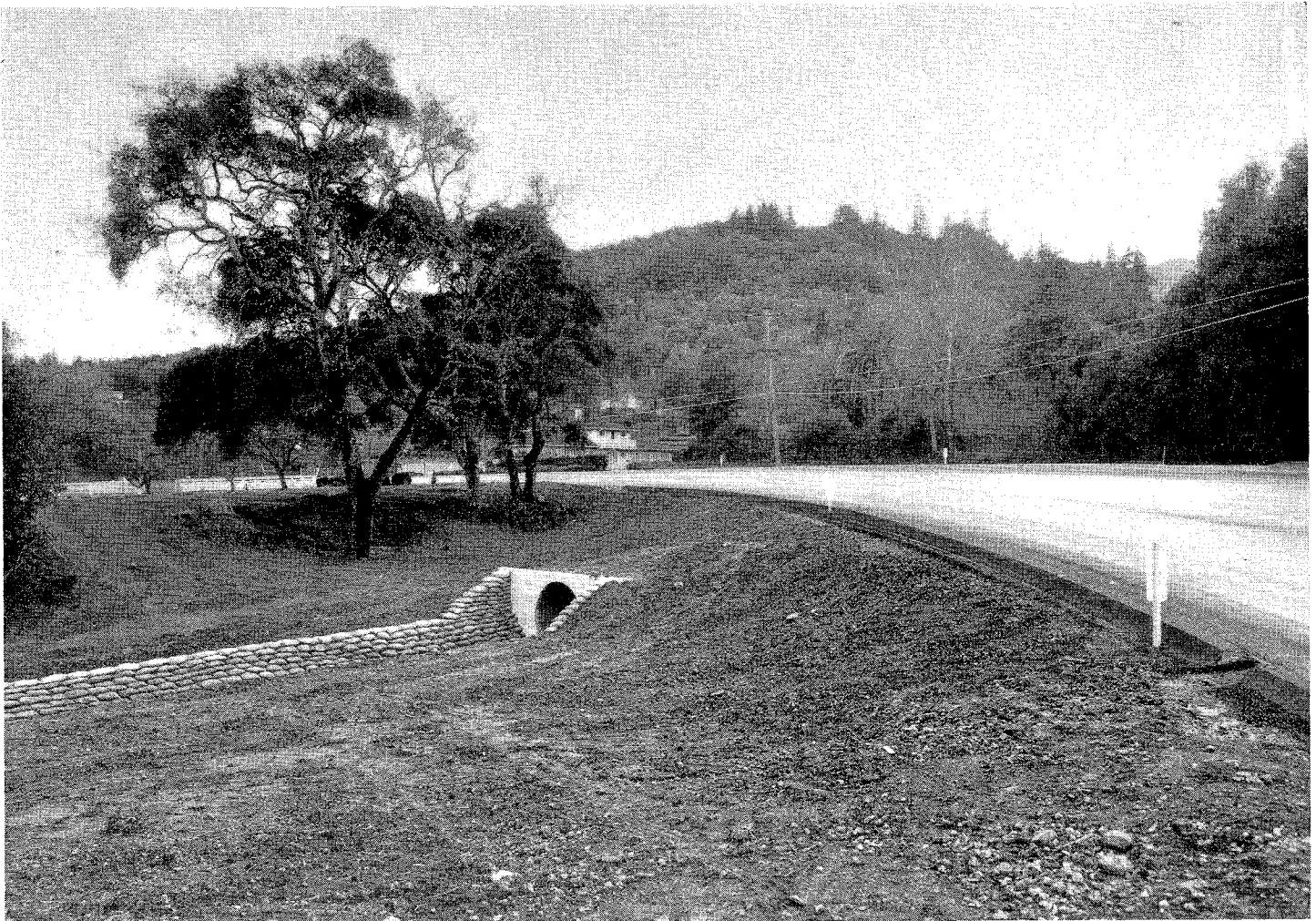
The contract on the project just completed was awarded by the Director of Public Works on April 30, 1953, to the L. C. Smith Company of San Mateo. Work was started on May 12, 1953. A loss of valuable "working weather" was registered during June and July due to a labor wage dispute thus causing the work to run into unfavorable weather con-

ditions and delaying the completion date. Work was completed on January 4, 1954, at a final cost of \$189,600, exclusive of engineering.

Before the realignment the improvements on Unit No. 1, known as the Whiskey Hill Road, and Unit No. 2, which is a portion of the Portola Road, consisted of two 8- to 9-foot traffic lanes with substandard alignment, blind curves, and dangerous sight distance clearances on the vertical curves. The realignment of these units conformed with the Standards of Federal Aid Secondary Roads in rolling topography with an average daily traffic count of from 400 to 1,000 vehicles.

FAS Route 1048, a San Mateo County road recently reconstructed with federal, state, and county funds





Portola Road at Dennis Martin Creek in San Mateo County—a typical Federal Aid Secondary project

Construction Design

The roadbed section used on this job consisted of two 11-foot traffic lanes with 6-foot shoulders, identical with the finished section used on the FAS project completed in 1952, which project is southerly of and joins Unit No. 2 of the present project. In the project just completed, the traffic lanes were paved with plant-mixed surfacing 2½ inches in thickness and the shoulders were paved with plant-mixed surfacing tapering from 2½ inches at the edge of the traffic lane to 1¼ inches at the outer edge of the shoulder. Underlying the plant-mixed surfacing is six inches of untreated rock base and 8½ inches of imported subbase material. This differs from the last FAS project where a Class "B" single seal coat was applied to the six-foot shoulders.

The major clearing and grubbing on the project was accomplished by letting a separate contract for this work during the winter while the plans for the road project were receiving approval and being advertised. This was done with the thought of completing the clearing during the rainy season so that the contractor doing the road work would be able to make the most of the dry "working weather."

Excavation Job

The major portion of the earthwork on the project consisted of excavating material from a 35,000 cubic yard rock cut on Unit No. 1 and hauling this material over Unit No. 1 for a distance of approximately one mile, and an additional mile over the Sand Hill Road which separates the two

units comprising the project to Unit No. 2 where the material was deposited to make the roadway embankment through Upper Searsville Lake.

Additional right of way required for the realignment and construction of the project was acquired by the County of San Mateo. The only court action necessary for the acquisition of the right of way was a friendly condemnation suit against Leland Stanford Jr. University which was necessitated by certain deed conditions under which the university acquired title to the land. Very little difficulty was encountered in the acquisition of this right of way by the county which was an indication of the general public's approval and desire for this improvement.

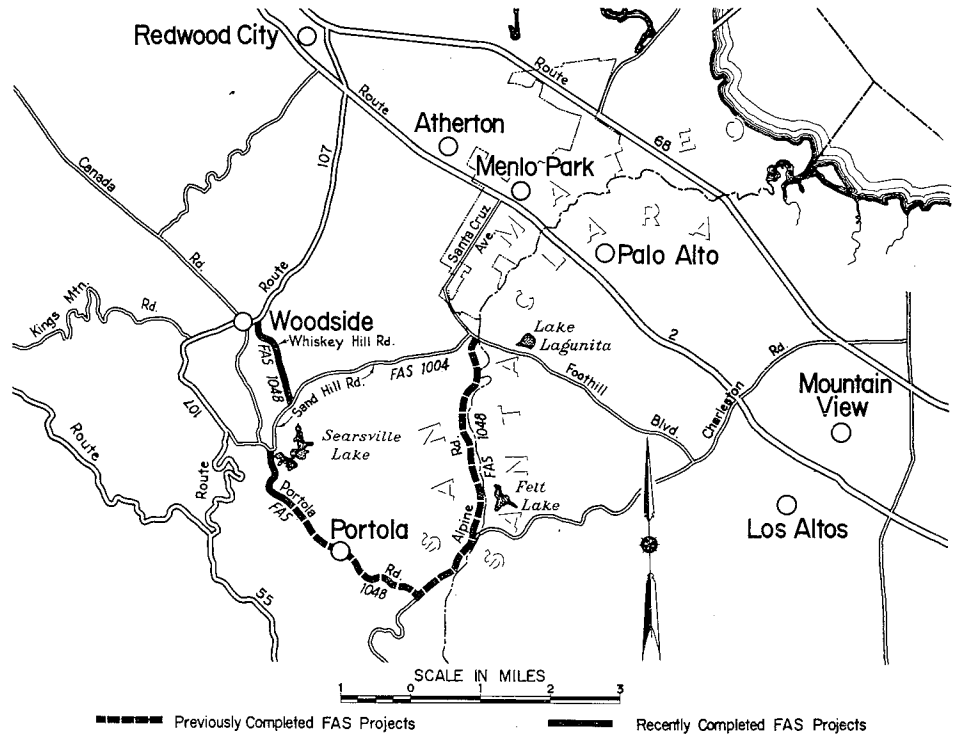


North end of Portola Road. This county road was recently reconstructed under the Federal Aid Secondary Highway Program.

Built on State Standards

The county has adopted as its own standard, the Division of Highways' Standard Specifications and Construction Manual which publications are used by the county's construction forces on all county road work. The policy of using as many of the State Division of Highways' construction procedures, specifications and forms has enabled the county to draw on the State's experience and facilities which has kept the county abreast of many of the new developments in road building pioneered by the Division of Highways. This allows the county to integrate these developments into its own program with a minimum of time or effort expended, thus enabling the county's limited forces to concentrate on the planning and construction aspect of their road building program.

Although the federal aid secondary program is carried out in cooperation with the Division of Highways and the United States Bureau of Public Roads, San Mateo County uses its own forces for preliminary and construction engineering. The County



**Whiskey Hill Road & Alpine-Portola Road
San Mateo County FAS Route 1048**

Road Commissioner, M. A. Grant, and his staff are looking forward to more FAS projects which are now in the planning and designing stage.

Superintendents for the contractor, L. C. Smith Company of San Mateo, during the construction on the project were J. H. Thomas and F. H. Brown.

Conveyor Tunnel

Freight Travels Under New Freeway Section on US 101

By J. F. POWELL, Assistant Right of Way Agent

SINCE opening of a new freeway section on US 101 between Chualar and Spence underpass, south of Salinas, the neighboring Eckhart Seed Co. has two trucks for sale.

It also has two former truck drivers employed elsewhere in the plant, for all rail freight is now carried between the plant and spur track by a conveyor passing through a tunnel under the new freeway.

History of the tunnel goes back indirectly to 1936 when the Eckhart company began rail loading and unloading operations at the old Spence siding. This involved crossing the conventional highway in front of its

plant, driving several hundred yards south on the highway, making a right angle turn directly onto and over the Southern Pacific mainline tracks, then turning south to the freight dock. Return was, of course, by the same hazardous route.

In 1942 a railroad accident at this crossing demolished an Eckhart truck and killed two employees.

Siding Problem

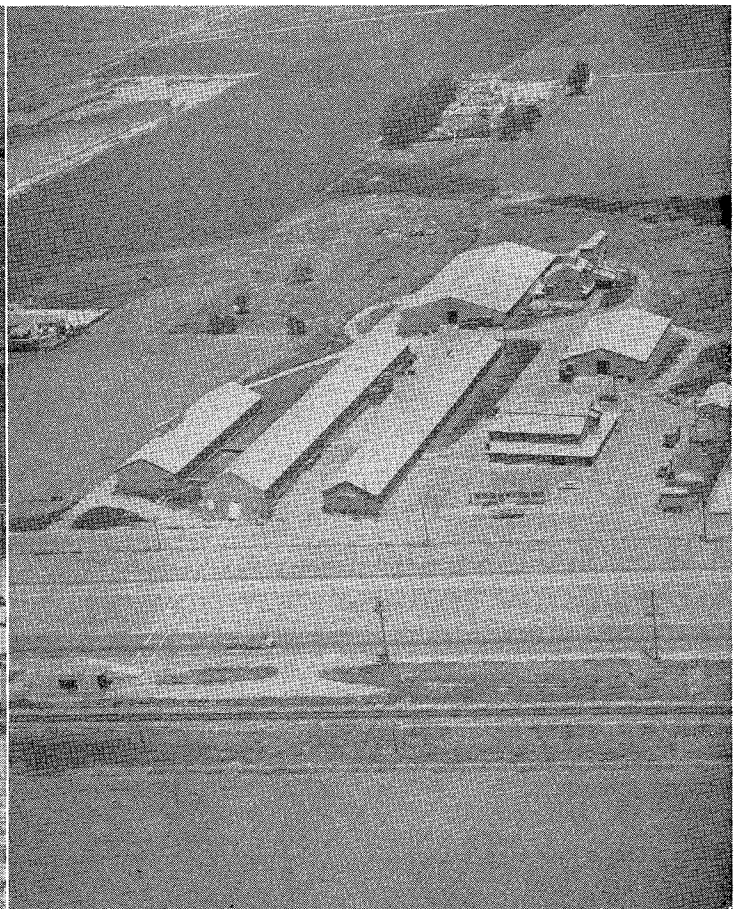
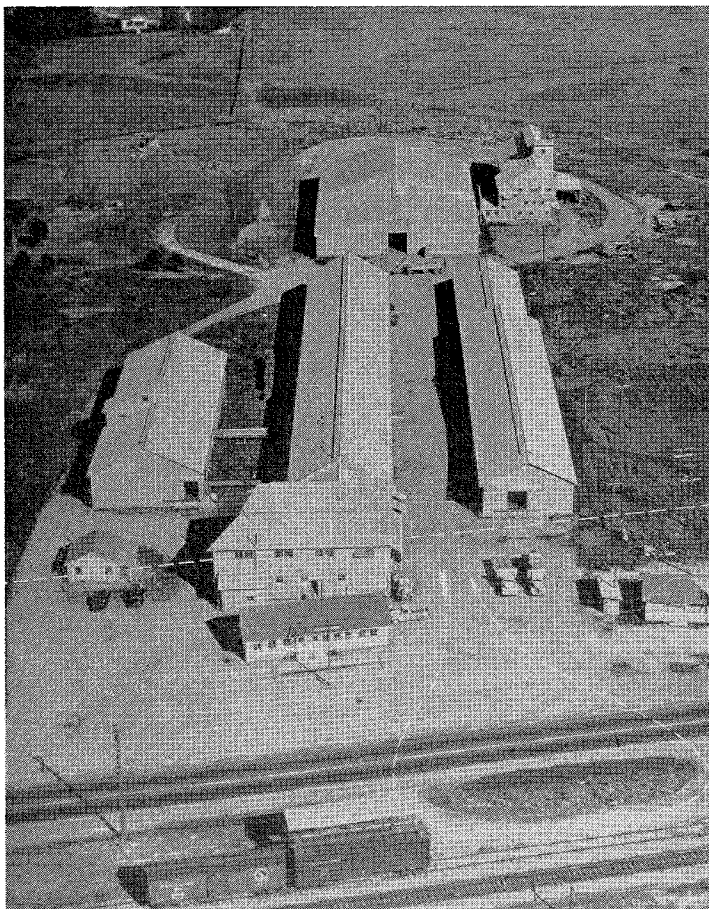
This moved the Eckharts to apply for a spur track crossing the highway and coming alongside their own plant. In view of the ever-increasing traffic and attendant dangers along

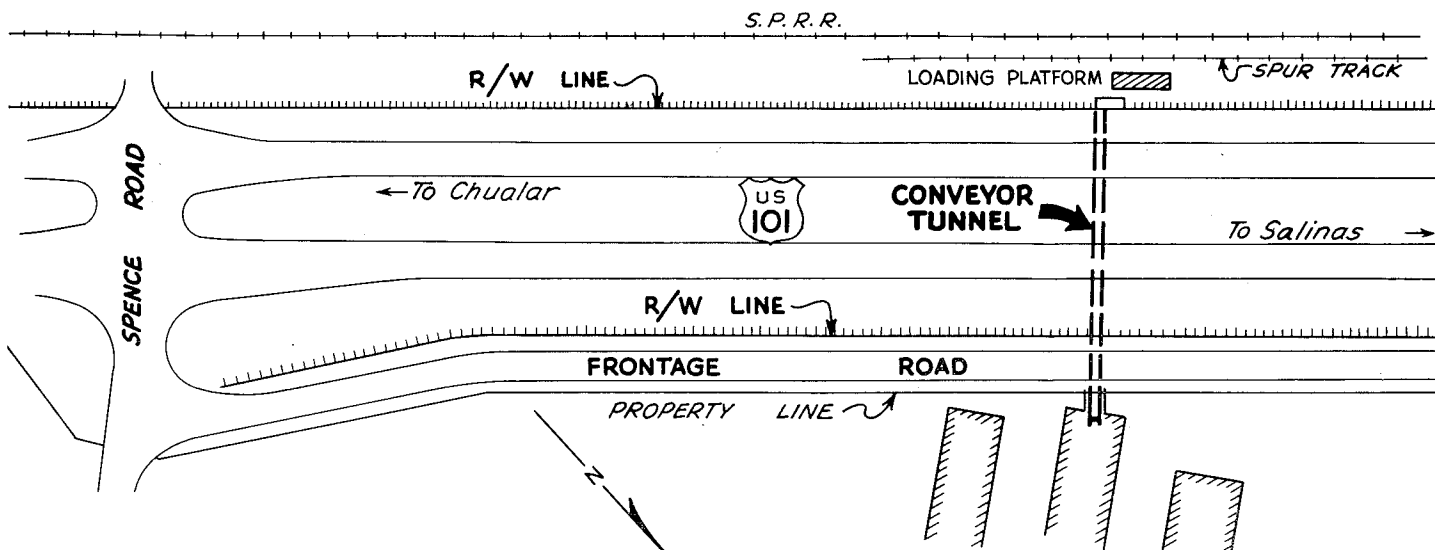
the crowded conventional highway, it is understandable that the application was not granted.

The company did, however, obtain a siding and construct a loading dock on Southern Pacific property between the mainline tracks and the highway, directly opposite the plant. This eliminated the danger of many truck trips across the tracks but not across the ever-busier highway. In subsequent years the company considered itself fortunate to get by with a single traffic accident damaging one of its trucks.

In 1950, as plans were being completed and appraisals made to widen

LEFT—Before view. Dotted line shows new right of way boundary. All improvements forward of this had to be relocated. Other lines show former route of trucks to and from loading dock. RIGHT—After view. Dotted lines show where conveyor tunnel lies under freeway. Note relocation of buildings. Mill building has new location. Large new building, upper right, not involved in move.





the existing highway and convert it to limited access freeway status, it became increasingly apparent that taking of access on both sides would seal the Eckhart company off from its loading dock.

After considerable relocation and rearrangement of its other facilities

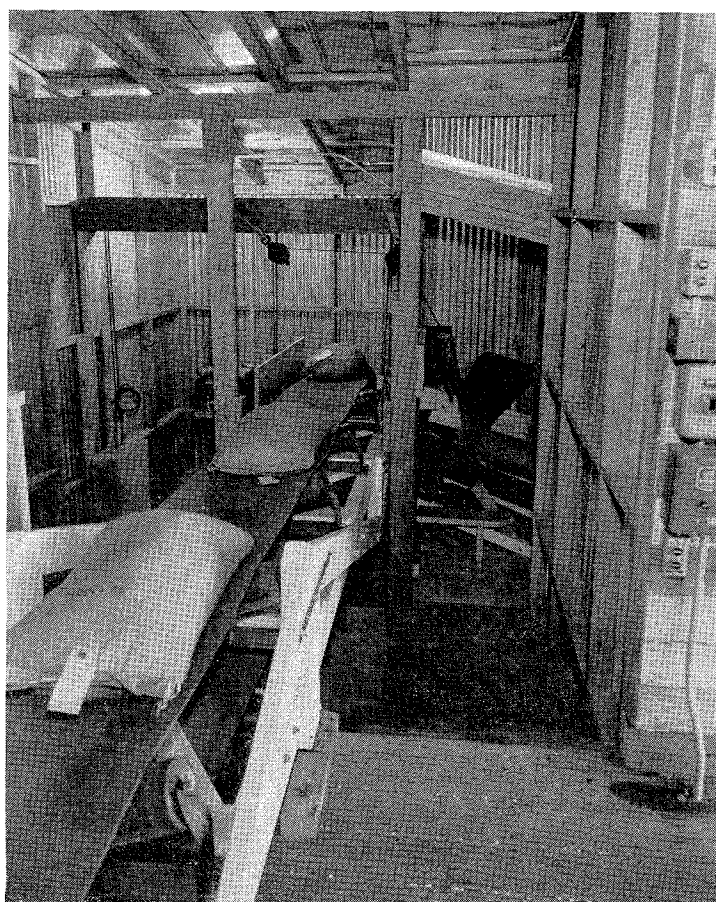
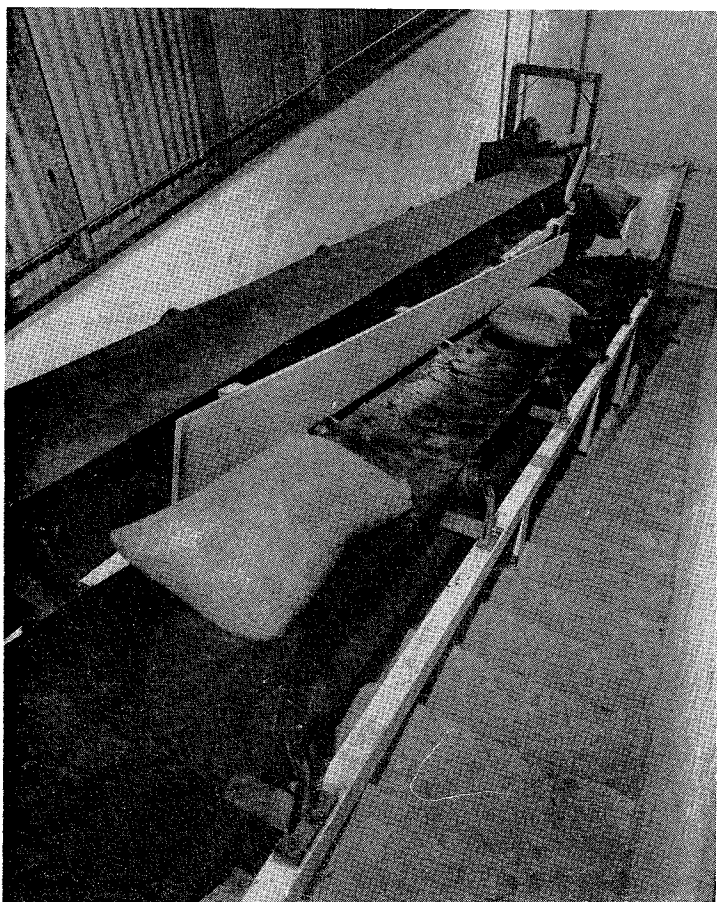
the company was to be served by a frontage road leading south to an expressway connection at Spence Road.

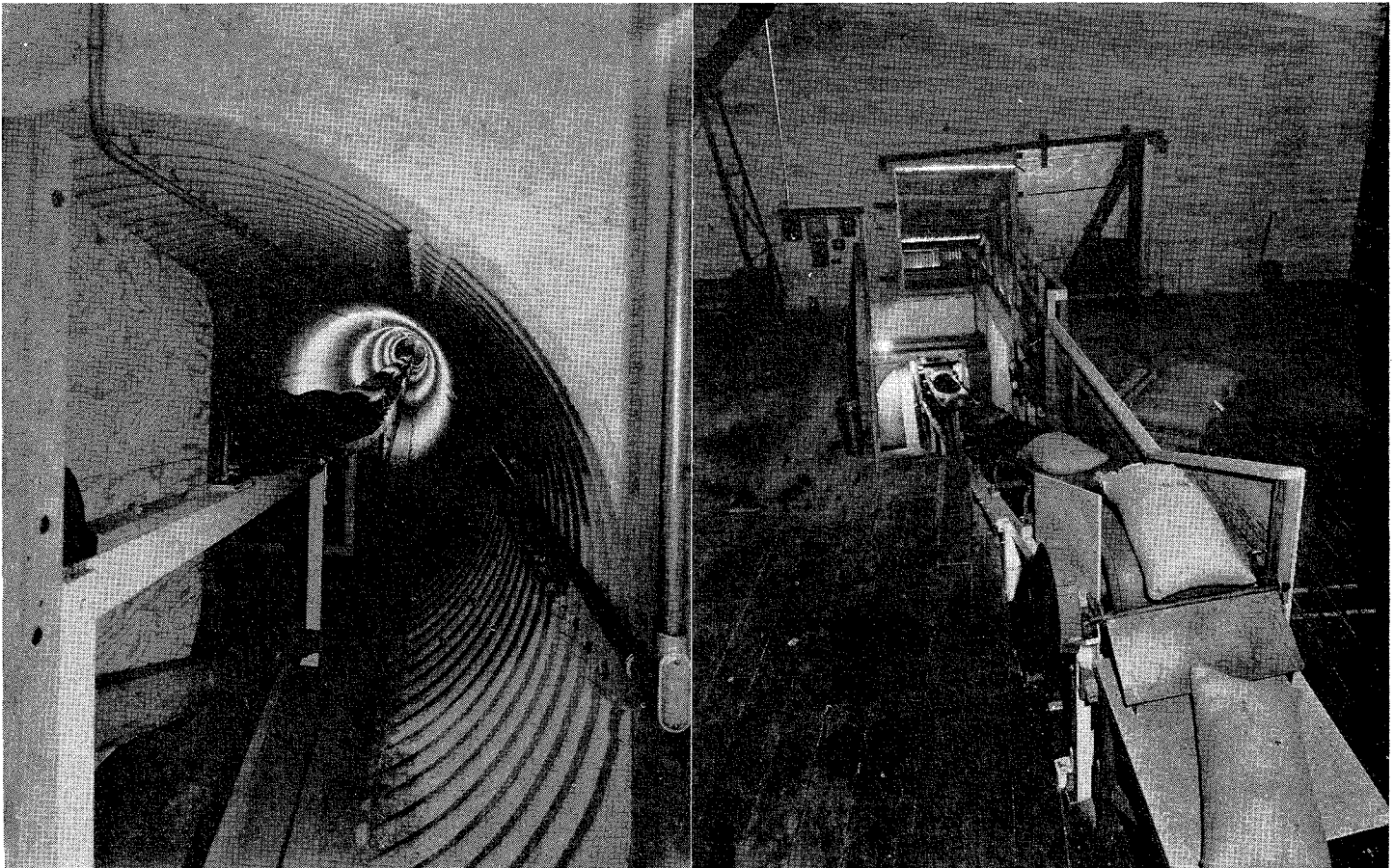
Traffic Hazard

Trucks could, of course, come down this frontage road and cross both freeway lanes to reach Southern

Pacific operating property. Space and topography, however, precluded driving up railroad right of way to reach the existing loading dock. Crossing the mainline tracks to reach the old Spence siding to the south again did not, of course, appeal to the seed company. Nor did it appeal to Dis-

LEFT—At west end of tunnel, main belt dumps sacks on short belt for trip up to freight dock. Belt on left is for incoming shipments. RIGHT—With a slight rearrangement, belts at freight dock end can be reversed to feed incoming shipments from car to reversible main belt.





LEFT—As vehicle traffic speeds overhead, an outbound shipment of California navy beans moves from plant to car under the freeway. RIGHT—With conveyor reversed and outgoing feeder chute hoisted clear, main belt delivers incoming sacks quietly and efficiently to main warehouse. Head wall of tunnel is right of way line.

trict V engineers and right of way agents who, in studying the number of truck trips that would have to be made across the freeway in an average year, recognized a traffic hazard problem requiring immediate solution.

The matter of damages to the seed company by virtue of cutting it off from its loading dock did not enter into the matter, incidentally. Whereas unity of use existed between the plant and the dock, there was no contiguity nor unity of ownership. Compensable damage may have accrued to the Southern Pacific railroad, on whose land the dock was located, but not to the seed company in this respect.

Tunnel Is Solution

In the meantime, however, no solution presented itself that did not involve crossing both the freeway and the railroad tracks, until the possibility of a tunnel under the freeway was suggested. Investigation indicated

this to be a practical solution to the traffic hazard problem and, incidentally, the company's freight loading and unloading problem.

Construction details were worked out cooperatively by C. H. and H. C. Eckhart of the seed company, by District V representatives, and by engineers of Link-Belt Company.

Construction was in two phases, the east portion of the tunnel being constructed by Fredrickson & Watson Construction Co. when the new northbound freeway lanes were built, and the west portion being completed by Rice Brothers, Inc., when the existing highway was subsequently resurfaced to serve as southbound freeway lanes.

By open cut method, 90-inch multiplate was installed for approximately 200 feet with a concrete flooring. Reinforced concrete wells and stairs were constructed at each end and the State's work was complete.

Conveyor Equipment

The Eckhart brothers then proceeded to give the tunnel interior a coating of white paint, to reconstruct the loading dock, and to purchase and install approximately \$10,000 worth of Link-Belt conveyor equipment. Cost of labor was estimated at \$5,000, as all installation was done and many additional items of equipment were fabricated on the job by Eckhart employees.

The main 2-foot by 500-foot belt is powered by a 7½ h. p. motor with gearhead drive.

Operation is relatively simple. Lift trucks bring outgoing cargo (usually 100-lb. sacks of processed beans, peas, or seed) to the east end of the conveyor. With one man loading the conveyor and two men at the other end transferring the sacks into a car, one 30-ton freight car can be loaded with 600 sacks in an hour.

Rapid rearrangement of certain chutes and short feeder belts permits

reversal of the main belt to handle incoming cargo.

Complex Relocation

Inclement weather can no longer interfere with loading or unloading operations, as freight is under cover from plant to car.

Construction of the tunnel actually was only a small part of a rather complex relocation and rearrangement of facilities necessitated by freeway construction in the seed company area, as can be quickly noted from the accompanying before and after views.

Involved in moving were the company's main office and truck scales, well and pump house, restaurant building, and most important of all, the large mill building containing 2½ stories of complicated processing machinery.

By a schedule carefully coordinated between road construction and plant relocation, advantage was taken of the company's slack season, and all moving completed without loss of a day's production.

MR. KELLY DESERVES THIS

ASSOCIATION OF WASHINGTON CITIES
250 Smith Hall, University of Washington
Seattle 5, Wash.

March 12, 1954

MR. KENNETH C. ADAMS, *Editor*

DEAR MR. ADAMS: Although I have not had the opportunity of reading the entire contents of your last publication of the magazine *California Highways and Public Works*, January-February issue, I have had the opportunity of reviewing its contents and reading in some detail the article by Mr. Kelly on motels and freeways, and wish to convey to you and your staff our appreciation for these publications.

This last issue is outstanding, although the other ones are of tremendous value. Please be assured that we appreciate the fine work you and your colleagues are doing.

Sincerely,

FLOYD M. JENNINGS
Planning Consultant

Annual Bonneroo In Los Angeles Being Planned

THE CONSTRUCTION DEPARTMENT of District VII, Los Angeles, State Division of Highways, will have its Third Annual Bonneroo Stag Party at the Rodger Young Auditorium, located at 936 West Washington Boulevard, Los Angeles, on the evening of May 7, 1954, to honor resident engineers and contractors who completed the 10 best contracts in the district during the calendar year of 1953.

Resident engineers on the 10 best contracts were Haig Ayanian, H. E. Belford, R. A. Collins, Basil Frykland, J. L. Needham, and C. J. Woodbridge. Contractors were Griffith Company, J. E. Haddock, Ltd., Sully-Miller Contracting Company, Ukropina, Polich, and Kral, Webb and White, and Winston Brothers Company.

The best contract of the 10 will be announced at the party. The resident engineer and the contractor will each be awarded a trophy signifying the completion of the best contract for the State Division of Highways in District VII during 1953. The assistant resident engineers and the contractor's superintendent on the best contract will be presented with certificates of honorable mention. State Division of Highway personnel, and all contractors and their employees, are cordially invited to attend.

The story of how the "Bonneroo" got started and why this festive occasion got this name was explained in detail in the November-December, 1952, issue of *California Highways and Public Works*.

New construction during the 1952-53 Fiscal Year made possible the dropping from the posted bridge list of the Division of Highways of five bridges with load restrictions and 10 with speed restrictions. On June 30, 1953, there remained 33 bridges on state highways posted for reduced loads and 72 for restricted speeds. As of the end of the 1952-53 Fiscal Year there were 4,875 bridges on the State Highway System.

Bay Bridge

Continued from page 18 . . .

The widening of the toll plaza and its approaches to provide for 10 additional toll gates will not only serve to expedite traffic flow across the bridge but will also tie in with East Bay highway improvements and with the North Harbor development contemplated by the Port of Oakland. The design of the project allows for access to any future harbor improvements north of the bridge approach.

Roadway Widening

The roadway widening will extend from the East Bay Distribution Structure to and beyond the toll plaza. Expansion and widening of the Distribution Structure and the Eastshore Freeway north from Oakland are now under contract.

The Port of Oakland Overhead will be reconstructed and extended to span the widened highway east of the toll plaza.

When the new toll lanes have been completed and the existing lanes revised, all drivers bound for San Francisco will pay their tolls at one of 15 booths north of the administration building and all eastbound drivers will pay at one of 15 booths south of the building. Collection will be from the driver's side only. Experience has shown that "on-side" collection is more efficient and is preferred by bridge patrons.

Another project financed from the bonds issued by the Toll Bridge Authority has already been completed at a cost of \$220,000. This was the construction of a new painting gantry, or scaffold, which simplifies the maintenance and painting of the bridge and improves safety conditions for employees.

GOOD TEAMWORK ON THE HIGHWAY

Signals clearly given and understood make for good teamwork on the highway, points out the National Automobile Club. Motorists who clearly and deliberately signal their intent to turn or stop, and those who watch carefully for such signals, are helping substantially to reduce our tragic traffic accident toll.

ANOTHER MILE OF RAMONA FREEWAY OPENED TO TRAFFIC



UPPER—Highway Commissioner Robert E. McClure officiates at ribbon cutting on Ramona Freeway. LEFT TO RIGHT: H. N. A. Stump, President of Rosemead Chamber of Commerce; Audrey Runyon, Dorothy Buckley, Jeanine Nelson, Commissioner McClure, Colleen Kalbfleisch, Gay Egeter. LOWER—This map shows the new section of the Ramona Freeway. Traffic interchanges at San Gabriel Avenue, Walnut Grove Avenue and Rosemead Boulevard will give access to the freeway for practically every motorist of the area served.

ON TUESDAY, February 16th, last, another mile of the Ramona Freeway in Los Angeles County was opened for the use of the motoring public. This section was from San Gabriel

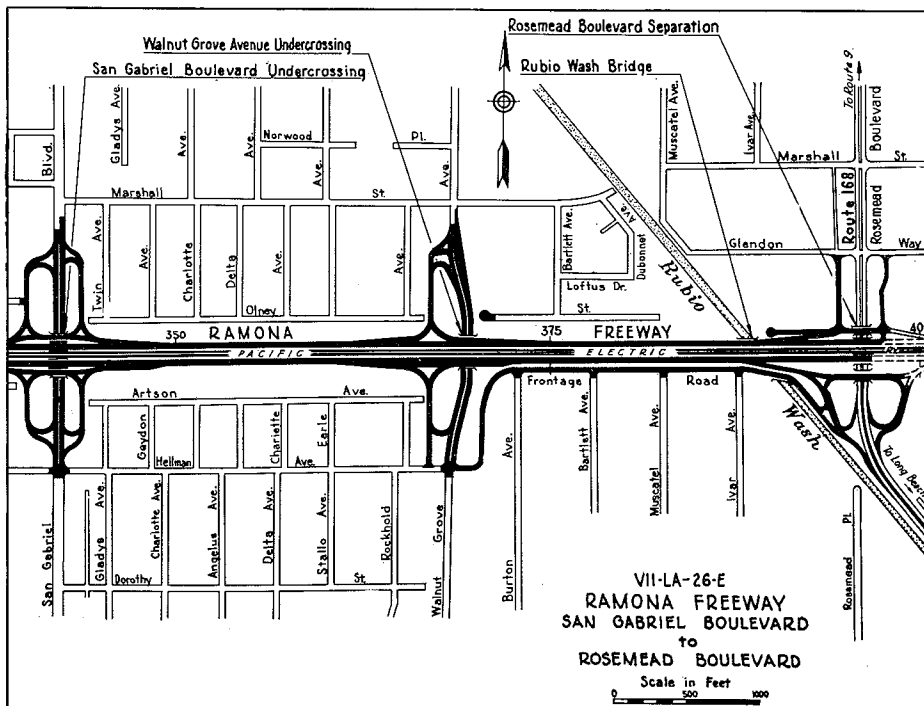
Avenue to Rosemead Boulevard. The contract was completed by Griffith Company of Los Angeles at a cost of \$2,500,000 and extended from Jackson Avenue to Rosemead.

The contractor finished the unit to San Gabriel Avenue first and that section was opened last December. Completion of the last mile was made the occasion for a celebration by Rosemead citizens.

The Rosemead High School Band, the Majorettes, the Flag Girls and the Color Bearers all turned out for the event, sponsored jointly by the Rosemead Chamber of Commerce and the Kiwanis Club.

Burl Blue, Jr., Chairman of the Roads and Highway Committee of the Chamber of Commerce, and Ray Galceran, Public Affairs Committee of the Kiwanis Club, were comasters of ceremonies. Introduction of special guests and remarks by representatives of chambers of commerce surrounding Rosemead participated.

Robert E. McClure, California Highway Commissioner from Santa Monica, was the principal speaker and cutter of the ceremonial ribbon. He was helped in the ribbon cutting by five young ladies, known as the Rosemead High School Princesses, and by H. N. A. Stump, president of the Rosemead Chamber of Commerce.

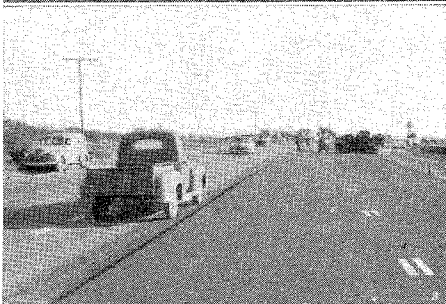
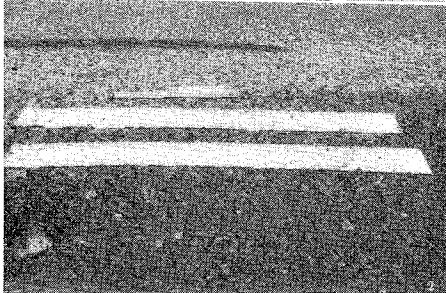


TEMPORARY TRAFFIC STRIPE SOLVES HIGHWAY PROBLEM

By W. T. RHODES, Associate Highway Engineer

THE EXPEDITIOUS handling of traffic through construction and particularly the proper delineation of the traffic lanes has become an increasing problem in view of the ever increasing traffic flow. This is especially aggra-

Placing strips on new plant-mixed surfacing to delineate traffic lane. Closeup showing pavement lane delineation strips adhering to rough-textured pavement. Pavement lane delineation strips placed immediately behind paving operations. General view of traffic lane markings.



vating on projects where it is necessary to shift traffic lanes on paved areas to clear different construction operations.

Contract 54-11VC7 provided for the construction of an additional uphill lane for trucks between the Torrey Pines Mesa and Penasquitos Creek, XI-SD-2-SD. During grading operations, in order to accomplish this, the existing center island curbs had to be removed and traffic shifted to the right portion of the roadway while grading was in progress adjacent to the left lanes. Later traffic had to be shifted to the left while paving operations were in progress on the right lanes. The large volume of high speed traffic required four lanes open at all times plus room for the contractor to carry on his construction operations. It was apparent that traffic lanes would have to be changed a number of times and must be done quickly and efficiently without interference to the flow of traffic or undue delays to the contractor.

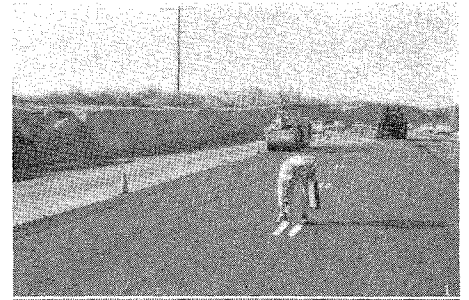
Prefabricated Strips

The conventional method of painted stripes was not considered to be the best solution because of the impossibility of removing or adequately obliterating the stripes when traffic was to be shifted and the probability of numerous conflicting stripes after one or two shifts of the traffic lane. As a solution to this problem, prefabricated strips were constructed of heavy roofing paper, 4-inch by 36-inch strips being cut from the roofing paper roll, painted with white traffic lacquer and glass beads applied.

To apply these strips to old pavement, an adhesive was used to hold them in position until traffic had permanently sealed them to the pavement. Asphaltic emulsion was used as an adhesive because of its availability although possibly some other colorless adhesive would be better, particularly on white portland cement concrete

pavements. As a word of caution, the use of adhesives can be overdone; only enough adhesive is necessary to hold the strips in place to prevent traffic from sucking them off of the pavement. After a short time, these

Placing strip on new plant-mixed surfacing prior to last pass of roller. Final pass of roller bonding pavement lane delineation strips to new plant-mixed surfacing. General view of traffic lane markings. Night view of pavement lane markings.



strips will adhere without trouble, due to the kneading action of traffic. If too much adhesive is used, they may have to be burned off the pavement and the resulting black spot defeats the purpose of the strip. If they have been placed correctly, no trouble should be experienced in removing them with a blade grader or a square point shovel.

Economical Feature

The ease of application on plant-mixed surfacing by one man provides the most economical feature. The strips, without adhesive, are laid on the warm pavement just prior to final rolling. The heat from the pavement, plus a pass with the roller, bonds them to the pavement, resulting in a well defined traffic lane ready for use as soon as the pavement is opened to traffic. Leveling course ahead can be lined in the same manner.

The slight elevation above the pavement afforded by the strips apparently creates outstanding visibility particularly at night under headlight beams. It is believed that any slight increase in cost over other temporary stripe, is more than offset by additional convenience and safety of the traveling public.

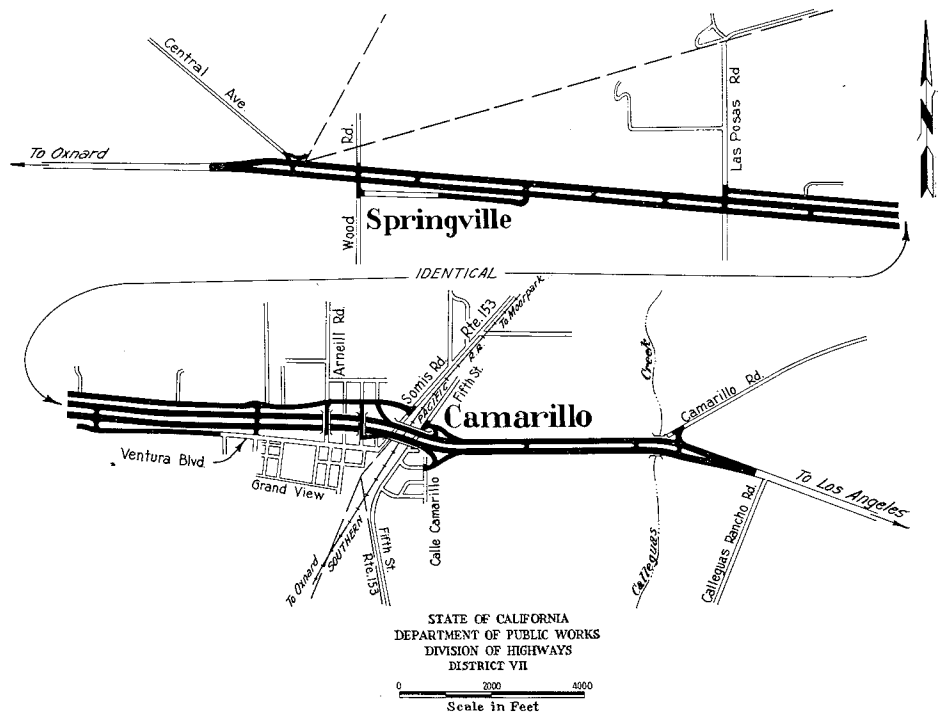
The above described method of applying temporary traffic stripe was developed by the writer, Resident Engineer, District XI.

USE JUDGMENT

Judgment is more important than merely obeying the legal limit when it comes to determining how fast you should drive, says the California State Automobile Association. Figures from about half the states indicate that speed is a factor in about 28 percent of all fatal accidents in traffic mishaps, but that in only 17 percent of such cases were drivers exceeding the prima facie limit. In the other 11 percent drivers were moving too fast for the prevailing conditions, even though they were not breaking the prima facie limit.

Nearly 2,500 vehicle drivers representing every district and department of the Division of Highways have been tested for vision and driving ability. The testing program is conducted by the Safety Section on a continuing basis.

Camarillo Grade Crossing on US 101 Eliminated



ELIMINATION of the last railroad grade crossing on U. S. Highway 101 between San Francisco and Los Angeles was accomplished on March 24th when the expressway through Camarillo, Ventura County, was opened to the motoring public. No longer will motorists have to wait while a train is on the siding at Camarillo. They will use the new overhead crossing of the railroad tracks.

The City of Camarillo celebrated the event with a ribbon cutting ceremony under the auspices of the Camarillo Chamber of Commerce. C. C. Tisdale, president of the chamber, was master of ceremonies and introduced the guests and speakers at the celebration.

Spectators gathered on the east-bound lane of the four-lane highway midway between the overpasses over Arneil and over Fulton Street, just opposite Glen Drive, which has become a closed street since the highway has been built.

The contract for this improvement was for well over a million dollars

and gives through traffic an uninterrupted highway through Camarillo and over the railroad tracks. The contract for the overhead and a separation structure over the railroad was for more than half a million dollars alone. This structure consists of two parallel bridges each 578 feet long and each provides a clear roadway width of 40 feet.

The completion of this project will remove the hazards of the grade crossing of the railroad and also facilitate cross traffic along Route 153 from Somis Valley to coastal points. It will provide 5.7 miles of new four-lane divided road for the motorists to use. At the present time there is a contract in force just east of Camarillo which goes through Newberry Park. This also is an enlargement of the present two-lane highway to a four-lane divided highway. This contract is for \$605,536.37.

Another job in preparation is west of the present road and will go from 0.4 miles west of Central Avenue to the Santa Clara River. This job is 5.1 miles long. There is \$1,943,000 in the budget for this new construction.

FAS Funds

Apportionments for County
Roads Total \$7,365,776

APPORTIONMENT of \$7,365,776 in federal and state funds to 57 California counties for improvement of county roads on the Federal Aid Secondary System for the fiscal year beginning July 1, 1954, was announced today by State Director of Public Works Frank B. Durkee.

Federal Government funds being made available to the counties total

\$5,091,975, with the remaining \$2,273,801 coming from state highway matching funds provided by 1953 legislation.

The federal funds are apportioned to the various counties according to the same formula used by the Federal Government in distributing them among the various states: one-third on the basis of area, one-third on

rural population and one-third on mileage of certain classes of rural mail routes.

Matching Funds

The money from state sources is for the use of the counties in matching the federal funds on the basis of approximately 58 percent federal to 42 percent local funds. The state law

COUNTY APPORTIONMENTS OF 1954-55 FISCAL YEAR FAS FUNDS UNDER FEDERAL-AID HIGHWAY ACT OF 1952 (SECOND YEAR); ALSO CORRESPONDING APPORTIONMENTS OF STATE HIGHWAY MATCHING FUNDS AUTHORIZED BY CHAPTER 1871 OF THE STATUTES OF 1953

County	Federal aid secondary	State	County	Federal aid secondary	State
Alameda.....	\$62,018	\$44,359	Orange.....	\$103,401	\$50,000
Alpine.....	25,460	18,211	Placer.....	64,691	46,271
Amador.....	25,722	18,398	Plumas.....	54,561	39,026
Butte.....	93,606	50,000	Riverside.....	196,190	50,000
Calaveras.....	31,109	22,251	Sacramento.....	121,462	50,000
Colusa.....	30,574	21,869	San Benito.....	36,230	25,914
Contra Costa.....	105,121	50,000	San Bernardino.....	361,521	50,000
Del Norte.....	25,460	18,211	San Diego.....	192,862	50,000
El Dorado.....	46,412	33,197	San Francisco.....		
Fresno.....	273,982	50,000	San Joaquin.....	121,627	50,000
Glenn.....	40,192	28,748	San Luis Obispo.....	84,272	50,000
Humboldt.....	112,898	50,000	San Mateo.....	31,708	22,680
Imperial.....	109,282	50,000	Santa Barbara.....	76,264	50,000
Inyo.....	127,722	50,000	Santa Clara.....	122,569	50,000
Kern.....	231,622	50,000	Santa Cruz.....	49,198	35,190
Kings.....	62,013	44,356	Shasta.....	86,994	50,000
Lake.....	36,242	25,923	Sierra.....	25,460	18,211
Lassen.....	73,847	50,000	Siskiyou.....	122,077	50,000
Los Angeles.....	216,815	50,000	Solano.....	49,023	35,064
Madera.....	65,912	47,145	Sonoma.....	139,005	50,000
Marin.....	37,040	26,493	Stanislaus.....	126,896	50,000
Mariposa.....	31,513	22,540	Sutter.....	37,881	27,095
Mendocino.....	92,931	50,000	Tehama.....	60,814	43,498
Merced.....	95,648	50,000	Trinity.....	52,169	37,315
Modoc.....	62,414	44,643	Tulare.....	205,548	50,000
Mono.....	46,662	33,376	Tuolumne.....	43,506	31,118
Monterey.....	113,337	50,000	Ventura.....	92,931	50,000
Napa.....	50,989	36,471	Yolo.....	44,969	32,165
Nevada.....	32,111	22,968	Yuba.....	29,492	21,095
			Totals.....	\$5,091,975	\$2,273,801

enacted in 1953 makes state highway funds available to the counties for this purpose, up to a maximum of \$50,000 per county per year.

The City and County of San Francisco, being entirely urban, is not eligible to participate in the federal aid secondary program.

On the basis of the federal apportionment formula, next year 27 counties will each receive more than \$70,000 in federal funds. Since it takes more than the maximum state contribution of \$50,000 to match federal funds above \$70,000, additional matching funds must be provided from county revenues if these 27 counties are to take advantage of their full federal apportionment.

The remaining 30 counties will receive state funds in the full ratio required to match the federal amounts, although some small percentage of county funds may be required for contingencies.

FAS System

The county roads on which federal aid secondary funds may be expended are those roads which have been designated by the county, with the approval of the California Highway Commission and the U. S. Bureau of Public Roads, as constituting the county's FAS system.

For the most part, these roads are next in importance to state highways in terms of traffic volume and economic service to the locality, and are often referred to as "feeder roads" or "farm-to-market roads." Of the approximately 68,000 miles of county roads in California, a total of some 5,600 miles are now on the Federal Aid Secondary System.

The largest FAS allocation for 1954-55 goes to San Bernardino County—\$361,521 federal and \$50,000 state funds. The smallest allocations are to Alpine, Del Norte and Sierra Counties, each receiving \$25,460 federal and \$18,211 state funds.

SAVING TIME BY CUTTING CORNERS

Many motorists try to save a little time by cutting corners. They may save time at the moment, but they may also find that they are taking a short cut to a shorter life.

In Memoriam

CLIFTON M. ALLEN

Clifton M. Allen, Highway Foreman at Julian, District XI, passed away at Mercy Hospital in San Diego on January 12, 1954. Cliff, as he was known to his friends and fellow employees, was born in Haverhill, Mass., on December 4, 1900. When he was very young his family moved to Canada where he received most of his schooling. In his second year of high school, the family moved to San Diego where his education was completed.

Prior to his entering state service, Cliff was employed by one of the major oil companies in the sales department. In March, 1934, he went to work at Julian Maintenance Station as a laborer. His conscientious devotion to duty won him consistent promotions until in 1944 he was appointed foreman at Desert Center. In November, 1949, he was transferred to Julian, where he continued his good work until his death.

Cliff was always active in community and civic affairs wherever he lived, serving especially well in groups and organizations where youth was to be sponsored. He will long be remembered in Julian for his work with deserving boys in the Soap Box Derby races.

He is survived by his wife, Pauline, and three sons: Lieut. David Allen, graduate of Annapolis, assigned to the Air Force; Sgt. Donald Allen, 22, also in the Air Force; and Gordon, 12; and one grandchild.

Funeral services were conducted on January 15, 1954, from Palm Mortuary in Escondido, with interment in Eternal Hills Memorial Park, Oceanside, California.

HELP YOUNGSTERS OBSERVE RULES

Sometimes persons who drive children to and from classes double-park at the school, thus requiring the youngsters to step between parked vehicles. Children are constantly taught at school not to step between vehicles parked at a curb, a rule that is vital to their safety, so don't encourage the youngsters to violate it, urges the California State Automobile Association.

Education Is Solution to Road Dilemma

THE SOLUTION to the Nation's highway dilemma lies in education, A. E. Johnson, president of the American Association of State Highway Officials, declared in Los Angeles at the Thirty-fifth Annual Convention of the Associated General Contractors of America.

"Public opinion is now ready for that challenge," declared Mr. Johnson. The critical highway problem—the same road system of the middle thirties with twice the number of motor vehicles operating on it—could be solved, Mr. Johnson said, by "letting the user know how much it costs not to have adequate highways, how much an adequate highway program will cost and letting the people decide how much highway program they will buy."

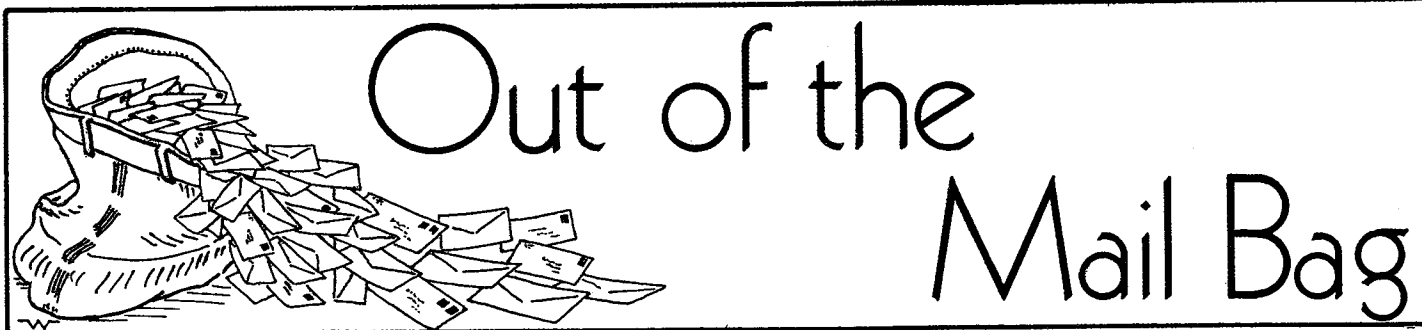
Mr. Johnson, who is chief engineer of the Arkansas State Highway Commission, said there now are 55,000,000 vehicles in this country—enough if bolted bumper to bumper to reach from here to the moon. The United States has 75 percent of all the passenger cars in the world and 50 percent of all the trucks, he added.

While stating that it is "absolutely true that highway revenues have doubled with the traffic increase," Mr. Johnson declared that highway costs have also doubled, so nothing has been gained financially and roads now must be flatter, straighter, wider and thicker to satisfy the traffic demand caused by more and faster cars and larger and heavier trucks."

Mr. Johnson estimated that it would take 50 billion dollars to take care of the over-all needs of the highways, roads and streets in the United States.

NO COLLISION NECESSARY

Motorists need not be involved in a collision in order to have a fatal accident. About 13 percent of all traffic fatalities in cities, and about 40 percent of all rural traffic fatalities do not involve a collision. The largest percentage of such accidents involved running off the road.



FROM AUSTRALIA

California Highways and Public Works
Sacramento, California

DEAR SIR: I have been fortunate in being able to read your journal, *California Highways and Public Works*, while employed by the City of Geelong West during the past three years.

I have now been appointed to the Shire of Bellerine and I would appreciate it if I could obtain future copies of your magazine.

This journal is by far the most useful data in magazine form that I have read and I hope that in the future I may have the pleasure of receiving copies.

Yours faithfully,

Assistant Engineer
G. N. TAYLOR

MAGAZINE HELPFUL

MR. KENNETH C. ADAMS, *Editor*

DEAR SIR: I would very much appreciate being placed on the mailing list for the publication *California Highways and Public Works*.

California Highways and Public Works is certainly one of the finest publications of its nature that I have seen. Every issue that has come to my attention has contained information of value to us in one or more of the phases of the research and planning work which we conduct.

Yours very truly,

W. E. CHASTAIN, SR.
Engineer of Physical Research

A COMPLIMENT

SOUTHWESTERN PORTLAND CEMENT COMPANY
Los Angeles, California

GEORGE T. MCCOY,
State Highway Engineer
Sacramento

DEAR GEORGE: The California Highway magazine is surely a "peach." I gave away my copy, the one that shows the four-level grade separation on the cover. I would appreciate if you will mark this to someone to see if I can get a half-dozen copies and if there is a charge, send a memorandum.

Certainly the department, the authors and editors all deserve congratulations.

Sincerely yours,

GEORGE WARREN
President

ROAD SIGNING PRAISED

SEATTLE 6, WASHINGTON

Editor
California Highways and Public Works

SIRS: Recently I had occasion to drive a car throughout the Bay region, and as a result I was thoroughly impressed with the road posting. This particular day was a foggy one and in addition I know very, very little about what proper turns to make or those not to make.

Across the San Francisco Bay, through Oakland, over the San Mateo Bridge, Palo Alto and on and on, you have expertly posted your roads, so that even a stranger such as I can get around with ease and also not impede traffic.

Thanks.

P. J. KLETT

FROM WALES

MORRISTON, SWANSEA
WALES, GREAT BRITAIN

Editor

DEAR SIR: I write to express my appreciation at receiving your magazine here in Britain since my return from the United States last year.

It is regarded very highly in the highways office of the London firm of consultants with whom I am employed, on account of both the informative contributions it contains from your field and design engineers and the excellent photographic record of the many interesting highway projects in California.

It serves, too, as a welcome reminder of the few weeks that I spent in Sacramento, San Francisco and Los Angeles, in May, June, 1951, and I sincerely hope that you will continue to mail it to me at the above address.

I remain,
Yours sincerely,

HARRY L. HOLLAND

LETTER FROM MELBOURNE

RINGWOOD, VICTORIA, AUSTRALIA
November 30, 1953

MR. K. C. ADAMS, *Editor*

DEAR SIR: Over a number of years I have been receiving your publication, *California Highways and Public Works*. It has helped me in my studies of harbour highway engineering, and also to learn new methods of construction and maintenance.

I wish you and your staff all the best for Xmas and the New Year. I remain

Yours sincerely,

JAMES BROWN

GREETINGS FROM TURKEY

Ankara, December 18, 1953

California Highways and Public Works,
Sacramento, California

DEAR SIR: In sending you my best wishes for a happy holiday season, I wish also to thank you for the generous help you people of *California Highways* have extended on every occasion during our training trip.

I should like also to thank you for the regular mailing of *California Highways and Public Works*, which is pleasant reading for many people here at home. Although I quit the Turkish highways a year ago, my heart still stays on the highway bridges.

I hope that the New Year will hold for all the kind people of the California Division of Highways all the best of happiness. I hope too, that I shall be seeing again the beautiful redwoods, Pacific Coast and lovely valleys of California.

Yours sincerely,

TURHAN ISKIT
P. K. 1090, Yenisehir
Ankara, Turkey

MAGAZINE INFORMATIVE

LOS GATOS, CALIFORNIA

Editor

California Highways and Public Works

SIR: I have derived great pleasure and information from all past copies of your magazine. Its reading gives one a much deeper appreciation of our Highway Commission's outstanding work and I know that by loaning my copies to my friends it has given them a different view on "Where does our gas tax money go?"

Most sincerely,

A. W. BASSETT

NEW NAME ON LIST

THE EDITOR

DEAR SIR: At various times we have noted references or abstracts in British publications to articles appearing in your publication and we believe it would be a useful addition to our technical library.

I would be glad, therefore, if you would place me on your mailing list.

Thanking you,

Yours very truly,

WM. H. MACMAHON
Chief, Technical Section

LIKES MAGAZINE

CAPITOL ENGINEERING CORPORATION
Dillsburg, Pennsylvania

MR. GEORGE T. MCCOY
State Highway Engineer
Sacramento, California

DEAR MR. MCCOY: Every letter should have a purpose. This one has two.

First, I want to congratulate you upon your recent election to the first vice presidency of the A. A. S. H. O. This is a well-deserved honor.

Secondly, I want to express my appreciation to the person responsible for sending me the *California Highways and Public Works* magazine. This is the outstanding publication of its kind in the United States. As Chief Engineer of the State Road Commission of West Virginia, I received and enjoyed it regularly. As of July 1, 1952, I resigned to go to Paris, France, on three airport jobs for Capitol Engineering Corporation. After my return to this Country I was sent down here for preliminary work on a proposed toll highway between Dallas and San Antonio, and lost touch with your magazine. However, it recently began to appear again and I have greatly appreciated it.

With best wishes of the season to you and to Mr. R. H. Wilson, I am

Sincerely yours,

M. L. O'NEALE

FROM ARGENTINA

CORDOBA, ARGENTINA

California Highways and Public Works
Sacramento, California

GENTLEMEN: A few days ago the girl in charge of the library at the Direccion Provincial de Vialidad showed me an issue of *California Highways and Public Works* magazine, which I found very interesting.

The issue referred to is dated September-October, 1953, and it brings two articles about roadside planting and traffic studies that are not only informative, but exceedingly valuable as a reference work.

The Province of Cordoba has a road network of about 20,000 km. mostly built on natural soil. Apart from the national routes that bind the city with other important provinces, which are mostly paved, the province owns a good section of paved highways.

The writer is a highway engineer and would thank the editor if he were so kind as to send him regularly a copy of *California Highway and Public Works* magazine.

Yours sincerely,

F. TONOLI
Cordoba, Argentina

MORE POWER TO YOU

STOCKTON CHAMBER OF COMMERCE

STOCKTON, CALIFORNIA

March 1, 1954

MR. KENNETH ADAMS, Editor

DEAR MR. ADAMS: We were very much interested in the excellent article (FAS-Project-Pacific Avenue, San Joaquin County) by Clement Plecarpo in your January-February issue.

We would like to call attention to the fact that the 18-foot median strip has been landscaped with minimum maintenance plant material. This was done in one Arbor Day last November by the Lions Club of Stockton, which also purchased the plants. The saving to the Highway Department by cancelling proposed blacktopping of the median strip will maintain the project for a number of years.

The Lions Club and the County Highway Department deserve much credit for their splendid cooperation, making possible this safety and beautification planting on a major approach to Stockton.

Sincerely,

STOCKTON CHAMBER OF COMMERCE
CITY APPROACHES COMMITTEE

"GUS" SIMPSON, Chairman
BRUCE CRAVER, Secretary-Manager

Flared Guard Railing

Reduces Accidents at Bridge Approaches

By R. J. ISRAEL, Assistant Traffic Engineer

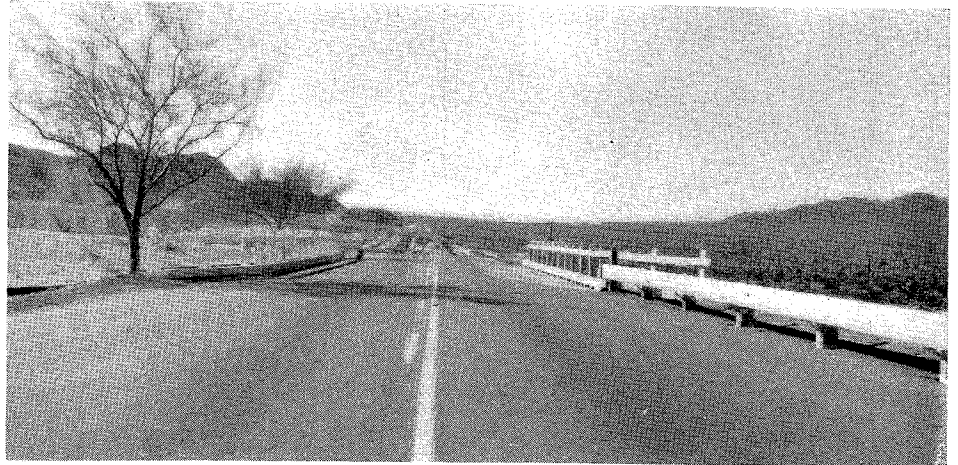
ONE OF THE principal methods which the California Division of Highways employs in its continuous effort to increase highway safety is the careful study of the effect of engineering improvements. The analysis by the division's Traffic Department first points the way toward the solution to a safety problem. After the solution has been applied, the traffic engineers study the location or locations concerned to see the extent to which the accident-producing condition has been alleviated.

An outstanding recent example of such before-and-after studies in evaluating the effect of an improvement of this type had to do with the installation of flared guard railing at the approach corners of substandard width bridges on a high-speed highway through desert country. When the figures were in and tabulated, they showed that this one device had reduced the over-all rate of accidents at bridge ends by 55 percent. With respect to fatal and injury accidents, the reduction was 68 percent.

Bridge Accidents

The accident records maintained and analyzed by the Division of Highways show that a considerable number of mishaps involve vehicles running into the ends of bridge railings, particularly when the railings are set closer together than the out-to-out width of the shoulders on the approach to the bridge. In certain instances a specific bridge or other structure, because of a combination of factors, such as restricted approach sight distance plus narrow width, will be the focal point of a concentration of accidents.

Such "sore thumb" locations are not under consideration in this discussion. They are treated individually in the same manner as other points of high accident frequency, such as certain curves and intersections. Corrective measures are applied as deter-



This photo shows type of flared guard railing used at bridge approach

mined by analysis of the accident pattern. What centered attention on the bridge-end problem in the desert area was the collective picture. Individually, these structures were involved in an average of less than one accident per year; collectively, there were so many of them so similar in nature that they demanded study and treatment.

Flared Guard Railings

It had long been recognized that a relatively inexpensive method of reducing bridge-end accidents in both number and severity was the installation of flared guard railing at the right-hand approach corners of the structure. Railings are set on a parabolic curve with the length determined by the width of the highway shoulder. For example, a six-foot offset between bridge curb and the edge of the shoulder calls for a 90-foot length of railing.

Accordingly, the Division of Highways had begun some time ago to install approach railings at the ends of bridges where the accident situation proved to be critical. In 1948 it was made design policy to provide such railing on all new structures whose width was less than that of the adjacent roadway and shoulders.

Before long it was apparent in a general way that there were fewer accidents involving bridge-ends. The improvement in safety at specific locations might be statistically evident, but it is usually not so easy to present a clear collective picture of the effect of a single type of corrective device at a number of different locations. This is because the individual accident locations may differ widely as to physical conditions, traffic volume or other important factors; these extraneous elements ordinarily make it difficult to measure the effect of a common corrective measure.

Bridges Studied

The Division of Highways' accident analysts were fortunate in this case, however. Data were available on a substantial number of approach guard railing installations on like-type structures all on a single highway route which present homogeneous conditions throughout its length.

The bridges chosen for study were those on U. S. 60-70 in the desert area of the easterly half of Riverside County. Approach guard railings had been installed as follows: 11 bridges in 1946, 8 in 1948, and 9 in 1949, a total of 28.

This stretch of highway is all two-lane, generally straight, and level or only slightly rolling. Traffic is fairly uniform as to volume throughout the length of the route studied, and the high percentage of through vehicles means that all structures carry substantially the same traffic. Speeds are generally high all along the route; there are no built-up areas or limited speed zones near any of the 28 bridges. Finally, all the bridges concerned are of the same design: timber trestle construction with timber curbs and railings. All of them have, within a few inches, the same roadway width—approximately 24½ feet.

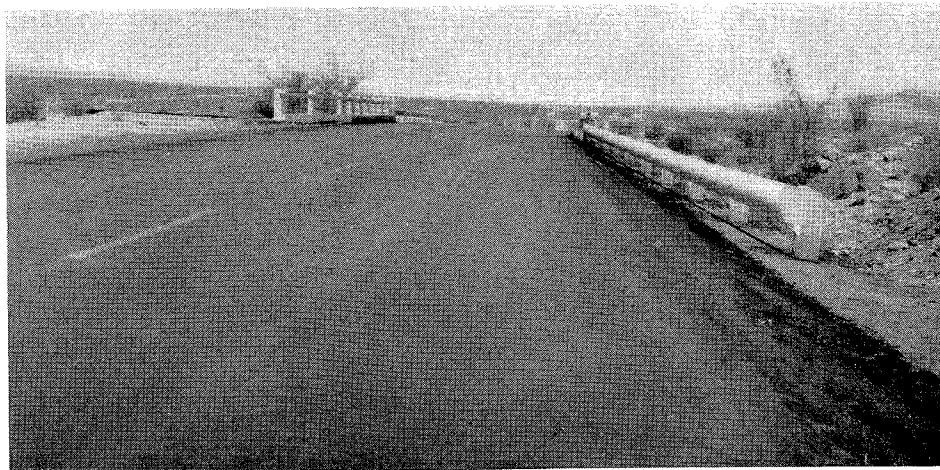
Period Covered

The total period covered by the study was from January 1, 1942, to July 1, 1951. This period included a factor which would tend to bias the results against the improvement. The pre-guard rail period included the years of gasoline rationing and the special 35-mile wartime speed limit. It is true that on this important interstate route traffic volumes were not materially reduced during the war; but the smaller percentage of nonprofessional drivers using it and the reduction of over-all speed should have resulted in lower accident rates during the portion of the "before" period. No effort was made to adjust for this factor; the total period of record was used in the study, in order to increase the size of the statistical sample.

Because of the previously mentioned uniformity of physical and traffic conditions, it was feasible to combine accident data for all 28 bridges. All of them were considered to have an equal accident potential; the only weighing done was on the basis of actual traffic and of the period of exposure—as noted, the "before" period ranged from four years to seven, with the "after" period varying accordingly.

Reported Accidents

During the years prior to the installation of the guard rail, the total traffic exposure on the group of bridges added up to 101.1 million vehicles. The "after" period, shorter in most cases, showed a total exposure of 50.0



Another bridge approach protected by flared guard railing

million vehicles. The actual number of reported accidents in the respective periods is shown in the following table:

	Before period (101.1 M.V.)	After period (50.0 M.V.)
Fatal accidents	7	1
Injury accidents	31	5
Property damage accidents....	20	7

To place the comparison on an equal exposure base, it is necessary to divide by the number of vehicles involved in the respective periods. Thus, the over-all accident rate per million vehicles in the pre-guard rail period was 0.574, as compared to a rate of 0.260 after the installations, making a reduction of 55 percent in the rate for all types of accidents at bridge-ends. For the fatal and injury accidents combined, the reduction was even more striking: from 0.376 per million vehicles before to 0.120 after, a reduction of 68 percent. It is noteworthy that while the casualty accidents during the "before" period outnumbered the noninjury accidents almost two to one, the noninjury mishaps actually exceed the more serious ones in the "after" period.

Cost of Installations

Guard rail tapered across the width of the shoulder at the bridge approach achieves this remarkable improvement in safety in two ways. Obviously, it is a distinct aid to visibility, particularly at night, and also serves as a general warning to the driver unfamiliar with the route that a situation requiring caution and added alertness lies ahead. It provides an ex-

tra cushion of safety against the special danger resulting from the combination of high speed and driver fatigue particularly prevalent on desert routes.

In addition, the railing acts to deflect into the proper lane a vehicle which is traveling too far to the outside of the roadway. Even though the vehicle may actually strike the guard rail, the damage will often be negligible. In the extreme case, a sideswipe crash into a flexible guard rail is considerably less likely to be lethal than a head-on crash into a solid bridge-end. The fact that property damage accidents show a smaller proportionate reduction in the "before" and "after" periods than the casualty accidents appears to bear out this observation.

The total cost of guard rail installations at the 28 bridges included in the study was \$13,092.20, an average of \$468 per bridge. These cost figures include, of course, the relatively high transportation expense and excessive travel time involved because of the relatively isolated locations of the structures.

Twenty-two railroad grade crossings were eliminated from the State Highway System during the 1952-53 Fiscal Year by construction, changes in highway alignment or abandonment of railroad tracks. Of the seven railroad grade separations completed during the year, five were new crossings on new alignment and two eliminated existing grade crossings.

Retirements *from* Service

Richard A. Tremper

RICHARD ARTHUR TREMPER with over 41 years of service with the Division of Highways was honored at a retirement dinner given in his honor at the New Tivoli Restaurant in San Francisco. The event was attended by more than 100 of his close friends and co-workers.



RICHARD A. TREMPER

"Tremper" was born in Stockton, California, on December 16, 1887. He attended school in both Stockton and Santa Rosa. He began his employment as a rodman for District II in 1912 and progressed steadily within the organization through the various grades of employment as instrumentman, levelman, chief of party, location engineer, resident engineer, highway maintenance superintendent, assistant district maintenance engineer and district maintenance engineer.

Through his steady progress in District II from the very start of the organization until the present his work and counsel were very definitely considered assets to the Division of Highways. Since "Tremper's" main family ties remained in the Bay area he obtained a transfer to District IV in 1949 and he was one of the valued employees of District IV Maintenance Department since that time. This is no better explained or exemplified than by the late District Highway Engineer Fred W. Haselwood's letter to this district upon Mr. Tremper's transfer which read as follows:

"Mr. Tremper has very ably filled a vital role in our Maintenance Department for a number of years, and although we will regret losing his services, we will not stand

... Continued on page 64

Alexander N. Lund

ON JANUARY 1, 1954, Al Lund retired from the Division of Highways, thus terminating a 32-year career, 18 years of which were spent in District X.



ALEXANDER N. LUND

On November 5, 1953, a party of 225 of Al's friends from all over California gathered in Stockton to bid him good-bye. District engineers, contractors' representatives and other friends made up the group which was presided over by Cliff Temby as master of ceremonies. All previous speaking records were broken by Al when he talked for 62 seconds.

Born Alexander Nelson Lund on December 28, 1888, in Dresden, Yates County, New York, Al, as he is known to all, went through grammar and high school in Ovid, New York, and graduated from the University of Michigan in 1911, receiving a B.S. in engineering.

Served Overseas

Employed by the U. S. Bureau of Reclamation and the Great Northern Railroad Company after graduation, he quit to join the armed forces in 1917 and served overseas for two years.

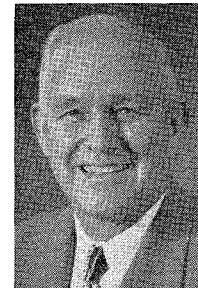
Returning in 1919, Al worked on several projects up and down the State of California, finally joining the Division of Highways as instrumentman on May 7, 1922.

In October, 1923, he transferred to District VI as assistant superintendent on the Yosemite All-Year Highway between Briceburg and El Portal. He was destined to rebuild this stretch

... Continued on page 64

D. C. Willett

Daniel Clinton Willett celebrated his 34th anniversary as a member of the Department of Public Works by retiring February 11, 1954. Willett, chief construction engineer, had been in charge of all construction, structural engineering, maintenance survey and repair of state buildings and of the schoolhouse activities of the Division of Architecture for the last seven years.



D. C. WILLETT

Willett was born in Kentucky March 6, 1893. He attended parochial schools in Henderson and Ritnor Elementary and High School in St. Louis, Missouri. He was graduated from the Christian Brothers College in St. Louis in 1915 with the degree of bachelor of science in civil engineering.

Came West in 1920

During the summer of 1914 Willett was employed as draftsman and engineer for T. C. Lee, Architect, of St. Louis, and following graduation he practiced architectural design at the Ritnor School and the Overland Bank Building in St. Louis County.

In June, 1915, he entered the employment of the Missouri, Kansas, and Texas Railroad at Parsons, Kansas, in the chief engineer's office. It is of interest that Willett took a job in the office in which Highway Bridge Engineer F. W. Panhorst had worked the previous fall when the office was in St. Louis.

From February, 1915, to January, 1920, Willett worked successively for the Rock Island Railroad; the Missouri Pacific Railroad, in the Standards Department; the U. S. Department of Interior Reclamation Service, as struc-

... Continued on page 59

Leo E. Robinson

On December 31, 1953, Leo E. Robinson, Highway Foreman in District II, retired after 31 years of service in the Division of Highways.

Robinson was born on December 6, 1890, in the San Felipe Valley in Santa Clara County, moving to Shasta County in 1921.

Ed started work with the Division of Highways in District II on October 10, 1921, driving a four-mule team hitched to a Fresno scraper on Hatchet Mountain on Highway 299 east of Redding. This was on a day labor construction project under the supervision of F. C. Macaulay. This first employment terminated November 4, 1921. He was employed again on this project on November 21, 1922, and worked until the camp was closed on April 25, 1924. In the winter of 1922-1923 he was given the task of keeping the snow off the Burney side of Hatchet Mountain, using horses and a small grader. In the spring of 1923 he was promoted to truck driver and has many interesting experiences to tell of the old solid tire trucks left over from World War I.

Started in 1924

Robinson's permanent service started on August 8, 1924, as a truck driver in District I at Willits, but he was transferred back to District II on September 23d, and has worked in that district since that time.

Ed was made Acting Maintenance Foreman in 1925, gaining a permanent rating in 1931. He has served in this capacity since, and the last 17 years has been in charge of Highway 44 from Redding to Lassen Park.

A pot luck dinner at the Redding Maintenance Station was given on January 3, 1954, for him by his fellow employees, who wished him a lot of pleasure in his future plans and also presented him with a watch.

Mr. and Mrs. Robinson are buying a trailer and expect to travel. This year they plan only short trips and two months fishing on Hat Creek near Lassen Park. Next year they plan a two-year swing around the Country visiting Southern California, Texas, Mississippi, Florida, the Great Lakes and Yellowstone Park.

Frank A. Johnson

Completing 21 years of state service, Frank A. Johnson, Principal Structural Engineer of the Division of Architecture, has retired.

He is a native son, having been born in San Francisco, California, August 22, 1888. He attended high school at California School of Mechanical Arts (Lick School). Since March, 1906, one month prior to the San Francisco earthquake and fire, he has been actively engaged in the structural engineering profession in California.



FRANK A. JOHNSON

He attended University of California, College of Civil Engineering. In 1917 he served in the United States Army.

During the period September, 1922, to June, 1933, Mr. Johnson had varied employment in the structural design field. In June, 1933, he entered the service of the State of California, Division of Architecture. The first nine years of this state service was in Southern California as supervising structural engineer in the administration of the "Field Act," which was enacted into law in 1933 to assure proper and safe construction of public school buildings in California. He was one of three engineers in Southern California who were selected to formulate policies and to initiate the Division of Architecture procedure in the checking of design and plans for schools under the provisions of the Field Act, immediately subsequent to the Long Beach, California, earthquake of March, 1933.

During his career, Mr. Johnson has participated in the structural design and construction of many structures, among which are the Balfour Guthrey Building, American National Bank Building and the Standard Oil Building in San Francisco.

He retires with the grade of principal structural engineer in charge of the structural design of all structures constructed by the Division of Architecture. This building program ex-

... Continued on page 58

Harry W. Bolin

After 20 years of service with the Division of Architecture, Harry William Bolin of Northridge, San Fernando Valley, retired on January 15, 1954.

Bolin had been area supervisor of the Schoolhouse Section in Southern California since 1934 with the rank of principal structural engineer since 1948, except during 1943 and 1944 when he handled special assignments for the U. S. Navy.

Bolin was born March 15, 1888, in Muskegon, Michigan, the son of August and Caroline (Johnson) Bolin. He was graduated from the University of California at Berkeley in 1913 with the degree of bachelor of science in civil engineering. He was employed as a structural designer and engineer by H. J. Brunnier of San Francisco from 1913 to 1924 with the exception of a World War I period when he was in service in France with the 23d U. S. Engineers, First Army. From 1925 to 1926 he was the manager of the Engineering Department of the J. E. Hayes Corporation at Shanghai, China, and from then until 1933, was a consulting structural engineer at Oakland, California.

He was employed by the Division of Architecture in 1933 as a structural engineer and that year became office engineer in charge of the Los Angeles Area Schoolhouse Office. In 1944 he was placed in charge of the activities of the Los Angeles Area Office, with the rank of supervising structural engineer until 1948 when he was promoted to principal structural engineer.

Bolin is a member of the Structural Engineering Association of California and served as its president in 1950. He is a member of the Structural Engineering Association of Southern California and served as its president in 1949. He is a member of the American Concrete Institute, the Earthquake Engineering Research Institute, the American Society of Civil Engineers, and served as chairman of the Seismology Committee of the American Society of Civil Engineers from 1940 to 1950.

Buren Thorleifson

On December 29, 1953, Buren Thorleifson, Construction Supervisor II, Division of Architecture, was honored with a dinner given for him by his fellow workers at the Turf Club in Rivera on the day preceding his retirement after 15 years of service with the State.



BUREN THORLEIFSON

Thorleifson was born May 4, 1885, on the Island of Sjaelland, Denmark, and was educated in the Technical School in Copenhagen, majoring in construction engineering.

In 1907 he was employed by the Government of the Republic of Chile as building inspector and supervised the construction of the Naval Academy at Valparaiso and the customs office at Santiago.

Came to California in 1910

In 1910 he decided to leave this position and go to Australia. However, he came to the United States instead, landing at San Francisco in the fall. Inasmuch as he could speak no word of English, he decided to go to Fresno where there was a Danish colony. During the years 1910 to 1912, he was employed at Fresno by the California Wine Growers Association. After this he again went into the construction business, working in Chicago; Bridgeport, Connecticut; Racine, Wisconsin; and other places.

Worked in Detroit

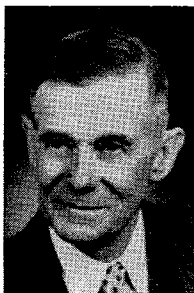
He returned to California in 1921 and was employed by Darrell-Condley Company for two years and then went into business for himself from 1925 to 1929. From 1929 to 1931 he worked for Stone and Webster as estimator on the Rock Island Dam project in the State of Washington, after which he again returned to California, working for Robert E. McKee, and was then employed by the U. S. Public Works Administration.

In 1938 he entered state service as inspector for the Contractor's License

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Frank W. McManus

Frank W. McManus, Assistant Equipment Engineer of the Division of Highways, retired of as March 5, 1954, after 33 years of service. The Capitol Inn near Sacramento was the scene of a testimonial luncheon given for him on March 6, 1954, with about 125 friends and colleagues present.



FRANK W. McMANUS

"Mac" was born in Sacramento on June 11, 1886, son of George and Lucy McManus, early residents of this city. He graduated from local schools. Some of his earlier positions were with the Southern Pacific Company in 1902 where he advanced to the status of draftsman; then to Sacramento County for about three years (1906-09), working on county roads when the Auburn, Franklin, Stockton, Jackson and Mills roads were first built to highway standards. He also surveyed several subdivisions for the City of Sacramento and later operated his own private practice.

Army Service

McManus served in the National Guard and was stationed along the Mexican border prior to being inducted into the regular army during World War I. He was married in Tucson, Arizona, in 1917 to Maude Annereaux of Sacramento. Upon returning to Sacramento, he was associated with the Liberty Iron Works as an aeronautical engineer, doing experimental work on airplane design. Following this period in his career he built and flew airplanes until July, 1921. At that time he went to work for the State as draftsman and in May, 1922, transferred to the Equipment Department of the Division of Highways as junior equipment engineer and progressed to associate equipment engineer in October of 1951. In the latter position, he was in charge of requisitions for repair parts for some

6,000 construction and maintenance units.

"Mac" is a Mason, becoming a member of Washington Lodge No. 20, in 1917-18. He sold his "ranch" located in the Del Paso Heights region, recently, and is now living in Sacramento during the construction of a new home in Carmichael.

"Mac" and Mrs. McManus plan on buying a house trailer for an extended tour. He will be greatly missed by his fellow employees and many friends while he is on tour.

FRANK A. JOHNSON

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ceeds \$50,000,000 in construction projects annually. In this present work, Mr. Johnson has been affiliated with such structures as the State Highway Building in San Francisco, the Business and Professions Building Annex, the Public Works Annex, the State Department of Education Building, the Motor Vehicle Building and the State Capitol Annex, all of Sacramento. He had charge of structural design for the proposed Department of Employment Building, a structure of approximately \$10,000,000 in cost. Also, he has been responsible for the structural design of all buildings of the new Sacramento State College. His successor will be Charles Peterson of Sacramento.

Mr. Johnson is a registered civil engineer in the State of California with authority to use the title of structural engineer. He is a life member of the American Society of Civil Engineers and an honorary member of the Sacramento Chapter of that society. He is married. His wife was formerly Abby Gibson of Berkeley. He has two daughters and six grandchildren.

By adding a separate power unit to conventional farm machine rotary weed beaters the Division of Highways Equipment Department has improved their efficiency in roadside weed eradication. The beater is pulled by a small tractor and the mounted engine eliminates the necessity of a power take-off.

D. C. WILLETT

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tural designer at El Paso, Texas; the American Smelter and Refining Company, Mexican Division, where he assisted in the redesign and reconstruction of the Chichuahua and Monterey Smelters in northern Mexico; the Illinois State Highway Commission, as office engineer, East St. Louis Division; and for St. Louis County, Missouri, as assistant highway engineer.

On November 27, 1915, he married Florence C. Fuchs, who had formerly worked as a stenographer for the California State Compensation Insurance Fund. The new Mrs. Willett strongly desired to return to California and did her best to persuade Willett to come west, which he finally did in 1920.

In Bridge Department

Willett was employed by the Division of Highways February 20, 1920. He worked for the Highway Bridge Department until 1921 when he was borrowed by the Division of Architecture to check the plans of the Printing Plant at 11th and O Streets and later to act as construction superintendent. He was recalled by Highways on April 27, 1923, and was appointed Office Engineer of the Bridge Department with the class of Structural Engineer V, equal to our present-day supervising structural engineer, a rank which he held for 20 years. In 1924 he was assigned to field work, handling construction of bridges all over the State. Among his most important jobs was the supervision of the construction of the Ventura Seawall.

Returns to Architecture

In January, 1927, Willett again returned to architecture; this time permanently, as assistant to C. H. Kromer, Principal Structural Engineer. On November 1, 1931, Willett's class of Structural Engineer V was retitled Supervising Structural Engineer.

Probably the most important contribution of Willett's long and rich public service is his virtual authorship of the California Earthquake Safety

Law, popularly known as the Field Act. On the occasion of the Long Beach earthquake March 19, 1933, State Architect George B. McDougall sent C. H. Kromer down to Long Beach for a look at the damage. The Legislature was in session and the late Assemblyman C. Don Field of Glendale asked State Architect McDougall for a meeting with a legislative committee to discuss legislation which would seek to prevent the repetition of the serious damage sustained by many of the buildings in Los Angeles-Long Beach Area. That morning Willett had taken up a suggestion by the late Fred Green, a structural engineer with the Division of Architecture and, using the Dam Act as a model, had written up a proposed bill which he discussed in a conversation with Assemblyman Field. Field introduced the bill to the Assembly where it was passed unanimously.

Field Act Becomes Law

The bill passed the Senate and was signed by Governor Rolph on April 10, 1933. This act has since been the basis of construction of all public schoolhouse structures in the State of California up to and including the junior college level. The efficiency of this act has been demonstrated many times. No school erected in California since the adoption of the Field Act and under its rules has suffered damage more severe than a minor crack in the plaster in the Bakersfield earthquake in 1952. Willett has been in charge of administering this act for the ensuing 21 years.

Immediately after the adoption of the Field Act in April, 1933, Willett went to Los Angeles where he set up the Division of Architecture, Schoolhouse Section, in that city. He headed this office until December of that year when he returned to Sacramento. He left the Los Angeles office under Harry W. Bolin as office engineer with Julius Stafford and Frank A. Johnson as district engineers assigned to field checking of construction. It is interesting to note that both Bolin and Johnson are retiring within one month of Willett. On the retirement of Kromer in 1939 Willett assumed the additional duties of head of the Structural Engineering Section.

He was advanced to the grade of principal structural engineer after Anson Boyd became State Architect.

In 1947 Willett was appointed Chief Construction Engineer and assumed charge of, besides the Schoolhouse and Structural Engineering Sections, the Construction Section, including all of the work performed by the Division of Architecture in the field. In 1949 the Maintenance Survey and Repair Section was put under Willett's jurisdiction.

Willett is a member of both the Northern and Central California Chapters, and was the first president of the Central California Chapter, of the Structural Engineering Association of California. He holds Registration No. 55 as Structural Engineer and Civil Engineering License No. 568 in the State of California.

Schoolhouse Construction

Since 1933 Willett has been responsible for construction of \$1,244,177,-291 in public schoolhouses which includes 11,570 projects as of January, 1954, and since 1947 has been responsible for construction amounting to \$244,429,171, which includes 2,222 work orders covering more than 400 sites in every county in the State except Alpine. Of this amount, \$133,-055,210 has been completed in the field while \$111,373,961 is currently under construction. Combining state institution work and public schoolhouse work, Willett has, during his 34 years with the State, been in charge of one and one-half billion dollars worth of construction, which includes almost 14,000 separate projects.

Although Willett is retiring from active administration, he plans to remain interested in the work of the Division of Architecture. He has outlined a five-year period of travel during which he intends to inspect construction of all types in every part of the globe, taking notes, pictures, and absorbing technical information.

PUYALLUP VALLEY

Puyallup Valley in Washington State is reported by the National Automobile Club to grow four times as many daffodil bulbs as are imported from Holland each year.

Earl S. Wise

AFTER completing 25 years of continuous service with District V of the Division of Highways, Associate Highway Engineer Earl S. Wise retired effective March 11, 1954. During the early part of this quarter century of service Earl accomplished many different assignments for the district. During the last part his work has been entirely with the Design Department, and the results of his work can be observed throughout all of District V.



EARL S. WISE

Earl was born on a farm near Lansing, Michigan, of English parents on December 1, 1888. His elementary education was obtained in that vicinity, and while he does not claim to be a football player, he attended Michigan State College for two years. It was during this period that Earl obtained his first taste for highway work, as he spent his summer vacations working for the Ingham County Highway Department out of Lansing.

U. C. Graduate

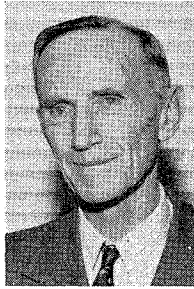
In 1925, becoming tired of the blessings of bachelorhood, Earl traveled to Regina, Saskatchewan, to claim his childhood sweetheart, Fern Moyman, as his bride. Immediately after the marriage, the couple moved to California to reside permanently.

Earl at this time completed his college education by enrolling at the University of California at Berkeley where in 1928 he obtained the degree of Bachelor of Science in Electrical Engineering. After graduation he received an offer of employment as draftsman from the San Luis Obispo office of the Division of Highways. Having had prior experience in highway work, the offer was accepted, and on December 17, 1933, 25 years of continuous service with the State of California and District V of the Division of Highways was completed.

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George Farnsworth

On January 29, 1954, open house for associates and friends was held in George E. Farnsworth's offices to celebrate his retirement from state service, that became effective February 1, 1954. Upon this occasion he was presented with a big cake dramatically showing in colored icing a section of freeway and inscribed with the words, "Thanks for helping build them."



GEORGE E. FARNSWORTH

George, born in Blair, Nebraska, on January 16, 1884, had reached the age of 70 after having completed more than 20 years' service with the State Division of Highways the major portion of which was in District VII. For the past several years George had been the Senior Highway Engineer in charge of the important section of the district office engineer's organization which has responsibility for status of contract reports, progress pay estimates to contractors, and preparation of engineer's estimates of costs for all preliminary reports of proposed construction.

University of Nebraska Graduate

He obtained his engineering training at the University of Nebraska where he graduated with a B.S. in Civil Engineering in 1904. It is interesting to note that George was a freshman at the University when Spencer V. Corley, retired Assistant State Highway Engineer formerly in charge of District VII, was a senior and playing on the varsity football team of that year earned the title of All-American right end. The "Cornhuskers" still have staunch supporters on the District VII staff, headed by none other than the top man of the district, Paul O. Harding, University of Nebraska, 1922.

Between the time of his graduation and his coming to the State Division of Highways, George had extensive and varied railroad and highway engineering experience in Mexico and in Ore-

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Ben Henry

AFTER almost 41 years of continuous service with the State, excepting one year in the military service during 1918-1919, Ben Henry of District VII retired on March 31, 1954. A dinner attended by approximately 100 close friends and co-workers was given in his honor on March 26th.



BEN HENRY

Ben started work with the State Division of Highways on August 5, 1913, in District I. After two years there as instrument man he transferred to District II. While there he served as chief of party on location of the Feather River Highway, also as resident engineer on construction, and later as superintendent of construction camps operated with prison labor. He later became District Construction Engineer in District II.

In 1930 he transferred to District V as superintendent of the prison camp at San Simeon. In August, 1935, he transferred to District VII to take over superintendency of the newly established Angeles Crest Camp. Due to World War II this camp was closed in September, 1942, and Ben became Assistant District Maintenance Engineer and served in this capacity until retiring, with the exception of the year he again served as superintendent of the Angeles Crest Prison Camp in 1946.

Ben was born on March 12, 1891, near Elko, Nevada. He moved to California in 1909. Prior to entering state service he was engaged in railroad engineering.

Ben's plans after retirement include trips to faraway places as well as trips over the many miles of state highways in California that he has helped develop from wagon roads to high speed expressways. His base of operation will be his home at 1352 Salisbury Road in La Canada. All who have known and worked with Ben Henry wish him many enjoyable years of a well-earned retirement.

HIGHWAY BIDS AND AWARDS

January, 1954

ALAMEDA COUNTY—In the City of Oakland on Seventh between Broadway and Cypress Streets, about 1.1 miles in length, to be planed and resurfaced with plant-mixed surfacing. District IV, Route 69. Ransome Company, Emeryville, \$42,392; Gallagher and Burk, Inc., Oakland, \$45,200. Contract awarded to Independent Construction Company, Oakland, \$41,785.

EL DORADO COUNTY—Between west city limit of Placerville and 0.2 mile east of Washington Street Overhead, about 13 miles of four-lane divided highway to be graded, two pedestrian over-heads and three bridges to be constructed and three bridges to be widened. District III, Route 11, Section C. Fredrickson and Watson Construction Company and M and K Corporation, Oakland, \$874,719.90; Granite Construction Company, Watsonville, \$884,763; Gordon H. Ball and San Ramon Valley Land Company and John Delphia, Berkeley, \$895,100.94; Eaton and Smith, San Francisco, \$911,377.70; H. Earl Parker Inc., Marysville, \$920,837.50; Lew Jones Construction Company, San Jose, \$930,815.90; B. J. Ukropina, T. P. Polich, Steve Kral and John R. Ukropina, San Gabriel, \$969,463.50; Nomellini Construction Company, Stockton, \$1,099,067.75; Charles MacClosky Company and Clyde W. Wood and Sons Inc., Los Angeles, \$1,166,262.50; A. Teichert & Son Inc., Sacramento, \$1,218,726. Contract awarded to Pionbo Construction Company, San Francisco, \$809,970.

FRESNO COUNTY—At the intersection of U. S. 99 with Cherry Avenue in the City of Fresno, channelization to be constructed and highway lighting to be furnished and installed. District VI, Route 4. Stewart & Nuss, Inc., Fresno, \$34,939; Paul E. Woof, Fresno, \$35,365; Gene Richards, Inc., Fresno, \$37,281; George C. Ranz Construction Co. Inc., Gilroy, \$44,256; Stanfield and Moody, Tracy, \$46,831; Baun Construction Co., Fresno, \$46,974. Contract awarded to Thomas Construction Co., Fresno, \$34,160.

LOS ANGELES COUNTY—At the Ramona Freeway, Santa Ana Freeway interchange in the City of Los Angeles, a bridge to be constructed, about 0.29 mile of approaches to be graded and paved with plant-mixed surfacing, and about 0.14 mile of additional freeway to be regraded and paved with Portland cement concrete. District VII, Route 26.2. J. E. Haddock, Ltd., Pasadena, \$494,458.50; George W. Peterson and Jack W. Baker, Los Angeles, \$512,514; Webb & White, Los Angeles, \$569,968.50; Byerts and Sons, and George K. Thatcher, Los Angeles, \$596,454.50; Bongiovanni Construction Company, Los Angeles, \$671,809.90. Contract awarded to Charles MacClosky Company, Los Angeles, \$465,443.

LOS ANGELES COUNTY—Between Todd Avenue and Pioneer Boulevard on the Santa Ana Freeway, about five miles in length of roadside areas to be planted and median strip to be surfaced with plant-mixed surfacing. District VII, Route 166, Section A. Henry C. Soto Corporation, Los Angeles, \$39,795.15; K. E. C. Company, Inc., Long Beach, \$45,584.21; Jannoch Nurseries, Altadena, \$45,593; Justice-Dunn Co., Oakland, \$53,730.50. Contract awarded to Huettig, Schromm & Bennett Inc., Palo Alto, \$39,034.60.

LOS ANGELES COUNTY—At the intersections of Redondo Beach Boulevard with Inglewood Avenue and of 174th Street with Redondo Beach Boulevard-Grevillea, Hawthorne Boulevard, Prairie Avenue, Crenshaw Boulevard, Western Avenue and Normandie Avenue, traffic signal systems and highway lighting to be furnished and installed. District VII, Route 175, Section RdoB, Tor, Gar, A. Electric & Machinery Service Inc., South Gate, \$87,088; C. D. Draucker Inc., Los Angeles, \$88,757; Westates Electrical Construction Co., Los Angeles, \$88,980. Contract awarded to Fischbach and Moore, Incorporated, Los Angeles, \$85,477.

NAPA COUNTY—Placing sacked concrete riprap on channel change under Br. No. 21-77, Cayetano Creek, and constructing metal plate guard railing at approaches to bridge 0.4 mile east of Napa city limits. District IV, Route 8, Section B. Arthur B. Siri Inc., Santa Rosa, \$8,226; O. C. Jones & Sons, Berkeley, \$10,200; James W. Hill, Walnut Creek, \$10,827; Bos Construction Company, Berkeley, \$12,790; McGuire & Hester, Oakland, \$13,700; J. Henry Harris, Berkeley, \$18,071. Contract awarded to Baldwin Contracting Company, Inc., San Rafael, \$7,991.

ORANGE COUNTY—On Santa Ana Freeway from Red Hill Avenue to First Street, highway lighting and illuminated sign system to be furnished and installed; a temporary traffic signal system to be relocated and removed. District VII, Route 2, Section C, Tus, SA. Electric & Machinery Service Inc., South Gate, \$86,120; J. M. Mathes, Bell Gardens, \$87,133; C. D. Draucker, Inc., Los Angeles, \$89,424; Westates Electrical Construction Company, Los Angeles, \$90,024; Fischbach and Moore, Incorporated, Los Angeles, \$97,092. Contract awarded to Newbery Electric Corporation, Los Angeles, \$82,720.

RIVERSIDE COUNTY—Across Oban Ditch, about 42 miles west of Blythe, a reinforced concrete slab bridge to be constructed. District XI, Route 64, Section C. Fred D. Kyle, Pasadena, \$23,078; O. B. Pierson, Bellflower, \$23,153.80; Louis J. Strona, Pomona, \$24,808.50; E. S. & N. S. Johnson, Fullerton, \$24,970; Owl Truck and Construction Co., Compton, \$25,775; Byerts & Sons, Los Angeles, \$29,325. Contract awarded to C. B. Tuttle, Los Alamitos, \$21,494.

SACRAMENTO COUNTY—At the intersection of Folsom Boulevard with 65th Street, in and adjacent to the City of Sacramento, traffic signal system and highway lighting to be furnished and installed and channelization to be constructed. District III, Routes 11, 98, Section B.A. Brighton Sand & Gravel Company, Sacramento, \$22,512; J. R. Reeves, Sacramento, \$23,200.75; A. Teichert & Son Inc., Sacramento, \$23,726.85. Contract awarded to McGillivray Construction Company, Sacramento, \$21,720.86.

SAN BERNARDINO COUNTY—Between east city limits of Redlands and Live Oak Canyon Road, about 2.9 miles to be resurfaced with plant-mixed surfacing. District VIII, Route 26. Ralph B. Slaughter, Julian, \$53,945; Matich Brothers, Clough, \$57,060; George Herz & Co., San Bernardino, \$58,160; E. L. Yeager Co., Riverside, \$61,830; R. A. Erwin, Colton, \$62,875. Contract awarded to G. W. Ellis Construction Co., North Hollywood, \$53,190.

SANTA BARBARA COUNTY—Between Gaviota and 0.5 mile north of Las Cruces, about 4.2 miles in length of roadside areas to be prepared and planted. District V, Route 2, Section E. Justice Dunn Co., Oakland, \$22,355.60; Huettig, Schromm & Bennets Inc., Palo Alto, \$22,584.70; Diablo View Gardens, Antioch, \$23,029.25; Watkin & Sibbald, San Anselmo, \$25,684; K. E. C. Company, Inc., Long Beach, \$29,722; James E. Boothe, Compton, \$37,197.65. Contract awarded to Rudolph Watson, San Mateo, \$19,925.70.

SANTA CLARA COUNTY—At the intersection of West San Carlos Street with Meridian Road, in and adjacent to the City of San Jose, traffic signal system to be furnished and installed and channelization to be constructed. District IV, Route 5, Section B. Joe W. Douglass, San Jose, \$19,049; Howard Electric Co., Gilroy, \$19,309; L. C. Smith Co., San Mateo, \$19,724; J. C. Bateman Inc., San Jose, \$20,746.30; Donald Graves, San Jose, \$21,733; J. Henry Harris, Berkeley, \$22,669. Contract awarded to A. J. Raich Paving Company, San Jose, \$18,949.

SISKIYOU COUNTY—Across the Klamath River at Walker, an existing steel truss and timber trestle bridge to be reconstructed and approaches to be graded and bituminous surface treatment applied thereto. District II, Route 46, Section D. James B.

Allen, San Carlos, \$39,773; Underground Construction Co., Oakland, \$45,380; R. E. Hertel, Sacramento, \$47,947; Bos Construction Co., Berkeley, \$53,583. Contract awarded to James H. McFarland, San Francisco, \$32,627.

SOLANO AND YOLO COUNTIES—At the junction of U. S. 40 with new U. S. 99W and at the Woodland Wye west of Davis, highway lighting and illuminated sign systems to be furnished and installed. District III, Routes 6, 7, Section E.A. R. Gould & Son, Stockton, \$20,093; Karl F. Stolling, Santa Rosa, \$21,090; Grason Electric Co., Sacramento, \$21,159; L. H. Leonardi Electric Construction Co., San Rafael, \$21,262; Hall Sloat Electric Co., Inc., Oakland, \$21,595; Luppen & Hawley Inc., Sacramento, \$22,004; Collins Electric Company, Inc., Stockton, \$22,222.22; Reliable Elevator Works, Sacramento, \$22,491; R. Flatland, San Francisco, \$23,650; Foothill Electric Corporation, Oakland, \$24,700; Ed Pierce Electric Company, Vallejo, \$25,409; Underground Electric Construction Company, Oakland, \$25,683; Sacramento Electric Works, Sacramento, \$31,349.60. Contract awarded to Howard Electric Company, Gilroy, \$15,993.

SONOMA COUNTY—At Adobe Creek, Ellis Creek and Stage Gulch Creek, between three and five miles east of Petaluma, three existing bridges to be reconstructed. District IV, Route 104, Section D. John Carcano, San Rafael, \$22,378.55; Charles S. Moore, San Jose, \$22,468; Baldwin Contracting Co. Inc., San Rafael, \$23,618.50; E. A. Forde Co., San Anselmo, \$23,924.50; James W. Hill, Walnut Creek, \$24,302.25; Robert R. Murdock, San Jose, \$24,373.50; W. J. Kubon, San Rafael, \$24,483.75; Al. Erickson & Co., Napa, \$25,073.50; Brown-Ely Co., Contractors, El Cerrito, \$26,100.50; Morison Construction Co., and Ted Schwartz, Grass Valley, \$26,379.50; C. S. Phillips, Petaluma, \$27,447.05; Arthur B. Siri, Inc., Santa Rosa, \$29,298.25; Helwig Construction Co., Sebastopol, \$29,702.50; R. G. Clifford and C. O. Bodenhamer, Berkeley, \$30,813.50; J. Henry Harris, Berkeley, \$31,172.20; Bos Construction Co., Berkeley, \$31,663; James B. Allen, San Carlos, \$33,574. Contract awarded to James H. McFarland, San Francisco, \$20,853.75.

TEHAMA AND SHASTA COUNTIES—At the intersections of Main Street with Oak Street in Red Bluff and Route 3 with North Street and South Street in Anderson, traffic signal systems to be furnished and installed and channelization to be constructed. District II, Routes 3.7. Hall Sloat Electric Company Inc., Oakland, \$42,729; Underground Electric Construction Company, Oakland, \$43,312. Contract awarded to Collins Electrical Co., Inc., Stockton, \$38,867.

February, 1954

FRESNO COUNTY—In City of Fresno on Ventura Avenue, various locations between Hazelwood Boulevard and Orange Avenue, left turn lanes to be graded and surfaced with plant-mixed surfacing on untreated rock base. District VI, Route 41. Gene Richards Inc., Fresno, \$6,026.50; Volpa Brothers, Fresno, \$6,631.50; Baun Construction Company, Fresno, \$7,181; Saginaw Construction Company, Selma, \$7,479.50; Thomas Construction Company, Fresno, \$7,879. Contract awarded to Stewart & Nuss Inc., Fresno, \$5,550.90.

FRESNO COUNTY—Regrading State Highway between 0.6 mile and 0.8 mile east of Academy Avenue on Kings Canyon Road, roadway to be regraded and surfaced with bituminous surface treatment. District VI, Route 41, Section S. Paul E. Woof, Fresno, \$2,992; Saginaw Construction Company, Selma, \$3,260; Stewart & Nuss Inc., Fresno, \$3,426; Gene Richards, Inc., Fresno, \$3,575.50; Thomas Construction Company, Fresno, \$3,868; Petroleum Sales Division, Fortier Trans. Company, Fresno, \$4,162.35. Contract awarded to Baun Construction Company, Fresno, \$2,587.

LOS ANGELES COUNTY—Between Cahuenga Boulevard and Gower Street about 0.6 mile in length of roadside areas to be prepared and planted. District VII, Route 2. K. E. C. Company, Inc., Long Beach, \$43,313.55; Stephen L. Vistica, San Mateo, \$43,360.42; James E. Boothe, Compton, \$46,339.38; Justice-Dunn Company, Oakland, \$47,756.68. Contract awarded to Jannoch Nurseries, Altadena, \$42,208.93.

LOS ANGELES COUNTY—On Foothill Freeway, between Hampton Road and Montana Street, a four-lane divided highway with frontage roads and connections to be graded and surfaced with plant-mixed surfacing and six reinforced concrete bridges, and a reinforced concrete equestrian tunnel to be constructed. District VII, Route 9, Section B, Pas. J. E. Haddock Ltd., Pasadena, \$1,887,647.25; Guy F. Atkinson Company, Long Beach, \$1,930,139; Vinnell Company, Inc. and Subsidiaries—Vinnell Constructors, J. V., Alhambra, \$1,946,231.20; Peter Kiewit Sons' Company, Arcadia, \$2,014,761.60; B. J. Ukropina, Polich, Kral and John R. Ukropina, San Gabriel, \$2,042,156; Granite Construction Company, Watsonville, \$2,063,065; Winston Bros. Company, Monrovia, \$2,066,798.40; A. Teichert & Son, Inc., Baldwin Park, \$2,112,686.80; Charles MacClosky Company and Kirst Construction Company, Los Angeles, \$2,124,688.65; Vido Kovacevic Company and O. B. Pierson, Rosemead, \$2,174,303.98; J. A. Thompson & Son, Inglewood, \$2,184,005.80; Clyde W. Wood & Sons, Inc., and R. M. Price Company, North Hollywood, \$2,189,445.50; Gordon H. Ball & San Ramon Valley Land Company and Eaton & Smith, Berkeley, \$2,223,733.40; Webb & White, Los Angeles, \$2,258,737.10; Griffith Company, Los Angeles, \$2,293,220.50; Oberg Bros. Construction Company, Inglewood, \$2,296,151.50. Contract awarded to George W. Peterson, Jack W. Baker & Dragline Rentals Company, Los Angeles, \$1,831,071.

LOS ANGELES COUNTY—On Lincoln Boulevard between Olympic Boulevard and Santa Monica south city limits in the City of Santa Monica, traffic signal systems and highway lighting to be modified. District VII, Route 60. Electric and Machinery Service Inc., South Gate, \$86,216; A. S. Schulman, Electric Company, Los Angeles, \$91,800; C. D. Draucker Inc. Los Angeles, \$93,455. Contract awarded to Westates Electrical Construction Company, Los Angeles, \$84,833.

MARIN COUNTY—Between Tamalpais Road and Muir Beach, portions about 0.1 mile in length to be graded and surfaced with plant-mixed surfacing on untreated rock base. District IV, Route 56, Section A. Brown-Ely Company, Contractors, El Cerrito, \$13,043.50; J. Henry Harris, Berkeley, \$14,240.50; O. C. Jones & Sons, Berkeley, \$16,815; A. A. Edmondson, Butte City, \$18,198. Contract awarded to Ghilotti Bros. Inc., San Rafael, \$10,184.

MENDOCINO COUNTY—Across Caspar Creek, about six miles south of Fort Bragg, a timber bridge to be redecked. District I, Route 56, Section E. Transocean Engineering Corporation, Hayward, \$56,603; Eaton & Smith, San Francisco, \$58,058; H. H. Anderson, Hayward, \$58,129; Stanley H. Koller Construction, Crockett, \$58,513.50; Payne Construction Company, Oakland, \$59,695.76; Charles S. Moore, San Jose, \$63,430; R. C. Clifford & C. O. Bodenhamer, Berkeley, \$63,700; W. J. Kubon, San Rafael, \$64,345.60; James B. Allen, San Carlos, \$64,466; Morison Construction Company and Ted Schwartz, Grass Valley, \$66,640; James H. McFarland, San Francisco, \$67,644.50; Baldwin Contractor Company, Inc., San Rafael, \$67,938.85; Humboldt Construction Inc., Eureka, \$73,876; Hart & Hynding, Inc., San Francisco, \$75,280; E. S. & N. S. Johnson, Fullerton, \$83,036; Bos Construction Company, Berkeley, \$83,391; LeBoeuf-Dougherty Contracting Company, and Erickson & Pierson, Richmond, \$93,792. Contract awarded to Bishop-Younger-Bradley Company, San Francisco, \$47,633.40.

MONTEREY COUNTY—On the San Juan-Watsonville Road between junction State Route 56 at Pajaro and 4.9 miles easterly; about 4.9 miles of existing roadway to be graded and surfaced with plant-mixed surfacing on untreated rock base. District V, Route 595. Granite Construction Company, Watsonville, \$227,484; Edward Keeble, San Jose, \$237,155; Clements Construction Company, Center-

ville, \$243,330; L. C. Smith Company, San Mateo, \$243,710; Joseph McFadden & Son Inc., Palo Alto, \$245,124.80; L. B. Wells Construction Company, Visalia, \$246,868; Volpa Bros., Fresno, \$260,326; Fredrickson Bros., Emeryville, \$265,225.75; McGuire and Hester, Oakland, \$273,043.50. Contract awarded to Baun Construction Company, Fresno, \$212,862.50.

ORANGE COUNTY—On Huntington Beach Boulevard and Stanton Avenue, between 0.1 mile north of Smeltzer Avenue and 0.1 mile north of Garden Grove Boulevard, about 3.0 miles in length, to be graded and surfaced with plant-mixed surfacing on untreated rock base. District VII, Route 171, Section A.B. R. J. Noble Company and R. J. Noble, Orange, \$498,863.85; M. S. Mecham & Sons, South Gate, \$500,080.30; Match Brothers, Colton, \$501,464.75; Dimmitt & Taylor, Monrovia, \$508,342.25; Roland T. Reynolds & Arthur H. Famularo, Anaheim, \$509,926.90; Ray F. Hess, Buena Park, \$515,913.85; Cox Bros. Construction Company, Stanton, \$516,068.20; Sheets Construction Company, Gardena, \$516,212; Sully-Miller Contracting Company, Long Beach, \$528,887.36; Ralph B. Slaughter, Julian, \$585,595. Contract awarded to S. A. Cummings, Compton, \$464,492.35.

RIVERSIDE COUNTY—Near the City of Riverside, at the intersection of Eighth Street with Iowa Avenue, traffic signal system and highway lighting to be furnished and installed. District VIII, Route 19, Section B. Drury Electric Company, San Bernardino, \$16,753; C. D. Draucker Inc., Los Angeles, \$16,987; Fischbach and Moore Incorporated, Los Angeles, \$17,358. Contract awarded to Paul R. Gardner, Ontario, \$14,203.30.

SAN BERNARDINO COUNTY—For tree removal between Beryle Avenue and Ramona Avenue near Alta Loma. District VIII, Route 190, Section A. Hubbs Equipment Company, Colton, \$972; James A. Gorman, Jr., San Bernardino, \$3,636. Contract awarded to California Tree Service Inc., Los Angeles, \$878.40.

SAN DIEGO COUNTY—Between one mile south and 0.7 mile north of Balboa Avenue, highway lighting systems to be furnished and installed. District XI, Route 2, Section S.D. Chula Vista Electric Company, Chula Vista, \$17,860; Ets-Hokin & Galvan, San Diego, \$18,894; California Electric Works, San Diego, \$20,944; Drury Electric Company, San Bernardino, \$30,098. Contract awarded to Pacific Electric, San Diego, \$15,883.08.

SANTA BARBARA COUNTY—Between one-tenth mile east of Carpinteria Creek and Seventh Street Overcrossing, about 1.4 miles of roadside area to be prepared and planted. District V, Route 2, Section H. Diablo View Garden, Antioch, \$14,385; James E. Boothe, Compton, \$15,030; K. E. C. Company, Inc., Long Beach, \$15,261.79; Stephen L. Vistica, San Mateo, \$15,447; Huettig, Schromm and Bennett Inc., Palo Alto, \$16,524; Rudolf Watson, San Mateo, \$19,242; Castro & Fisher, Glendale, \$20,560; Jannoch Nurseries, Altadena, \$21,420; Professional Landscaping Service, Redondo Beach, \$24,602. Contract awarded to Justice-Dunn Company, Oakland, \$13,246.

SANTA BARBARA COUNTY—About 1.5 miles north of the City of Lompoc on the Santa Ynez River; steel tetrahedron bank protection to be constructed. District V, Route 56, Section C. Hermreck and Easter, Contractors, Santa Maria, \$13,390; R. R. Hensler, Sun Valley, \$15,510; Stanley H. Koller Construction, Crockett, \$15,682; D. D. Galbraith and Robert F. Batty, Lompoc, \$15,778.08; Albert S. Pratt, Jr., Pasadena, \$16,630; Charles H. Major, Ojai, \$16,792. Contract awarded to Vic Martin, Pasadena, \$10,326.

SANTA CRUZ COUNTY—Portions between 6.2 miles east and 8.5 miles east of Watsonville, about 0.8 mile in net length, to be graded and surfaced with plant-mixed surfacing on untreated rock base. District IV, Route 67, Section A. Leo F. Piazza Paving Company, San Jose, \$124,903.38; Edward Keeble, San Jose, \$130,439; Joseph McFadden & Son Inc., Palo Alto, \$133,664.07; Fredrickson Bros., Emeryville, \$135,931.25; Hermreck & Easter Contractors, Santa Maria, \$137,711.25; Close Building Supply Inc., Hayward, \$141,037.70; Bickmore-Harper Inc., and Contracting Equipment Rentals Service, Santa Maria, \$142,884; McGuire and Hes-

ter, Oakland, \$143,967.70; George C. Renz Construction Company, Inc., Gilroy, \$144,834.10; Transocean Engineering Corporation, Hayward, \$147,677.35; S. A. E. Company, Redwood City, \$162,221.75. Contract awarded to Granite Construction Company, Watsonville, \$123,613.25.

SONOMA, CONTRA COSTA and ALAMEDA COUNTIES—At various locations, asphalt subsealing to be performed. District IV, Route 1, 75,107. W. V. Wright Construction Company, Dallas Texas, \$45,660; Vict Martin, Pasadena, \$46,650; J. Henry Harris, Berkeley, \$49,550; E. S. and N. S. Johnson, Fullerton, \$49,650; James M. Pope, Long Beach, \$58,000; McGuire & Hester, Oakland, \$61,500. Contract awarded to I. J. Ely Company, Larkspur, \$45,550.

TEHAMA COUNTY—Trimming trees on State Highway between Los Molinos and Mill Race Creek, District II, Route 3, Section D. Leonard's Tree Service, North Sacramento, \$3,200; Davey Tree Surgery Company, Ltd., San Francisco, \$6,370; Archie Draper, Red Bluff, \$16,440. Contract awarded to Joseph M. Oakley Tree Service, Sacramento, \$2,684.

VENTURA COUNTY—Between 0.1 mile east of Lord Creek and Route 155 in Fillmore, about 2.4 miles in length, to be graded and surfaced with plant-mixed surfacing on selected material, and construct two bridges. District VII, Route 79, Section B. George W. Peterson, and Jack W. Baker, Los Angeles, \$742,883.50; Tumblin Company, Bakersfield, \$765,261; Clyde W. Wood & Sons, Inc., North Hollywood, \$778,596.50; Griffith Company, Los Angeles, \$786,850.40; Gordon H. Ball and San Ramon Valley Land Company, Berkeley, \$794,061.68; L. A. and R. S. Crow, El Monte, \$794,162; Granite Construction Company, Watsonville, \$797,328; Basich Brothers Construction Company, R. L. Basich, N. S. Basich and O. B. Peterson, South San Gabriel, \$806,817.20; Norman I. Fadel, Inc., North Hollywood, \$807,235.60; J. E. Haddock, Ltd., Pasadena, \$816,612.45; W. F. Maxwell and Hermreck & Easter, Los Angeles, \$817,197.50; J. A. Payton, Riverside, \$819,337.10; F. W. Case Corporation and Case-Stafford, Inc., Newhall, \$831,392.50; Byerts and Sons and George K. Thatcher, Los Angeles, \$847,334.25; Webb & White, Los Angeles, \$853,104; L. C. Anderson Company, San Diego, \$860,637; Sharp and Fellows Contracting Company, Los Angeles, \$901,450.90; Match Brothers and Match Brothers Paving Company, Colton, \$918,926.50. Contract awarded to R. R. Hensler, Sun Valley, \$654,413.15.

YOLO COUNTY—On West Sacramento Freeway, between Yolo Causeway and Tower Bridge, highway lighting and illuminated sign systems to be furnished and installed. District III, Route 6, Section C. Sacramento Electric Works, Sacramento, \$57,485; Collins Electrical Company, Inc., Stockton, \$58,531; R. Goold and Son, Stockton, \$60,193; Hall Sloat Electric Company, Inc., Oakland, \$62,896; Grason Electric Company, Sacramento, \$63,389; Karl F. Stolling, Santa Rosa, \$65,200; Underground Electric Construction Company, Oakland, \$68,300; Luppen & Hawley Inc., Sacramento, \$69,837; Ets-Hokin and Galvan, Oakland, \$70,844; Foothill Electric Corporation, Oakland, \$71,111; Ed Pierce Electric Company, Inc., Vallejo, \$73,552; L. H. Leonardi Electric Construction Company, San Rafael, \$77,182; Reliable Elevator Works, Sacramento, \$80,129. Contract awarded to Howard Electric Company, Gilroy, \$54,981.

BLIND PASSING

It is foolish to pass on a curve, the crest of a hill or any other place where the view of on-coming traffic may be obscured. Yet every year, thousands of motorists try it. A few make it; many do not. Be sure your sight distance is ample and unobstructed before driving around a vehicle ahead of you.

Salinas Freeway

Continued from page 38 . . .

building the structures. The average subsidence at Market Street was about 1.6 feet and about one foot at John Street.

Construction of the third unit from Hartnell Road to Market Street, providing for the remaining grading and paving with portland cement concrete and plant-mixed shoulders and ramps, and reinforced concrete overcrossings at Spence Underpass, Sandborn Road and John Street, was awarded to Gordon H. Ball, San Ramon Valley Land Company and John Delphia of Berkeley. It is anticipated that this contract will be completed early in 1955.

To complete the project between Hartnell Road and Main Street, the fourth unit, construction of the reinforced concrete overcrossing at Bardin Road, will be advertised this summer.

The major items of work on this project consist of 1,300,000 yards of excavation, 36,500,000 station yards of overhaul, 290,000 tons of imported subbase and base material, 38,000 yards of Class "B" portland cement concrete pavement, 12,300 cubic yards of Class "A" concrete structures, 30,000 tons of plant-mixed surfacing.

The total cost of the freeway from Hartnell Road to Main Street will be approximately \$5,000,000.

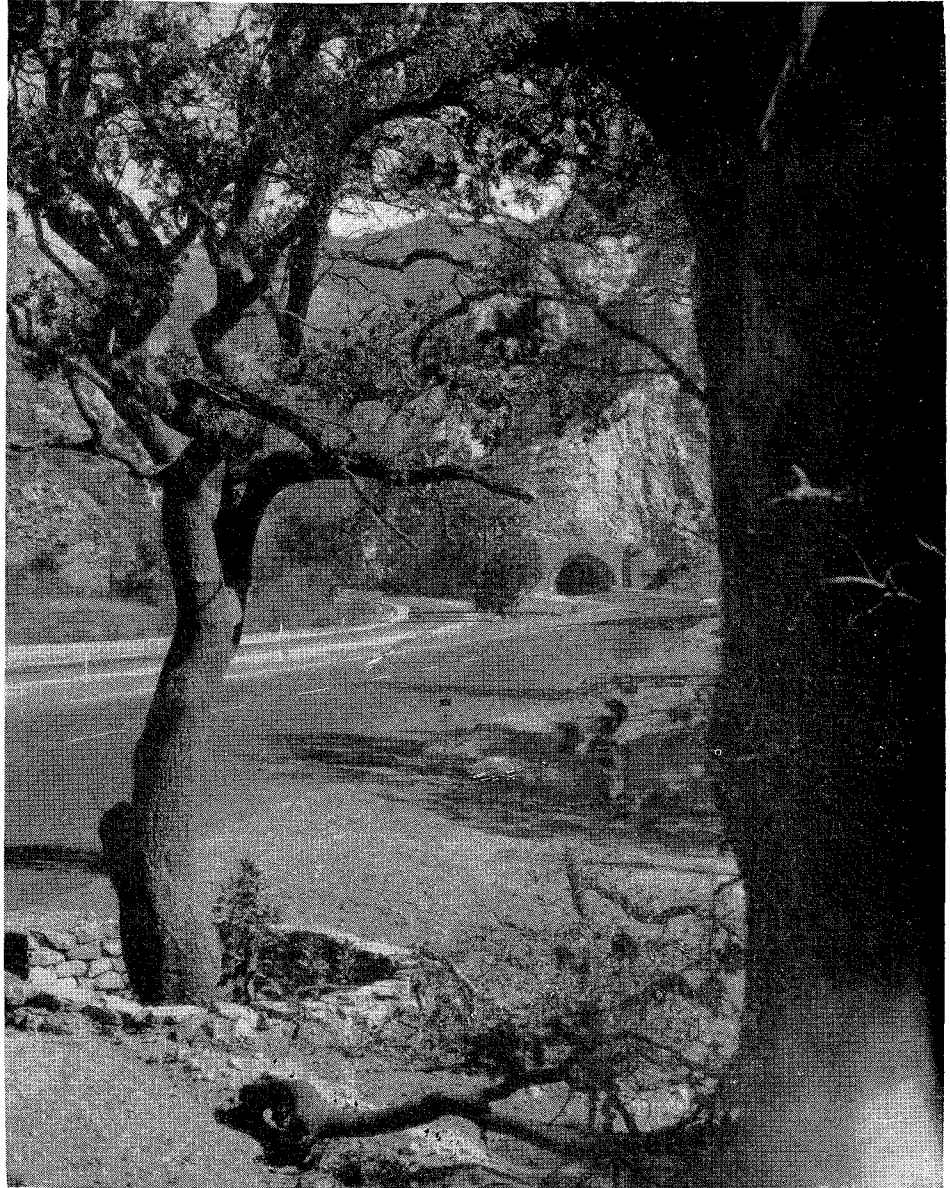
James S. Sturgeon is the Resident Engineer and the Bridge Department representatives are Guy Mancarti and A. E. Hoerchner.

GEORGE FARNSWORTH

Continued from page 60 . . .

gon, as well as in California. His first job with the State Division of Highways in California was as assistant resident engineer in 1922 on one of the first construction contracts on the Coast Highway north of Santa Monica through the Malibu Ranch. After handling many large construction projects at various locations throughout the district as resident engineer, George became a member of the dis-

Photographers Find This Section of Highway Alluring



One of many attractive spots on US 101 is the approach to the new Gaviota Tunnel in Santa Barbara County. This photo is looking north toward the tunnel entrance.

trict office engineering staff in 1947. Since that time, as demands became more and more pressing he has very successfully organized the functions of his department for greater efficiency and effectiveness.

Now that he has retired, George expects to devote more time to his special hobbies of gardening and photography. Knowing that there might be certain deficiencies in his photo-

graphic equipment that he might like to fill, his associates presented him with a check, the proceeds of which he will use for this purpose. He was also presented with an appropriately worded scroll to commemorate his years of service with the State Division of Highways, which was signed by his associates who all sincerely wish for him a full measure of success and happiness in the years to come.

Richmond-San Rafael

Continued from page 33 . . .

The triangular construction towers illustrated in Step 4 are used to set the first 9-foot reinforced concrete cylindrical shell, to brace the remaining shells during construction and to support the tremie pipes during the placing of the concrete inside the shells.

Survey Control Towers

Essential to the work was the fabrication and installation of survey control towers; the rebuilding of a clam-shell dredge for deep-water dredging operations; the design and construction of two large floating pile drivers, the Pacific Giant and the Pacific Titan; a floating concrete batching and mixing plant, the Pacific Mixmaster; and the floating derrick, the Pacific Atlas, capable of 160-ton lifts. In addition, the contractor's precasting yard in Petaluma was modified for the heavy precast bell units; the Gilmore yard was developed for splicing H-piles; and arrangements made for the fabrication of the four bell pier steel shell sections at the Basalt Rock Company plant near Napa.

The various methods of constructing the 79 piers for the Richmond-San Rafael Bridge were determined only after a careful study was made of the cost of pier types in relation to span lengths. Some 11 different types were designed and their cost estimated for the 100-foot girder spans, 13 types for the 289-foot spans, and nine types for the large cantilever spans. For the physical conditions existing at the site the bell-bottom pier construction proved, in most cases, much more economical than the other types of piers which were studied.

BUREN THORLEIFSON

Continued from page 58 . . .

Board, transferring to Division of Housing in 1942, and five years later to the Division of Architecture.

Altogether during Thorleifson's years with the Division of Architecture he has been responsible for the supervision of construction in the field in excess of \$11,240,000.

Oceanside Freeway

Continued from page 34 . . .

have occurred within the city limits, compared with 210 during the same period last year. This is a 58 percent reduction of auto accidents, Haver pointed out.

Although figures have not been compiled for February, data shows that 32 accidents occurred last November and December compared with 71 and 73 during those months in 1952, while 21 accidents were reported in January of this year compared with 66 during January of 1953.

Engineers of the Division of Highways point out that the marked reduction in accidents since the opening of the freeway is all the more dramatic because the "after" period included the Christmas and New Year holiday weekends when accident hazards are usually increased.

They attribute the marked reduction in the number as well as the severity of accidents throughout the whole City of Oceanside and vicinity area not only to the freeway, which is designed to minimize intersection conflicts, but also to the removal of through traffic from the city streets, leaving the latter less congested.

RICHARD A. TREMPER

Continued from page 56 . . .

in the way of his personal desires and will consent to his transfer to your district."

The district will greatly miss the valuable counsel that the younger members were able to obtain from "Tremper" and will look forward to continued acquaintance with him through the coming year. "Tremper," as he will be remembered by all, will always be missed in the district. It is hoped that he will find complete enjoyment in his retirement and have time to pursue certain beneficial hobbies that he prefers, having recently adopted photography and growing orchids.

ALEXANDER N. LUND

Continued from page 56 . . .

of highway twice more when the restless Merced River went on rampages.

After transferring to Districts I and II and attaining his Associate Highway Engineer's rating, Al finally arrived in District X in September of 1933, where he stayed until retirement, with the exception of a short break of two years spent as Assistant District Construction Engineer in District V.

Al's experience in the Merced and Feather River Canyons earmarked him as a heavy grading expert, so it was only natural that he was given the American Canyon project in Solano County which was the district's most ambitious project up to that time.

In February, 1950, Al won his promotion to Senior Highway Engineer and became District Construction Engineer, which position he held until his retirement.

Serving under four district engineers, R. E. Pierce, P. O. Harding, Chas. E. Waite and J. G. Meyer, District X is dotted with highways constructed under the supervision of Al Lund, their general excellence still bearing testimony to his skill and resourcefulness.

An untiring worker and a matchless instructor, Al will be missed by the entire Construction Department. We all wish him the best of everything in his retirement.

EARL S. WISE

Continued from page 60 . . .

Having considerable interest in the organization for which he worked and also for fraternal organizations, Earl took a very active part in both. During 1941 he served as president of Chapter 10 of the California State Employees' Association. In his fraternal work he served as master of the San Luis Obispo Masonic Blue Lodge and also as High Priest of local Chapter of Royal Arch Masons.

Earl is now looking forward to being at home at 346 Buchon Street in San Luis Obispo and eventually assuming the duties of a grandfather.

GOODWIN J. KNIGHT

Governor of California

FRANK B. DURKEE . . . Director of Public Works

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District VII

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State-owned Toll Bridges

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SACRAMENTO, CALIFORNIA



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- WALTER E. LORD Supervising Specifications Writer**
- GUSTAV VEHN Production Manager**

Construction Service

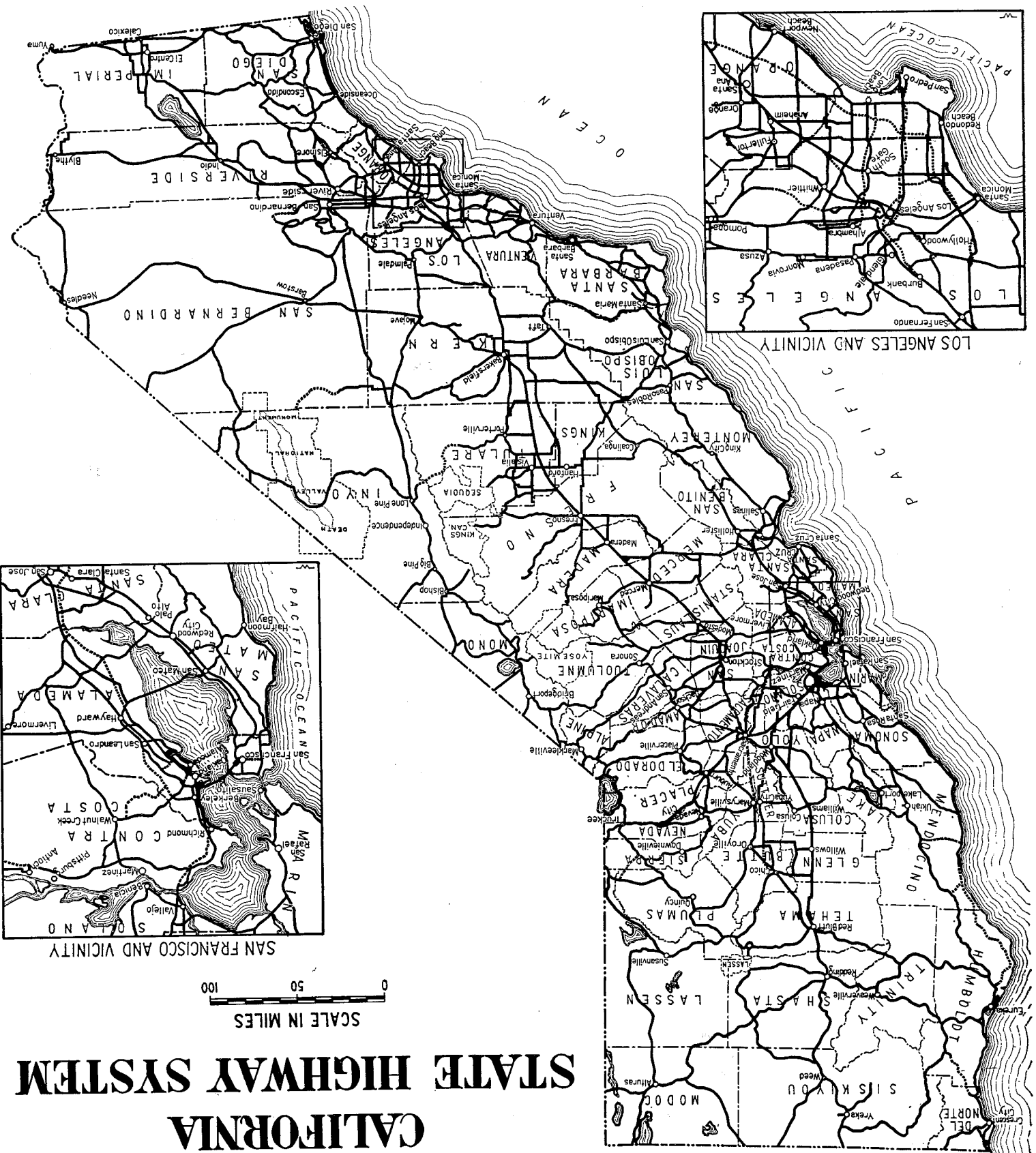
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- CHAS. PETERSON Principal Structural Engineer**
- NATE W. DOWNES Supervising Engineer of Maintenance and Operations**

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Area Structural Engineers, Schoolhouse Section

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- M. A. EWING Area II, Sacramento**
- ERNST MAAG Area III, Los Angeles**



CALIFORNIA STATE HIGHWAY SYSTEM

SCALE IN MILES
0 50 100