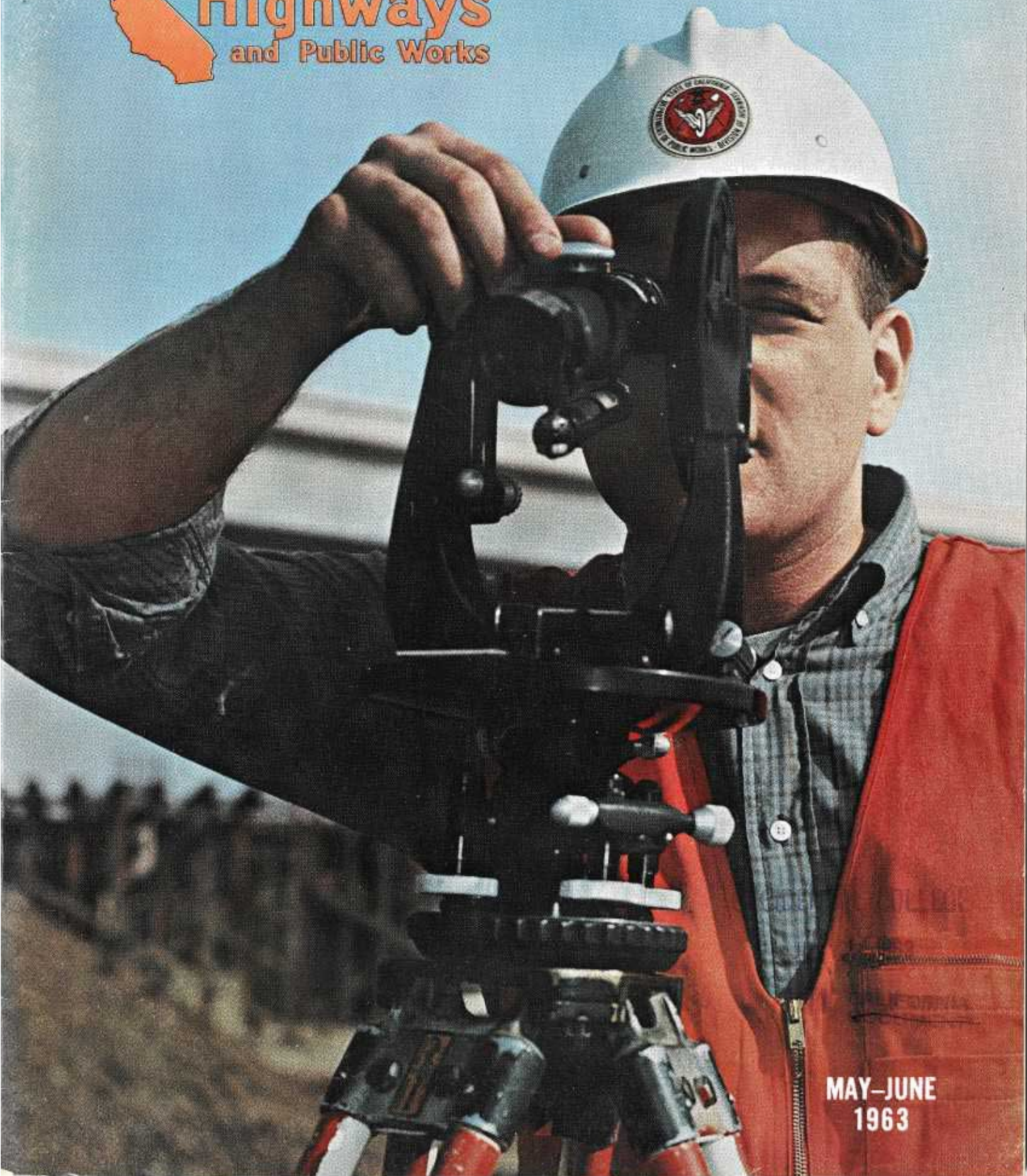


PB200 C35 Valley

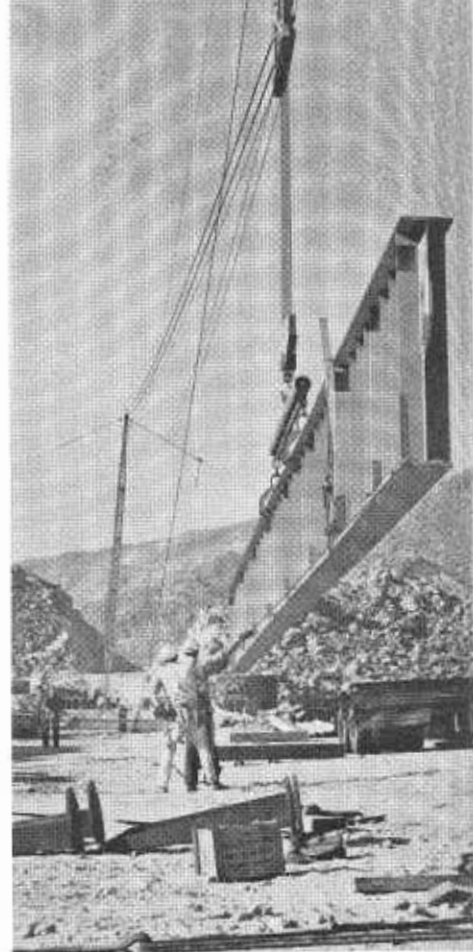
CALIFORNIA  
**Highways**  
and Public Works



MAY-JUNE  
1963



*Aerial view of site.*



# DEVIL'S CANYON BRIDGE

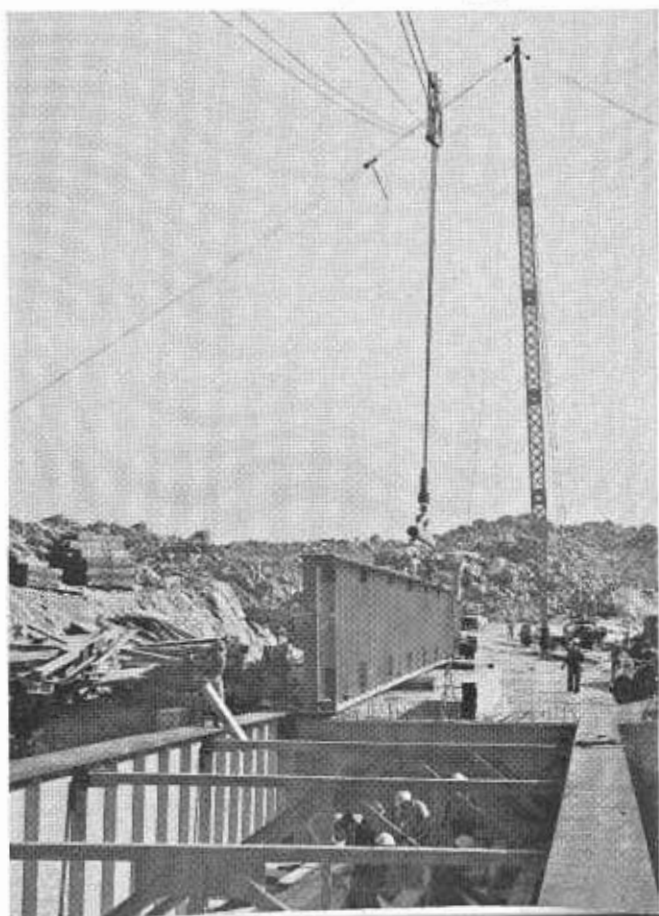
A critical stage in the construction of a bridge in Devil's Canyon in the barren Jacumba Mountains east of San Diego is shown in the photographs here and inside the back cover. The problem was handling steel girders up to 167 feet long and nearly 10 feet deep, weighing 43 tons, in rock-bound country as barren as the surface of the moon.

This bridge is one of two of the same type close together on this 10-mile section of U.S. 80/Interstate 8 being constructed on new alignment to carry the two westbound lanes of the route in the vicinity of the San Diego-Imperial county line. Travelers are undisturbed by the construction, since traffic continues to use the old route through In-Ko-Pah Gorge. When the Devil's Canyon section is completed, all traffic will be switched to it temporarily during modernization next year of the old route. The final result, of course, will be separated routes for eastbound and westbound traffic, constructed to Interstate standards.

Because of the difficulty of moving heavy equipment over the rugged terrain, it would have been extremely difficult to bring in cranes heavy enough to handle the girders. The rather unique solution of a "high line"

*(Continued on inside back cover)*

*Above and Below: High line operation moving girders.*



# California Highways and Public Works

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FRONT COVER: Steve Macola, Assistant Highway Engineer, Drainage Department, District VII Headquarters, Los Angeles, posed for the front cover to illustrate the professional rotation program for young engineers. See story "Job Rotation" on page 2. (Photo by Robert Dunn.)

BACK COVER: Illustrating one of the highways of District IV is the freeway between Walnut Creek and Lafayette, photographed at the Pleasant Hill interchange. See "Bay Area Report" on page 25. (Photo by Jack Meyerpeter.)

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Editors are invited to use information contained herein and to request prints of any black and white photographs.

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# Job Rotation

Broad, Varied Program  
Offered New Engineers

By A. C. BIRNIE, District Engineer—Administration, District VII

The highway builder of bygone days could lay out routes by following cowpaths, Indian trails, or the general lay of the land. His problems were uncharted country, untamed rivers, climate and geography that his primitive science struggled to cope with. The traffic he served was a sparse caravan of farm wagons and tin lizzies, which moved only in dry weather, and slowly even then.

Contrast his task with that of today's freeway builder, who must tackle huge traffic loads and skyrocketing land prices, who must design high-speed multilane all-weather interchanges, who must alter the terrain as often as he follows it.

For the young engineer going into highway work now, today's training is specialized, and tomorrow's training may be automated. Is today's young highway builder doomed to a pigeon-hole phase of the operation, with basic decisions eventually delegated to a computing machine?

## A Unique Program

To free the young engineer of the claustrophobia caused by narrow specialization—and to provide the public with highway leadership for the future—the California Division of Highways in 1957 instituted a unique program for junior civil engineers, the beginning level for graduate engineers.

## EDITOR'S NOTE

Although this article describes the rotation procedure for junior civil engineers in one district, the program is uniform throughout all 11 highway districts in the State.

The order by the State Highway Engineer establishing the rotation program, dated June 3, 1957, allows the employing unit discretion as to the order in which the rotation assignments may be made in each case, but the program itself is compulsory.



Arriving at work, the new junior civil, illustrated by Steve Macola, gets his employment information packet from Mary Hanson, personnel clerk.

Upon going to work for the division, each "junior civil" is placed in a rotation program which includes: six months in design, eight months in construction, four months in surveys (preliminary and construction stake-out), and a final six-month period in a fourth phase of highway work. A report is made on his performance in each phase, indicating assignments completed, employee's progress, and future schedule. He gets a copy of each report as does headquarters office in Sacramento.

At the end of this two-year program, he can expect to look back on two principal accomplishments: (1) he has demonstrated what specialty he can do best; (2) he has gained some first-hand familiarity with the scope of highway work.

With this foundation, he then steps into his first permanent assignment. A

certain amount of rotation will continue throughout his work with the division, too, so that he can advance logically to positions of wider responsibility.

The same policy of rotation—for constantly broadening experience—applies to the so-called technician categories within the division. Many opportunities exist in the jobs of engineering aid and promotional levels above them, constituting a parallel series of positions leading to highway engineering associate, with the possibility of "crossing over" to professional category along the way. In this manner, a qualified man is trained for important work even though he may lack a college degree.

## Two-year Rotation

The two-year rotation program, however, is specifically geared to junior civil engineers. Gaining Cali-

fornia a nationwide reputation among aspiring civil engineering students, this program attracts many a top graduate to enter state employment.

Prepared by printed information from the State Personnel Board, the applicant first meets one of the recruiters—generally a young engineer who faced the applicant's own problems only a few years ago. In his half-hour meeting with each applicant, the recruiter interviews the student on his college career and professional interests and helps him fill out the necessary forms. He also informs each student of the kinds and location of work, the rotation system and other facets of the California program such as leadership in technical fields, a civil service structure free from political pressure and funds devoted exclusively to highway purposes.

About 40 percent of student applicants contacted select highways. The student is invited to express a preference for the locale or highway district where he would like to work, and a firm job offer is made.

Once recommended, the applicant receives confirmation of the offer of work from Division of Highways



*In design, Steve transfers necessary information to an interchange drawing, for the use of the bridge department. In background, Tony Wong.*

Headquarters in Sacramento. In the case of District VII, this is followed

up by a letter from the district personnel officer, Lloyd B. Hughes, enclosing printed information on the Los Angeles area in general and on highway and freeway progress in the district. The young engineer, on accepting employment, indicates his choice of the first assignment on his rotation program, and insofar as possible, he is accommodated.

#### **Career Goals Discussed**

Arriving at work, individually or in a group, the new junior civil meets an executive of the district, to discuss immediate problems and future plans. This conversation covers subjects ranging from career goals to housing accommodations. The top level of the district is deeply concerned with each new man, his welfare and his value.

Next, the junior civil reports to personnel and maps out his first three assignments, thus getting a preview of his work experience for the next year and a half, depending on district requirements. Decision is deferred on the final stage of rotation, until the new man becomes more familiar with assignments which may be available.

Now he goes to work, reporting either to design, construction or sur-



*On construction, Steve acts as the resident engineer's representative on one phase of the job. Here he confers with Clarke Tape, contractor's paving superintendent during construction on the San Diego Freeway.*



Working with the materials section along the route of a future freeway. Steve removes a soil sample from the drill rig. Assisting is Dick Hubinger, engineering aid.

veys. At the end of each phase, he returns to the personnel office for a conference.

Merle D. Demroff, assistant personnel analyst, maintains direct contact with the junior civils throughout the district. At each interview, he asks them questions like, "How successful was this phase?" . . . "What did you do; were you given responsible tasks?" . . . "How was the supervision; do you have any suggestions for improvement?"

If there is widespread criticism of any one phase of the program, the problems are brought to the attention of the section involved. In this man-

ner, the junior civil is afforded the opportunity to evaluate his own experience, while being evaluated himself.

#### Rotation Sequence Changed

Occasionally, rotation sequence is changed to accommodate work requirements of the district—or to accommodate the junior civil himself. Example: the young husband who asked to be assigned inside the building for a while so he could be near a phone. He's now a proud new father.

"The underlying factor to remember," says Demroff, "is that this is a management trainee program of a unique nature." As a recent rotatee

put it, "Where else do you get a 20-to-30-million-dollar set of plans to turn out? I feel that we're really doing big work." To which Demroff adds: "What other firm will risk \$15,000 to train a new man for two years?"

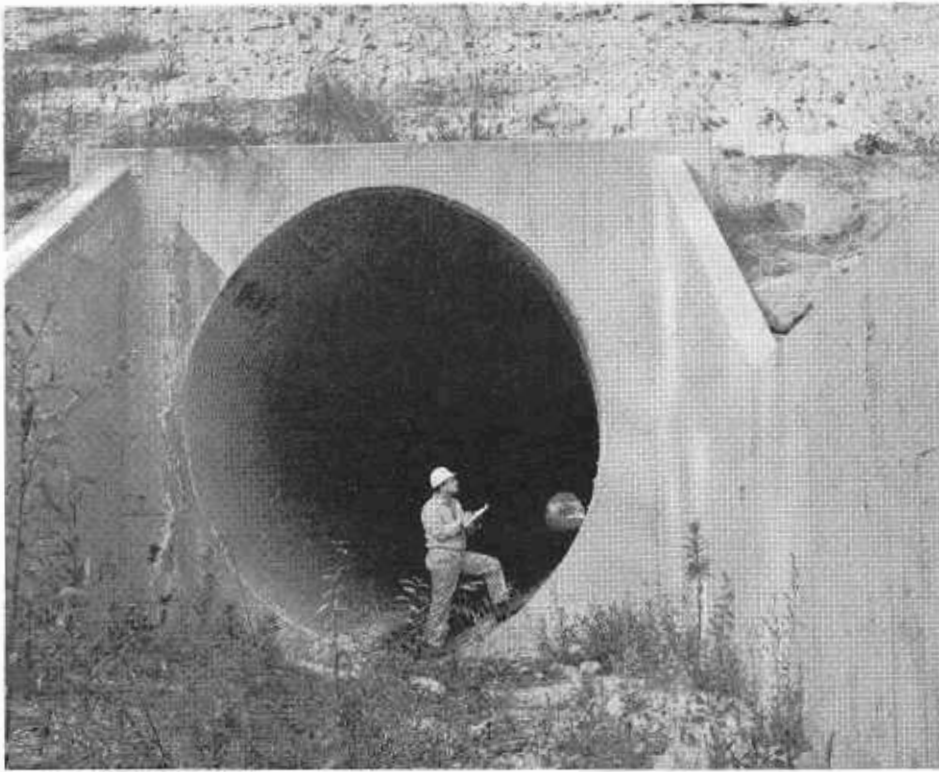
What is a typical rotatee's experience?

Steve Macola first learned of the program while an undergraduate in Connecticut. He selected California as the place he wanted to build highways, and a major reason for his choice was the practical appeal of rotation. Eager for breadth of experience, Steve worked with materials testing, as well as construction, design, and surveys, and then got his permanent assignment in still another department—drainage, where he is now an assistant highway engineer.

#### New Features Added

New features have been added to the rotation program since Steve completed his two-year stint. One example of improved service is the photogrammetric on-the-job training program now included in the survey phase of rotation. The program consists of a minimum of 40 hours and includes:

- A. Basic Principles of Photogrammetry
  1. Aerial photography
  2. Aerial mosaics
  3. Planimetric maps
  4. Topographic maps
  5. Ground control
  6. Stereoplotting instruments
- B. Photogrammetry for Highway Engineers
  1. Mosaics
  2. Reconnaissance type maps
  3. Design type maps
  4. Testing maps
    - a. General Specifications
    - b. Special provisions
    - c. Office checks
    - d. Field checks
- C. Contracts
  - a. Competitive bid
  - b. Plotter rental
- D. Type of Training
  - a. Lecture (photogrammetry and photogrammetric products as procured and applied in district; also types and kinds).



Now an assistant highway engineer in the drainage department, Steve checks a culvert in Ventura County; the Harmon Barranca channel, designed to carry 2,200 cubic feet per second.

- b. Self-study (A.S.P. Photogrammetry Manual, U.S.C. & G.S. Photogrammetry Manual, Headquarters and District Photogrammetry Manual).
- c. Practical (office editing and checking maps, mosaics, contact prints; plotting flight lines, developing supporting maps and data; indexing and filing).

The purpose of the photogrammetry training is to acquaint new junior civils going into other departments with the service available to them through the medium of aerial photography and mapping. This is in addition to the traditional survey skills covered in his four-month phase: three of those months on a construction job where he is given an opportunity to do all types of jobs; and brief courses in field first aid and safety, lane closure signing, and training and licensing in the Ramset—a device which shoots a cartridge into concrete to use as a horizontal control in surveying. A. K. Goldin, district surveys engineer for construction, is

enthusiastic about giving the beginning engineer a thorough grounding in the most modern methods.



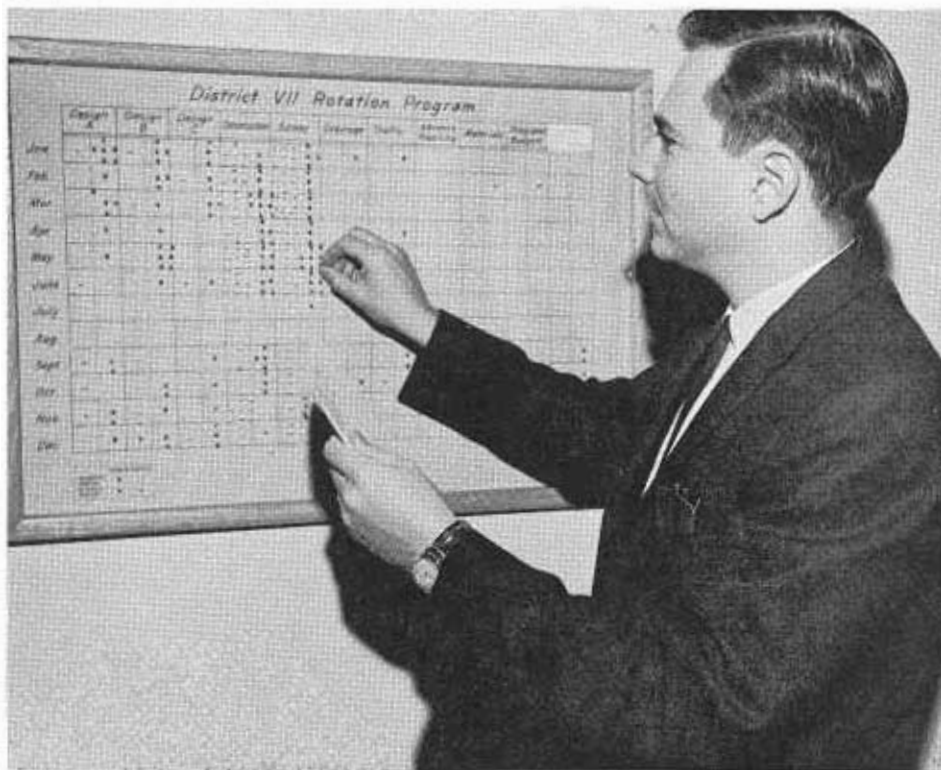
T. C. Spencer, right, supervisor of the photogrammetry section, explains use of the stereopticon viewer for aerial prints, to junior civils Ed Kashfi, Oliver Maxie, (at viewer), and Norman Taylor.

“Although they usually go to permanent assignments in other departments, we want them to know what we can supply to them—especially in this aerial work. With one of these aerial contour maps, one operator can get the information in one day that would otherwise take a survey party several weeks.”

#### Military Leave

Military leave is an important factor among rotatees, both in bridge and general highways work. California's provisions for military training leave apply to any employee in good standing—either probationary or permanent—with full reinstatement of salary and seniority status upon return to work. If the junior civil can complete a full year of work before going into the armed forces, he is eligible to draw state pay during his first 30 days of military service.

Starting salary is, of course, an important factor to a young man even in his first professional employment. Recruiters like Richard Williams of District VII's design section, operating in southern states where lower wage rates prevail, found the applicants impressed—and pleasantly sur-



Merle D. Demroff, assistant personnel analyst, keeps rotatees' assignments in line with work demands. District VII has 115-120 junior civil engineers going through its rotation program constantly.

prised—with the monetary value California puts on its young engineers.

Not all junior civils come to the division via the college recruiter. John Sheehan, in the Los Angeles office of the State Personnel Board, certifies many young men, previously uncontacted, who become highway engineers in District VII.

#### In Sixth Year

Now in its sixth year, how is the rotation program working?

Charles Bartell, of District VII's route planning section, knows the program firsthand—as a former junior civil, as a sometime recruiter in western states, and as a present senior highway engineer supervising the training of several junior civils in his own section.

"I was a good recruiter," says Bartell, "because I'm completely sold on the program myself. I could honestly tell the fellows what it's meant to me, and what the division has to offer. When I first came to work here, I thought of it as a 'first job'—some place to get five years' experience and then go out and find something better. But I've been with the State seven

years now and have no thought of leaving. This is challenging and important work. If a fellow has any doubt of that, two years of rotation will convince him."

It will also do something more for him, something at least as practical, for the experience accomplished in these two years is applicable to requirements for registration. In addition, a large majority of men who have successfully completed their rotation program in District VII have at the same time achieved promotion to assistant highway engineer.

Currently, District VII's typical distribution of rotatees finds:

30 in construction	10 in traffic
30 in design	5 in materials
20 in surveys	10 in route planning
10 in drainage	1 in advanced planning

Swelling population and mounting traffic demands add up to a challenging future for the highway engineer in Southern California. In 1980, the State will have twice the vehicles it has now. But by 1980, fully four times today's freeway mileage will be built to help carry that double load.

## William Whitehurst Named to Commission

William S. Whitehurst of Fresno was appointed to the California Highway Commission in April by Governor Edmund G. Brown, filling the vacancy created earlier in April by the Governor's appointment of John Erreca of Los Banos as State Director of Public Works and ex officio chairman of the commission.



WILLIAM S. WHITEHURST

Whitehurst's appointment is for the balance of Erreca's four-year term as a commission member, which expires January 15, 1965.

The new commissioner is a licensed mortician and has interests in four funeral chapels in the Fresno-Merced County area. He is also active in real estate and ranching.

#### City Councilman

Whitehurst's earliest governmental activity was as a city councilman in Los Banos in 1943. He served with the Army's 1st Cavalry Division in the Pacific in World War II, and later made his home in Dos Palos, where he was a city councilman from 1949 to 1953. He is a graduate of St. Mary's College.



# Career Guidance

*Exhibits Spur Student Interest in Engineering*



Some 43,000 students from high schools and junior high schools throughout the Los Angeles area visited the Career Guidance Center, sponsored by the

Los Angeles County Schools at the Great Western Exhibit Grounds, March 6-15. The Division of Highways booth attracted particular interest from the older students, and an estimated 30,000 pieces of literature were distributed.

Manning the booth, in rotating teams, were Lloyd Hughes, Merle Demroff, and Mark Johnson of personnel, and Bob Innes and John Muhich, construction. One engineer and one personnel officer worked together throughout the exhibit hours.

#### **Narrated Slide Show**

Flanked by the Marine Corps and sheriff's department, the highways exhibit featured a narrated slide show, a scale model of the Pomona-Long Beach Interchange, and a transit through which the students enjoyed sighting in on a target at the opposite side of the booth.

Planned as long-range guidance for youngsters interested in a civil engineering career, the exhibit also yielded an unexpected immediate return. A senior in engineering at a local state college made his first contact with the Division of Highways at the exhibit, and as a result will go to work here in the summer as a junior civil engineer.

#### **Other Exhibits**

The University Club, at Sixth and Hope Streets, was the scene of a Division of Highways exhibit from March 18 to 25. Entitled "California Freeway System," the exhibit featured

maps, charts, and photographs, illustrating the purpose and function of the freeway network, along with the scale model of the future Pomona-Long Beach Interchange.

#### **Highway Goals**

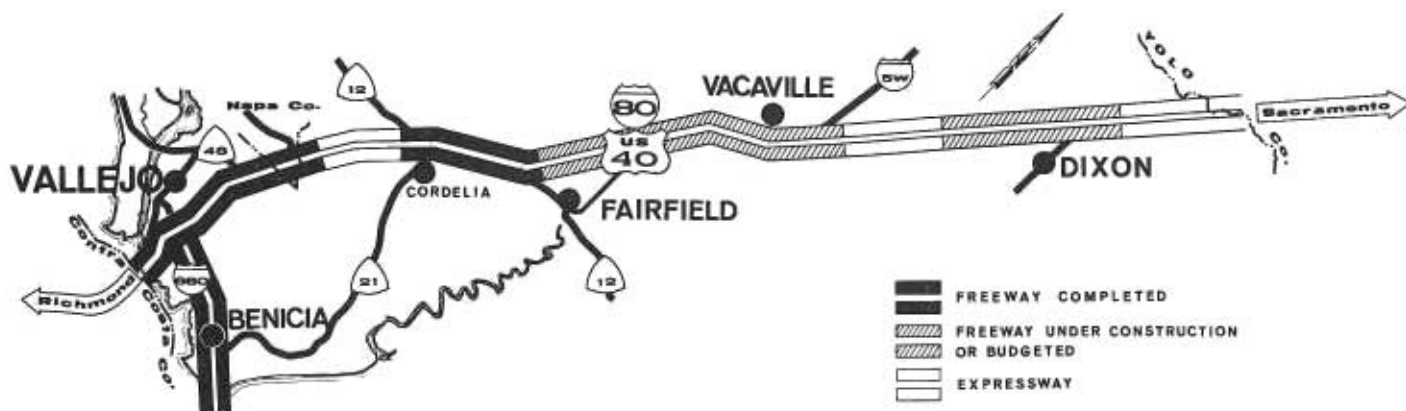
"California Highway Goals" is the theme of the new 24-foot-long exhibit mounted on the wall of the surveys corridor, on the first floor of the new building. Prepared at the request of Assistant District Engineer A. D. Mayfield, this display contrasts present achievements and conditions with those we can look forward to in 1980.

#### **Freeway Model**

On April 1 through 8, the Santa Monica-San Diego Freeway Interchange model built by John and Peggy Unruh was displayed at the Wilshire National Bank, Westwood. Flanking the model were before-and-after photos of the "Big Cut."



Look, kids, a new freeway! High school students get maps from Merle Demroff, at left, while John Muhich shows others how to sight through a transit, during career guidance exhibit.



Map shows freeway progress on U.S. 40/Interstate 80 in District X sector—between Carquinez Strait and Yolo county line.

# U.S. 40 in Solano County

By J. G. MEYER, District Engineer



District X continues to maintain its schedule in converting U.S. 40 (Interstate 80) in Solano County from expressway standards to full freeway status prior to the 1972 target date.

Since the last report (in the September-October 1961 issue of *California Highways and Public Works*) three contracts have been awarded for the construction of approximately 13 miles of freeway at a total cost of \$8,600,000 bringing the total of freeway completed or under construction to 55 percent of the route located in District X.

Plans for the conversion to freeway standards of the remaining 20 miles of this route are virtually complete. Seven miles are budgeted for the 1963-64 construction year and the remainder will go to construction as soon as financing can be arranged. A graphic portrayal showing the status of the

various sections of this important interstate route is revealed on the map on this page. It is noted that there are only three sections of expressway which remain to be budgeted and converted to full freeway.

### American Canyon Project

Traffic is now using that portion of U.S. 40, reconstruction of which was awarded to the Wunderlich Company on February 16, 1961. The original plan calling for the construction of four miles of six- and eight-lane divided freeway was enlarged to provide a full eight-lane divided freeway from near the Vallejo city limits easterly across Hunter and Rindler Hills and the upper portion of the American Canyon.

This project provides a grade separation structure at U.S. 40 and State Sign Route 48 and an overcrossing at the intersection of U.S. 40 with the American Canyon Road together with necessary on and off ramps. The American Canyon Road intersection was moved about 3,000 feet easterly

necessitating the construction of about one mile of county road.

In order to make the most efficient use of this new construction, Napa and Solano Counties have joined forces and awarded a contract to reconstruct the balance of the American Canyon Road to federal aid secondary standards. The portion being so reconstructed is from the end of our reconstructed section to State Sign Route 29.

As noted in the September-October 1961 issue, water in damaging quantities was encountered in all cuts and most of the fill areas. The cost of sub-drainage correction work was nearly double the original estimate. As construction progressed and the big cut through Hunter Hill exposed more of the underlying material, it became apparent that the material was too unstable to support itself on the designed slopes and as the cut became deeper excessive amounts of water were encountered which further weakened the stability of the material.

Not only was it necessary to flatten the slopes from planned  $2\frac{1}{2}:1$  to  $3\frac{1}{2}:1$ , it was also necessary to install horizontal drains. These were placed in both slopes of the cut and most of them are still flowing. The total cost of this project was \$5,500,000, some \$750,000 over the original estimate. R. B. Weaver was resident engineer for the State.

#### **Cordelia Project**

The construction of 4.4 miles of six and eight lanes of divided freeway with six bridges, three overcrossings, one separation structure at the intersection of U.S. 40 and State Sign Route 21 and an overhead structure at Cordelia over the Southern Pacific railroad was awarded to Gordon H. Ball on April 4, 1960, and completed on December 28, 1961. Completion of this project, with F. M. Babcock representing the State as resident engineer, extended the freeway section from the easterly end of the American Canyon to the Fairfield turnoff.

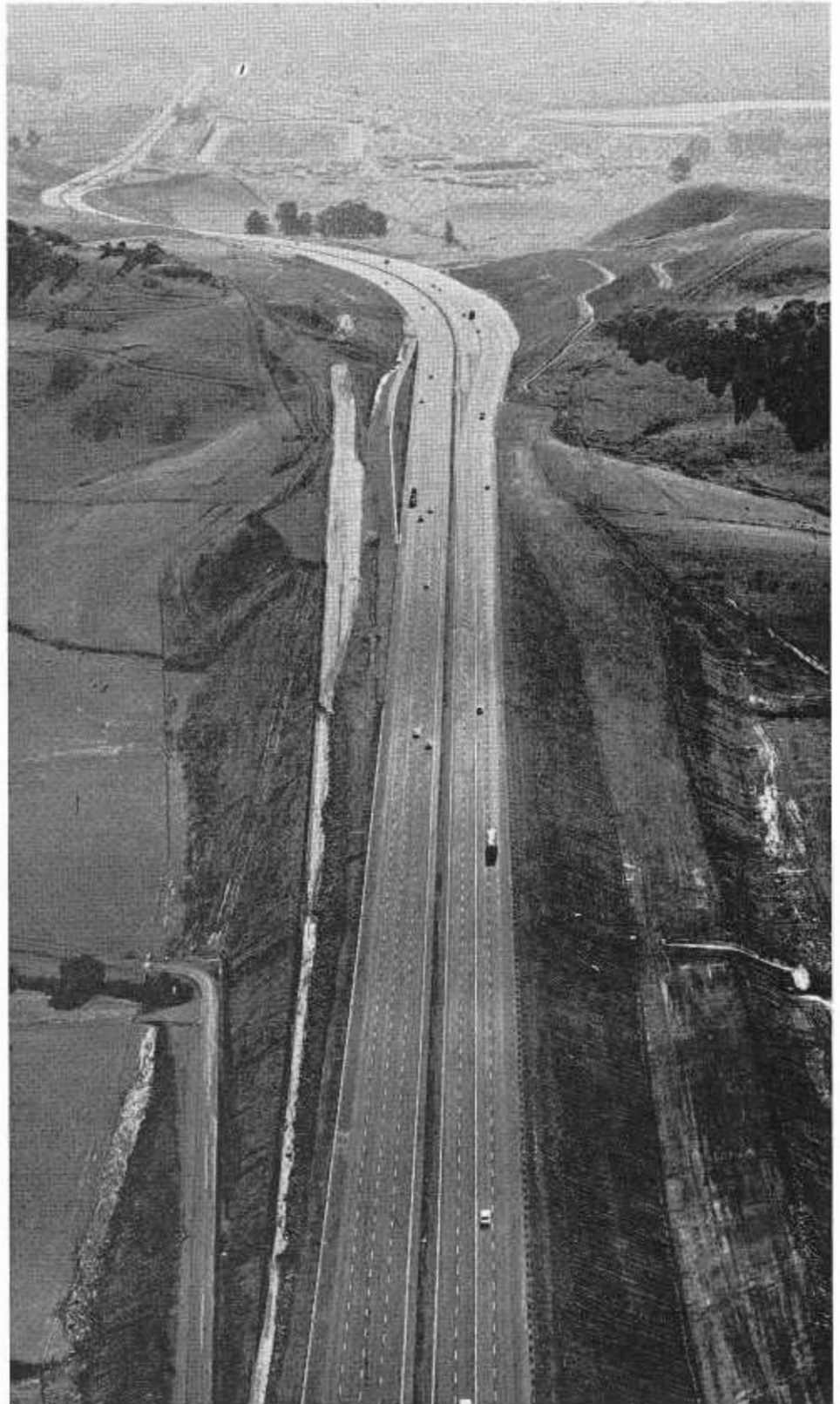
#### **Fairfield Interchange**

In connection with the construction of the interchange structure proper 1.6 miles of six lanes of divided freeway were also constructed which continued the freeway system easterly from the above project. This project was awarded to Charles L. Harney Company, Inc., on June 27, 1960, and completed on December 15, 1961.

This project provided a separation structure carrying U.S. 40 over State Sign Route 12 and the adjacent Sacramento Northern railroad tracks. This project had long been anticipated by the traveling public because it eliminated the last highway traffic signal between San Francisco and Sacramento. Final cost of this project was \$1,830,000. George Demetras was the State's resident engineer.

#### **Travis Boulevard Project**

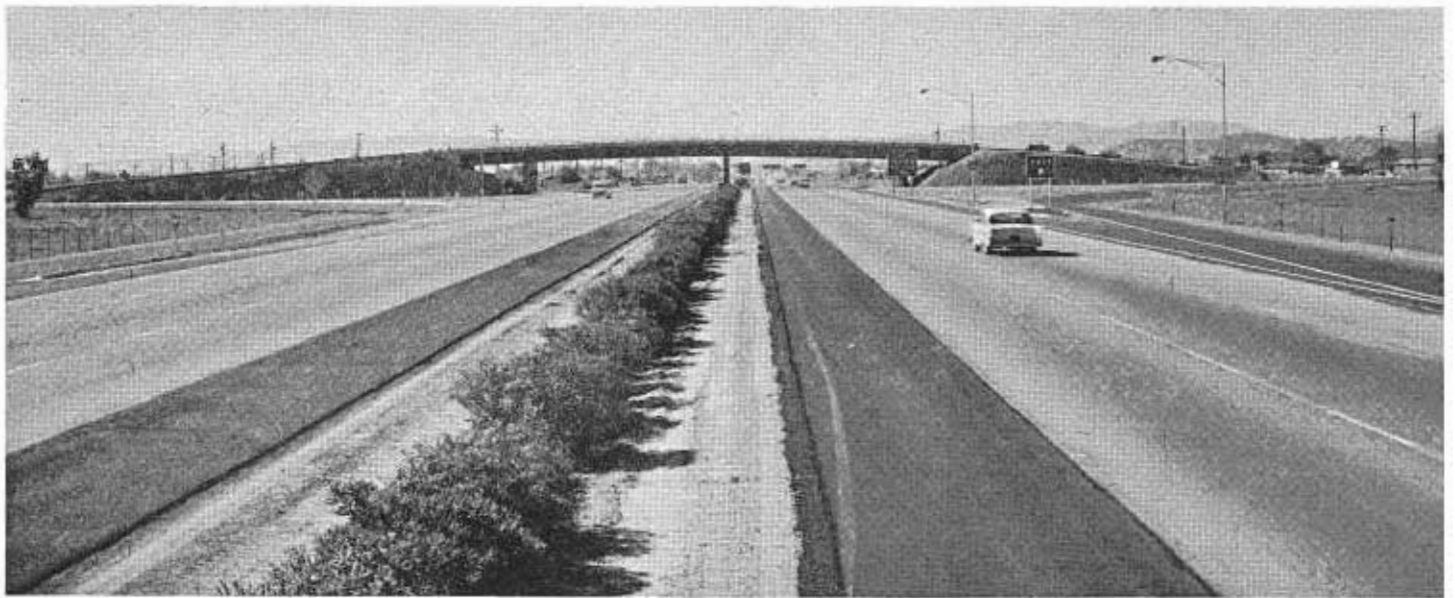
This project continues the six-lane divided freeway system 1.2 miles easterly of the above project and provides an overcrossing for Travis Boulevard along with the necessary on and off ramps. The six-lane construction consists of adding another PCC lane along the outside of the existing 24-foot slabs.



*Aerial view of new Rindler fill and Hunter Hill cut looking westerly toward Vallejo. Oval in distance is racetrack on Solano County Fairgrounds.*

This project was awarded to Ball and Vickery, Inc., and John W. Vickery, Jr., on November 9, 1961, and

was completed in February 1963 at a cost of \$490,000. Dudley Hatch was the State's resident engineer.



*Looking westerly toward Travis Boulevard overcrossing near Fairfield.*

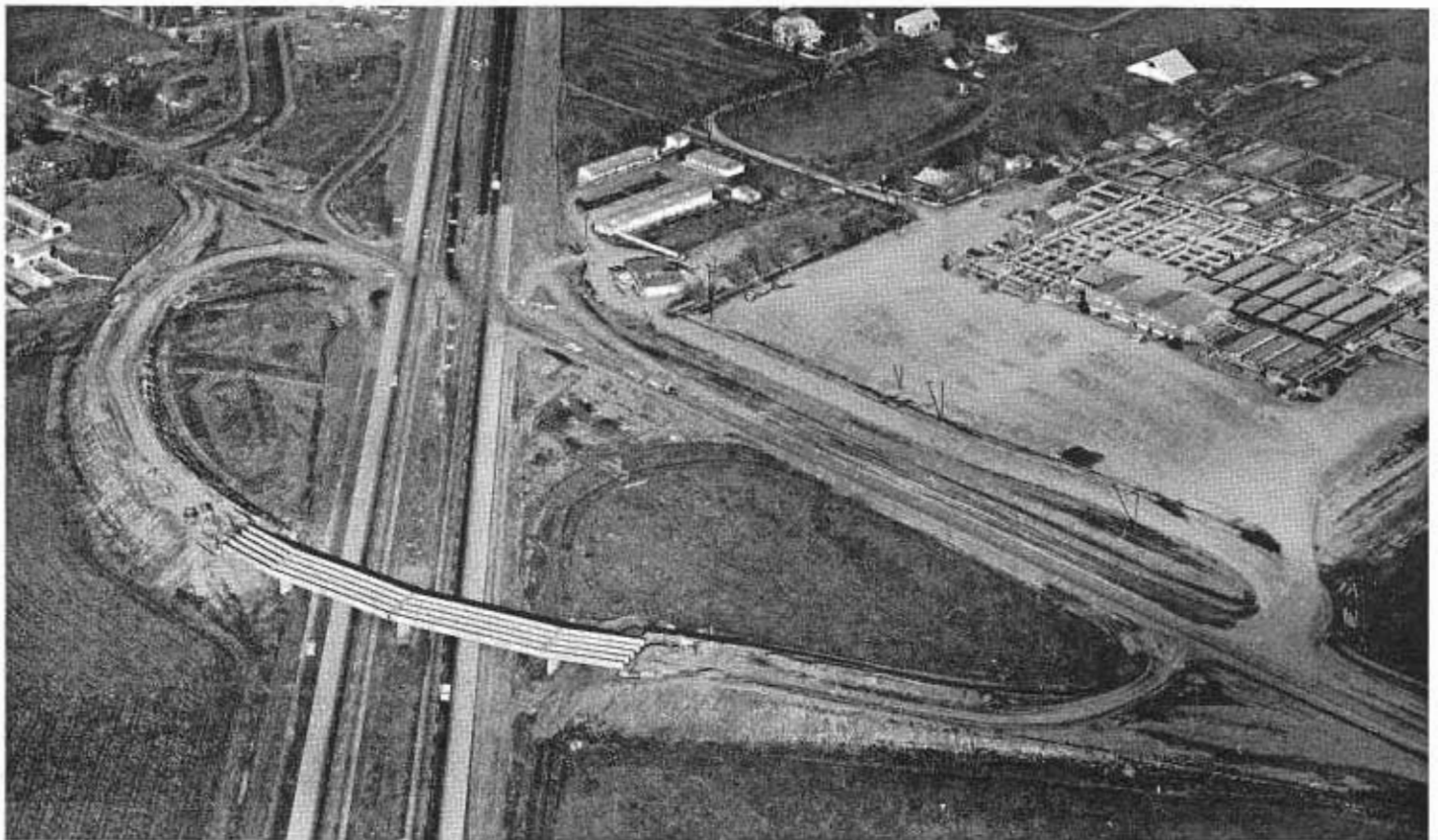
**Vacaville Project**

A contract was awarded to Gordon H. Ball and Gordon H. Ball, Inc., on November 17, 1961, to construct 5.1 miles of six-lane divided freeway through the City of Vacaville ending

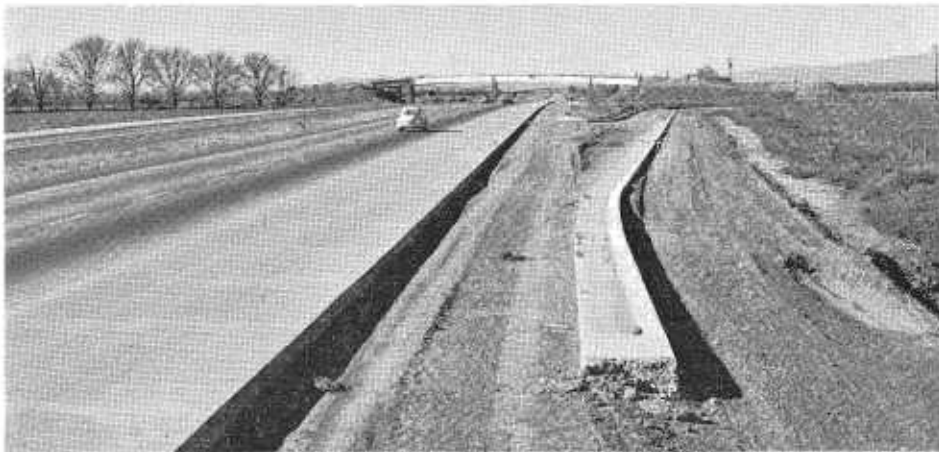
nearly one mile east of the Route 90 (Interstate 5W) Intersection. Herman Jantzen is the State's resident engineer on this project.

To convert this expressway to freeway standards, one new PCC lane is

being added to the existing 24-foot PCC slab on a short section and the balance of the project will consist of all new 36-foot PCC pavement. This project also calls for widening nine bridges, constructing five new bridges,



*Interchange at U.S. 40 and Legislative Route 101 at the Milk Farm (top left) looking easterly along U.S. 40 toward Sacramento, Dixon to right.*



Looking westerly along U.S. 40 at Pitt School road overcrossing.

constructing two overhead structures, which will carry U.S. 40 over Davis Street and the Sacramento Northern railroad tracks and four overcrossings together with the necessary on and off ramps and frontage roads. It is anticipated that the cost will be \$5,750,000.

It is anticipated that this project will be completed in the spring of 1964.

#### Dixon Project

A contract was awarded to Fredrickson and Watson Construction Company on January 25, 1962, to construct seven miles of six-lane divided freeway from Midway Road to Pedrick Road. Pedrick Road is located about one mile east of the junction of U.S. 40 and State Route 101 leading to Dixon. This project consists of adding an additional PCC lane on the outside of the existing eastbound and westbound PCC lanes for about six miles of the project length. The remaining mile consists of placing a cement-treated base widening strip 13-feet wide on the outside of the existing pavement and capping the full 36 feet with AC paving.

Reconstruction of this portion will necessitate the widening of four bridges and an equipment and cattle pass and the construction of one new bridge, two overcrossing structures, one separation structure at the intersection of U.S. 40 and State Route 101 and approximately two miles of frontage roads with the necessary on and off ramps at the various structures.

This project lies in the newly created Solano Irrigation District, which began active service about two

years ago. Construction of this project was hampered by the fact that new irrigation in the surrounding area had raised the water table to the point that it had saturated the basement soil of the entire project. To correct this condition, it was necessary to remove the saturated material and reconstruct the entire section.

Merle Larrabee is the resident engineer. He estimates that this project will be completed by June of 1963.

One of the main feeder roads to U.S. 40 is Interstate 680 which was completed to four-lane divided freeway standards on September 15, 1962. This project connects the new Benecia-Martinez Bridge to U.S. 40 and Vallejo. Northbound traffic can also use the old two-lane road to Cordelia. This portion of two-lane road is the original pavement laid in 1914 as part of the then Route 7.

## NEW LEGISLATION SIMPLIFIES HIGHWAY NUMBERING

Senate Bill 64, providing for renumbering of the state highway system to eliminate the long-standing multiplicity of various route designations for legal, administrative and traffic purposes, was signed into law by Governor Edmund G. Brown on May 14. It will become operative on July 1, 1964.

The Division of Highways is now in process of preparing a base map illustrating the new route designations. The map will be made available to firms and organizations publishing information for motorists.

As the new federal interstate highway projects become a complete sys-

## Supervising Engineer C. C. Winter Leaves

C. C. "Buck" Winter, supervising bridge engineer with the California Division of Highways, has retired after 31 years in state service.

Winter has been in charge of all bridge construction activity on the state highway system in Northern California since 1950.



C. C. WINTER

A native of La Crosse, Wisconsin, Winter graduated from the University of Cincinnati with a degree in civil engineering.

He joined the division as a junior bridge engineer in

1931.

From 1933 to 1937 he was assigned to the staff which supervised construction of the San Francisco-Oakland Bay Bridge. He was promoted to supervising bridge engineer in 1950.

He served three and a half years with the Navy Seabees during World War II, retiring with the rank of commander.

Winter and his wife, Rosella, have a son and a daughter.

Winter is a member of the American Society of Civil Engineers. He is also a Mason and a member of the Elks.

tem, the red, white, and blue interstate signs will replace some of the familiar U.S. sign routes (U.S. 40 will become Interstate 80, U.S. 91 will become Interstate 15). In most other cases, the old established state sign route number or noninterstate U.S. route number will become the legal as well as posted number for the highway.

The new route designation map, will not be available until late this summer. Although the renumbering bill has been signed into law, there are other bills affecting highway routes which may be under legislative consideration until late in June.

# Stockton Model

New Display Shows One Type of Freeway Design Being Considered

By THOMAS T. WHITE, Senior Delineator



A scale model showing one type of freeway construction now under consideration for the proposed Stockton Freeway has been on public display in the community after serv-

ing its original purpose of assisting in design studies for the project.

The model has aroused considerable public interest, and has been viewed by an estimated 45,000 persons to date. It has been displayed in banks, at service club luncheons and on television. The San Joaquin County Fair Association has requested that it be displayed at the county fair in August.

Although experienced engineers can visualize three-dimensional views of complex interchanges from the usual two dimensions, the model makes it easier for all concerned to work out the myriad of details that go to make up a modern traffic interchange. For instance, the model has helped in planning the relocation of utilities and studying the complicated grade systems and drainage patterns within the interchange areas. Study of the model has also been helpful to the designers in planning the sequence of construction operations and the

handling of public traffic in each construction stage.

The model has of course helped immeasurably in explaining to individual property owners how their property might be affected and what it might look like after the freeway has been completed.

The model is 4 feet wide and 40 feet long. It was constructed on 4-foot by 10-foot sections for ease of handling and transporting. The scale is 1 inch = 50 feet. The base of the model has two layers consisting of ¼-inch plywood on the first layer and ⅜-inch firtex on the second layer. The plywood gave the model rigidity while the firtex allowed for easy cutting of waterways and depressions.

The existing topographic features were made by gluing ozalid plastic prints of blown-up aerial photographs of the model area directly on the firtex. Household plastic type (cement was used because of its fast-drying, nondistorting qualities. The buildings were carved from balsa wood, painted in their true colors, and glued in their respective locations upon the base aerial map.

Since the height of the buildings in the downtown area was not readily available, a photographic method was worked out for proportions. The buildings were photographed in individual groups from the ground with a stadia rod in a vertical position against one of the buildings in each group of

photographs. This provided a visual scale for height.

The centerlines of the interchanges and the main roadways were laid out on the base map so that the structures and embankments of the freeway could be placed in their proper location. The fills were made of firtex, shaped with a wood rasp, using the profile grade as a template for height. Structure decks were cut to size from matboard and cardboard. The bridge piers were made of standard size nails chosen for correct diameter and length, and subsequently painted. Bridge rails and the freeway pavements were made of cardboard and painted gray with a water base paint.

Norwegian lichen, an imported reindeer moss used by model railroad enthusiasts for miniature reproduction of trees and shrubs, was used to landscape the fill slopes and the vacant areas within the interchanges. Various types of colored plastic tapes of proper width were used for traffic lanes and railroads. City streets adjoining the freeway to be improved, were shown by photographic black tape simulating an asphaltic concrete appearance.

The cost of labor and material for constructing this model was \$2,500. It was built by Robert Miller and Amando de la Rosa of the delineation section of the advance planning department of District X.

PHOTO BELOW. Freeway design display in Stockton bank lobby draws spectators.



# Reflective Markers

Epoxy, Polyester Buttons  
Aid Nighttime Visibility

By HERBERT A. ROONEY, Senior Chemical Testing Engineer

It has long been known and observed by motorists that during periods of inclement weather and moderate-to-heavy rainfall that water tends to accumulate on the pavement to a depth sufficient to cover and obscure the beaded painted centerline traffic stripe. Under such conditions, the refractive index is changed and light from a motor vehicle is not reflected back to the driver and he is unable to see the painted stripe. In this situation the driver often finds it difficult to remain in his traffic lane.

Beginning in 1954, the materials and research department began experimentation with the installation of reflectorized white "buttons" or markers, made of epoxy or polyester resins according to the Division of Highways' specification, four inches in diameter and three-fourths of an inch high, the convex shape corresponding to the outer segment of a sphere as shown in Figure 1 and Photograph No. 8. These buttons were cemented to the highway surface with an epoxy adhesive, one each in the center of the 15-foot gap in the broken painted stripe. In theory these elevated markers "shed the water" and are not readily submerged. Such markers are considered as auxiliary devices which provide adequate delineation during periods of wet weather, the normal painted stripe being considered thoroughly adequate in clear weather.

## 20-year Service Life

Performance since 1954 indicates that these markers should have a service life of at least 20 years on portland cement concrete highways. On asphaltic concrete their life is dependent upon the cohesive strength of the asphaltic concrete. In hot climatic areas some failures have occurred whereby, under the impact of traffic, the markers broke loose carrying with them portions of asphaltic concrete attached to the markers. Preliminary data show that suitable nails or spikes driven



PHOTO 1. Buttons on the pavement at nighttime, clear weather.

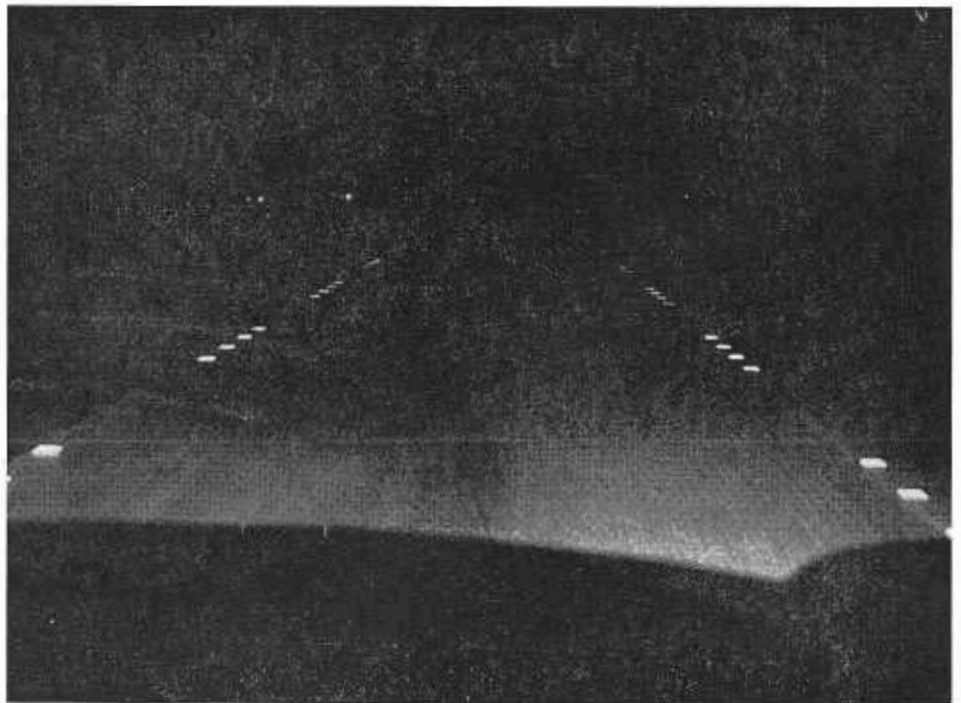


PHOTO 2. One-way wedges on the pavement at nighttime, clear weather.

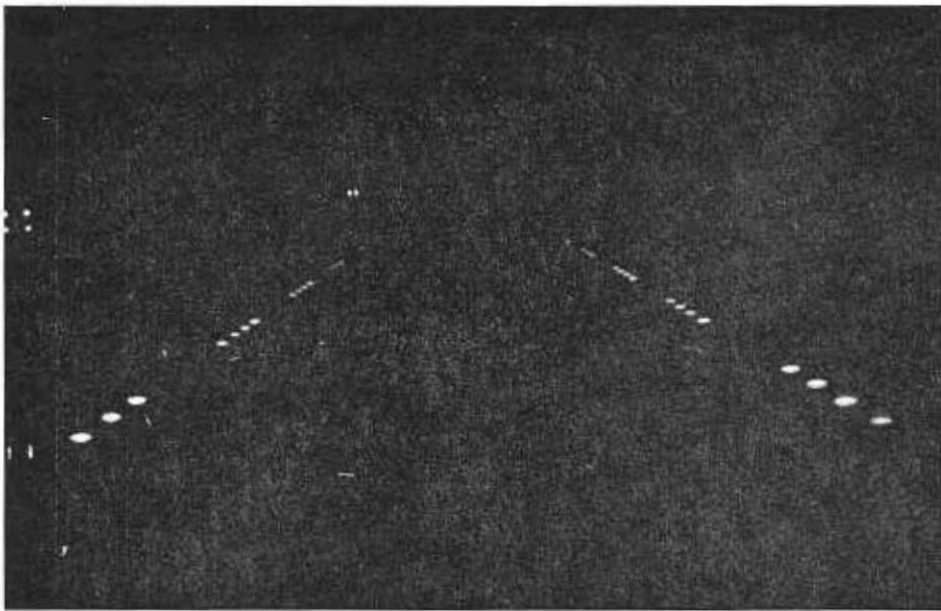


PHOTO 3. Buttons on the pavement at nighttime, moderate rain.



PHOTO 4. One-way wedges at nighttime, moderate rain.

into the asphaltic concrete under the bottom of the marker before it is cemented in place may prevent this.

Beginning in 1955 a test section was installed in which "wedge" type markers, as illustrated in Figure 3 and Photograph No. 6, were used as a complete replacement for a painted stripe on a portland cement concrete divided freeway. In this test section the distance between wedges varied, the extreme spacing being one wedge every 24 feet. All later installations had four markers, each three feet apart in the nine-foot sections where the normal stripe usually occurs. Some of these installations used the beaded wedges and others the beaded buttons. Two-way wedges as shown in Figure 2 and Photograph Nos. 5 and 12, except that they were beaded, have been used on two-lane roads or as a no-passing line on nondivided freeways in which latter case they would be yellow in color and two cemented adjacent to one another. Photograph Nos. 1 and 2 show clear weather nighttime delineation provided by the button and one-way wedge markers respectively and photograph Nos. 3 and 4 illustrate nighttime visibility of these markers during a moderate rain-storm. In another photograph taken in this area where a painted stripe was placed, the painted stripe was completely invisible.

#### Report Is Prepared

A "Report on a Study of Highway Dividing (Lane) Markers" was prepared by the materials and research department of the Division of Highways in co-operation with the Department of Motor Vehicles and the California Highway Patrol and submitted to the California Legislature in January 1963 in response to House Resolution No. 462 of the 1961 Regular Session. House Resolution No. 462 requested a study be made of methods and materials used or useful for markers which divide the highways of this State, for the purpose of finding or devising methods and materials which would render highway markers more easily seen at night and during periods of inclement weather.

The above report described work done by the materials and research department on this problem since 1936

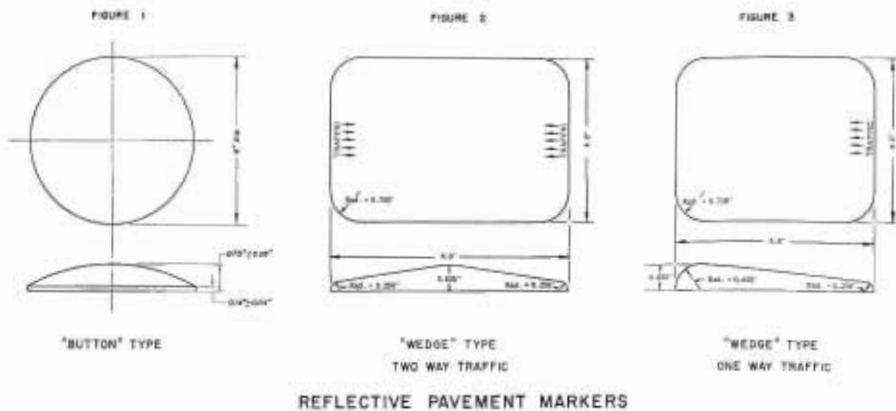




TABLE I  
RESULTS OF OBSERVATIONS \* OF VARIOUS TYPE MARKERS ON  
PORTLAND CEMENT CONCRETE ON III-SAC-11-B,A

Weather condition	Shape of marker	Beaded type		Nonbeaded type		Partially beaded and nonbeaded type	
		Daytime	Nighttime	Daytime	Nighttime	Daytime	Nighttime
Fair	Button	Poor	Very good	Good	Poor	Fair	Fair
	Wedge	Fair	Excellent	Very good	Poor		
Rain	Button	Poor	Excellent	Very good	Good	Fair	Fair
	Wedge	Poor	Very good	Good	Good		

\* Observations made after submission of legislative report.

and listed certain tentative conclusions concerning the use of such markers. These conclusions are based upon criteria as to whether the markers are to replace the painted stripe or are to act as a supplement to the stripe for wet weather delineation of the center line. If these markers are to replace the painted stripe they must provide the following:

1. Adequate delineation in the daytime in both clear and inclement weather.
2. Adequate delineation at night in both clear and inclement weather.
3. They must have a service life commensurate with the cost of the installation.

In the summer of 1962 a two-mile test installation of reflective pavement markers in lieu of a painted stripe, was made on III-Sac-11-B,A., a six-lane divided concrete highway surface near Nimbus, about 10 miles east of Sacramento on U.S. Highway 50. In this test installation the following types of markers were installed in an effort to determine which type or types would provide the best delineation day and night in all types of weather, in the absence of a painted stripe. Photograph Nos. 6 to 11 inclusive, show closeup views of these various types of markers.

Photograph No. 6 – Glass-beaded white wedge.

Photograph No. 7 – Plain white nonbeaded wedge.

Photograph No. 8 – Glass-beaded white button.

Photograph No. 9 – Plain white nonbeaded button.

Photograph No. 10 – Plain white top button with glass-beaded white rim.

Photograph No. 11 – Glass-beaded white top button with plain white nonbeaded rim.

In two of the test sections, three of the four markers in the nine-foot length where the painted stripe normally occurs were nonbeaded, and the fourth marker contained high index of refraction glass beads. The object of using nonbeaded markers is that they provide better daylight delineation than do beaded markers, the latter scattering the sunlight thereby giving them a grayish appearance, which on portland cement does not provide adequate contrast with the concrete.

#### Night Visibility

At night, in clear weather, the reverse is true; the beaded markers show very well whereas the nonbeaded ones are hardly visible. In order to

provide greater safety at night those test sections containing three nonbeaded and one beaded marker were changed three months later wherein two of the markers were beaded and two nonbeaded, the two types alternating in the nine-foot section. The partially beaded markers listed above and shown in Photographs Nos. 10 and 11, are an attempt to compromise the advantages and disadvantages of the beaded and nonbeaded types. Table I is a summary of the observations of the various types markers used on III-Sac-11-B,A.

Research to date indicates that the best combination of markers, in the event the painted stripe is eliminated, would consist of four markers spaced three feet apart in the nine-foot length where the painted stripe normally occurs, the markers being alternating beaded and nonbeaded wedges. If the markers are used to supplement the standard painted stripe, a minimum of three markers, preferably the beaded button type, spaced three feet apart in the 15-foot gap in the painted line would provide effective delineation for all light and weather conditions.

#### Overhead Lighting

Where overhead lighting is used such as in tunnels, on bridges and interchanges, reflectorized beaded markers or a beaded painted traffic

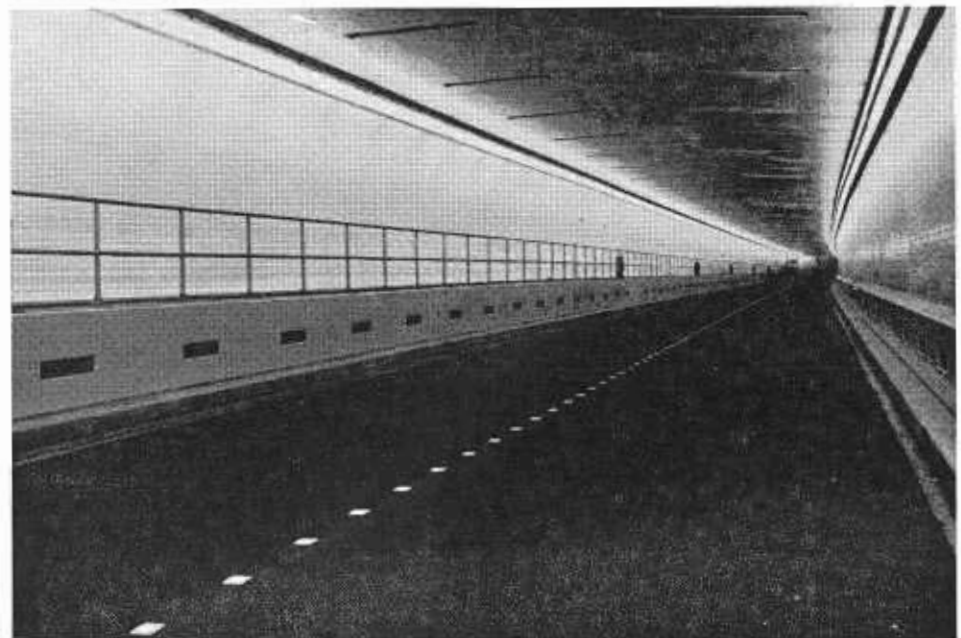


PHOTO 5. Two-way wedges, white nonbeaded, on the roadway of the Webster Street Tube.

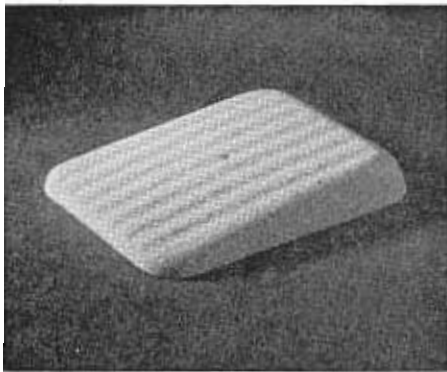


PHOTO 6. Glass-beaded white wedge.

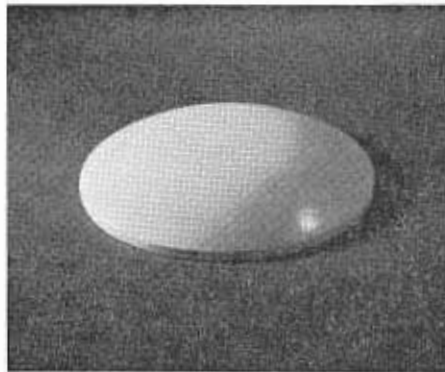


PHOTO 9. Plain white nonbeaded button.

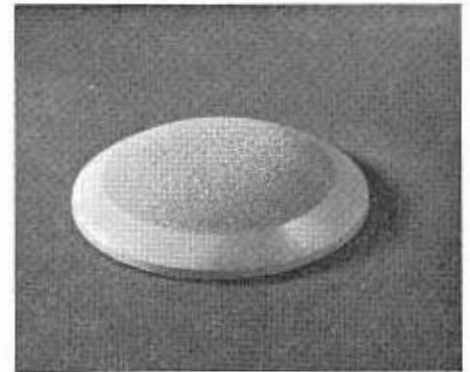


PHOTO 11. Glass-beaded white top with plain white nonbeaded rim.

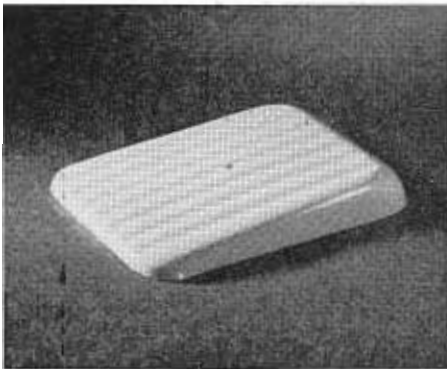


PHOTO 7. Plain white nonbeaded wedge.

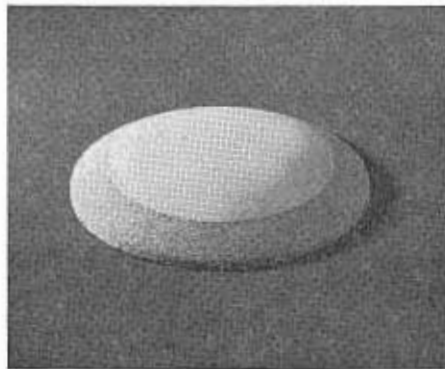


PHOTO 10. Plain white top button with glass-beaded white rim.

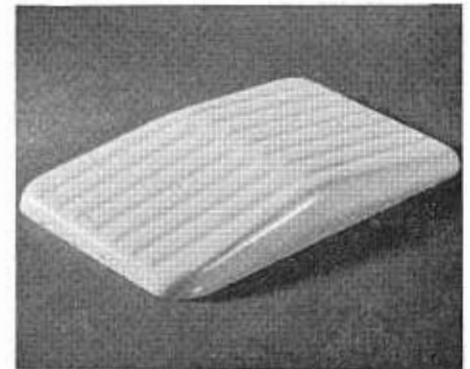


PHOTO 12. Plain white nonbeaded wedge.

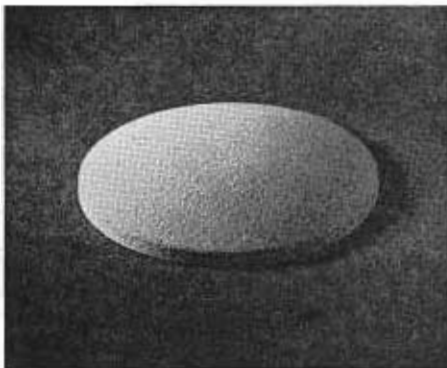


PHOTO 8. Glass-beaded white button.

stripe do not delineate properly because of the scattering of the overhead lighting by the glass beads. In situations of this type, the best delineation is provided by nonreflectorized white markers, preferably the wedge-shaped type which more adequately defines a line. An installation of this type is shown in Photograph No. 5 which illustrates the use of white nonbeaded wedges in the new Webster Street Tube in Oakland.

Many trial installations have been made in the various districts of the

Division of Highways throughout the State to determine the effectiveness of the markers under varying climatic, weather, and traffic conditions. These markers are under continuing surveillance by district personnel. In addition to comments on the effectiveness of the markers for delineation, most districts have commented favorably on the markers for the rumbling noise caused by traffic riding over them. This appears as an added safety factor in alerting motorists when they are crossing over a lane line.

A new rectangular marker combining the advantages of both the wedge and the button has just been developed and it is anticipated that a trial installation will be made to evaluate its effectiveness.

Development work on the markers is continuing and the Division of Highways will continue its efforts to provide the most economical and effective lane markings for all climatic and roadway conditions.

#### Author's Acknowledgments

These markers are a development of the Chemical Unit of the Central Laboratory, Technical Section, under the direction of Donald L. Spellman.

Appreciation is due F. N. Hveem, head of the materials and research department, for his suggestions and interest in promoting research relative to providing greater highway safety through better delineation of highway center lines; to the late Dr. E. D. Botts, former senior chemical testing engineer in this department who pioneered in the development of reflective pavement markers; to Robert Souza, staff photographer for the excellent photographs accompanying this report; to Enrico Maggenti, engineering aid II, for his conscientious work in directing the field installation of the test sections; and to James A. Cechetini, materials and research engineering associate, for his work in 1955 in designing the reflective wedge-type marker.

# Sacramento River Canyon

By ELLIS C. ENGLE, District Construction Engineer



Another section of Highway U.S. 99 (Interstate 5) between Redding and Dunsmuir has been constructed to modern four-lane standards. With the completion of this six-mile unit south

of Castella, there now exists approximately 30 miles of continuous four-lane expressway and freeway for use by the traveling public.

Total construction cost for this 30-mile section was approximately \$30,790,000.

In 1954 the Division of Highways started reconstruction of the portion of U.S. 99 between the north end of Shasta Lake and Dunsmuir. For a distance of 30 miles the existing highway was located in the rugged canyon of the Sacramento River. Also located in the canyon were the mainline tracks of the Southern Pacific railroad, high-tension transmission lines, and a coaxial telephone cable.

Completed section of expressway at Pollard Gulch.  
Note old highway and bridge on the left.

## Stability Is Determined

Providing room for a modern four-lane highway, at the same time keeping disruption of existing facilities to a minimum, taxed the ingenuity of the design engineers. The modern alignment and grades required high cuts and fills, and as the work progressed in the canyon extensive investigations were made by the materials and research department to determine the stability of fill foundations and cut slopes.

The first contract, for construction between Vollmers and La Moine, was

let to Piombo Construction Company; the contract for the bridge at Dog Creek, to Ukropina Polich and Kral and Ukropina; and the one for the section between Crespos and Vollmers, to Guy F. Atkinson. These three contracts provided for the construction of seven miles of 60-foot all-paved section with intersections at grade but no private access. Total quantities of earthwork amounted to 2,500,000 yards.

## Problems Become Apparent

The problems that were to trouble the construction engineers became ap-

## CANYON ROUTE HISTORY—FIRST ROAD BUILT IN 1858

By MARK E. CESSNA, Associate Highway Engineer

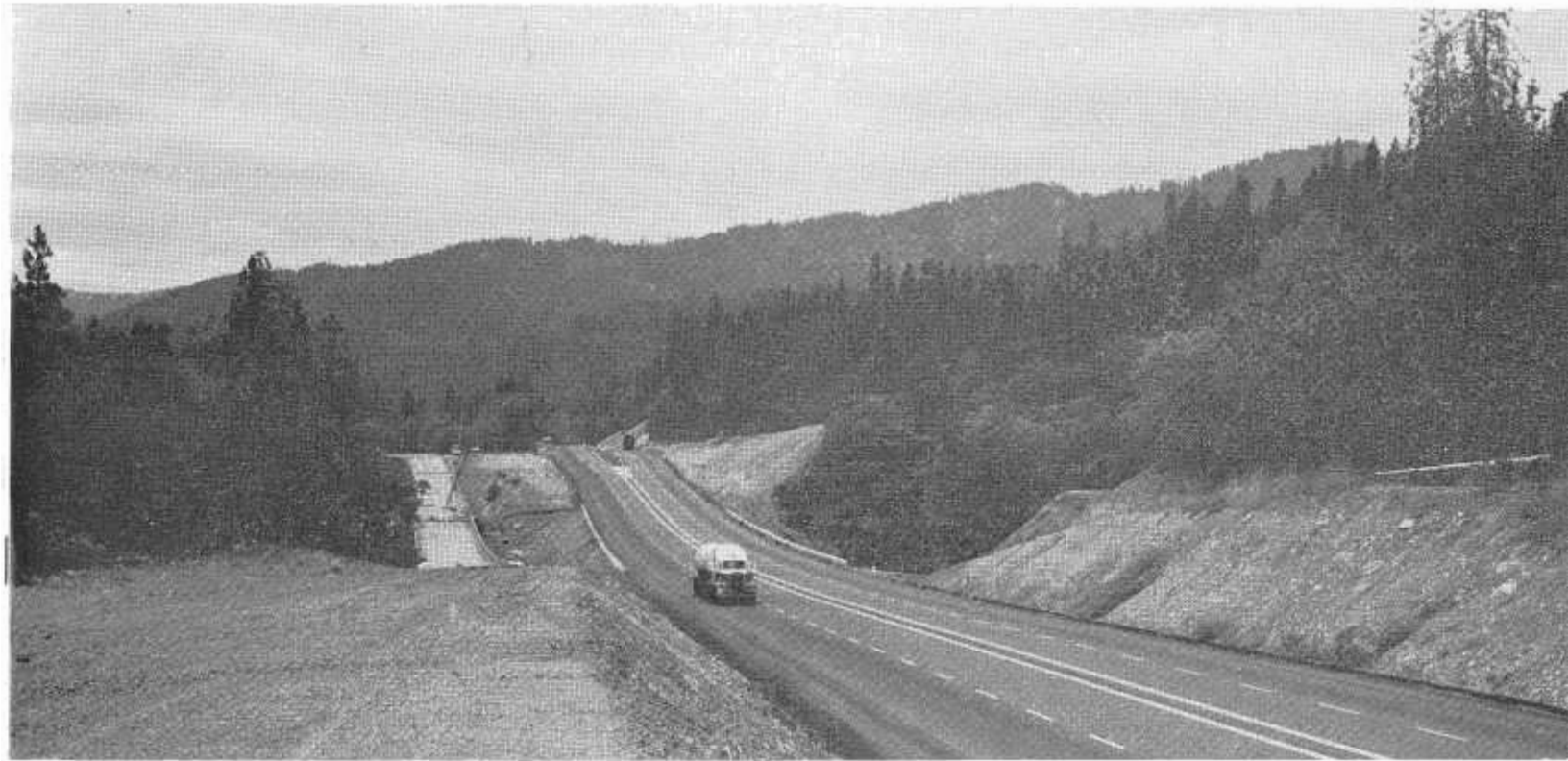
(Editor's Note: This historical account rounds out the background material contained in "Sacramento Canyon," which appeared in the May-June 1956 issue.)

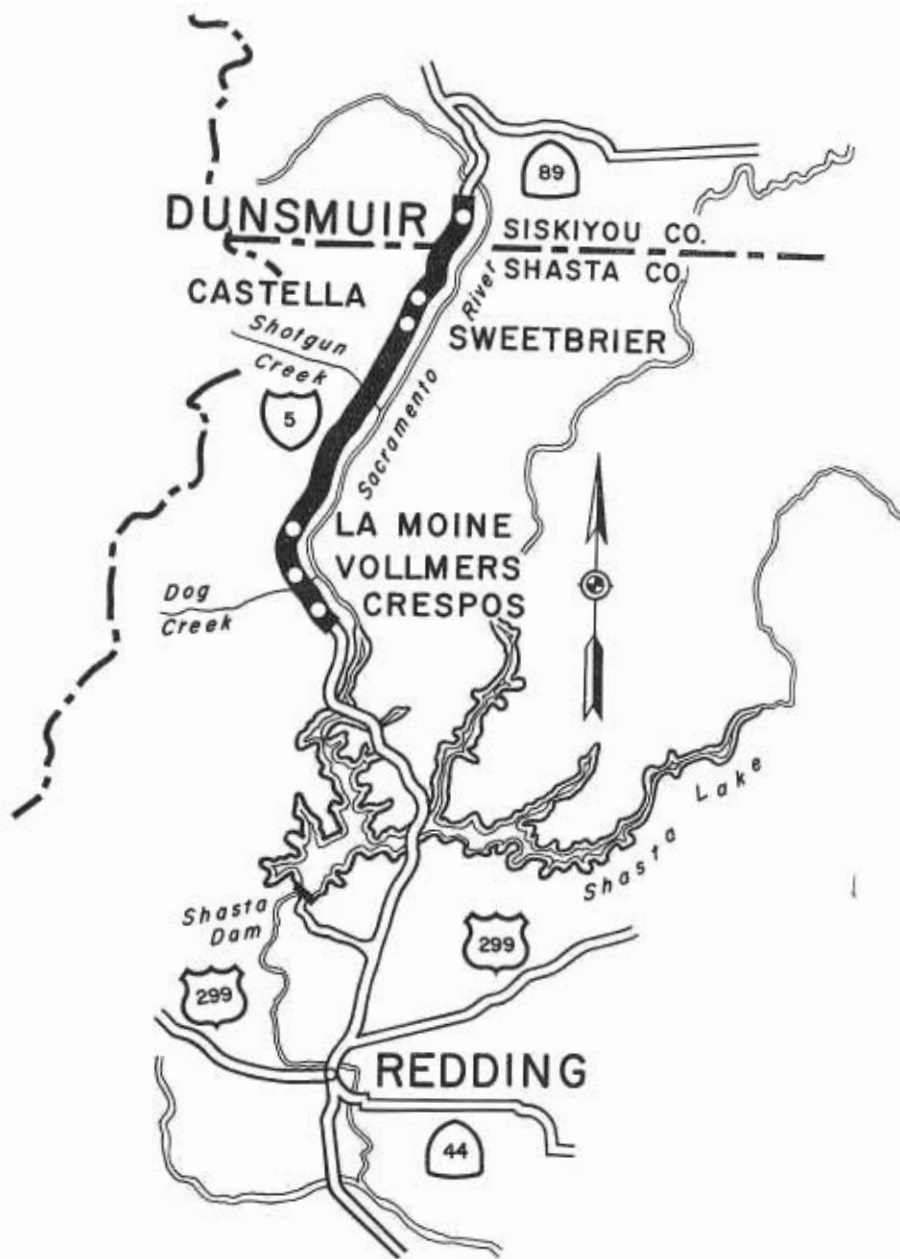
The history of travel in the Sacramento River canyon between the great Central Valley and the uplands of far northern California prior to 1837 is somewhat sketchy. Although this route must surely have been used

by hunting and war parties of the Wintu and other Indians, since it is the most direct route between the fertile Central Valley and the semiarid upland plateau, there is no positive evidence to support this belief.

Recent discoveries in ancient burial mounds near the City of Sacramento indicate that neolithic man also inhabited this fertile valley, and since he

... Continued on page 23





The heavy black line on the above map shows the location of the freeway construction on Interstate 5 (U.S. 99) through the Sacramento River Canyon described in this article.

parent at this time. The winter of 1955-56 with its heavy rainfall caused numerous large slides and one slipout of a major fill. These were corrected by the installation of horizontal drains and the shifting of the line into the hill. However, in the early stages of the next section between La Moine and Shotgun Creek, constructed by Gibbons and Reed in 1957 and 1958, it became apparent that more extensive measures of correction would be necessary to stabilize the foundations for

the deep fills. Large amounts of underground water, seams of decomposed serpentine, and highly plastic clays not only provided poor foundations for large fills, but also caused extensive slides. Some of these conditions existed 40 to 50 feet below the original ground on steep hillsides and were not susceptible to correction by ordinary means.

Numerous auger borings were made to determine the underground conditions. Corrective steps were under-

taken after consultation with the materials and research department. These steps, although expensive, were justified to prevent the possible loss of a major fill with consequent disruption of traffic and perhaps the closing of the railroad. These remedies were then made a part of the design for the remaining three projects in the canyon.

#### Corrective Measures

Corrective measures consisted of constructing stabilization trenches under the high fills where borings indicated the existence of unstable conditions. In areas where stabilization trenches were not considered feasible, a system of vertical wells (see photo) 24 inches in diameter were drilled and filled with filter material and perforated pipe to collect the water. These were then intercepted with horizontal drains at a lower elevation to drain the water from the hillsides. Extensive use was also made of underdrains to stabilize the subgrade areas.

The efficiency of these measures has been shown by their effectiveness at the old Shiloah slip a few miles north of La Moine. This slipout, which had caused a large expense to the maintenance department, was started by the placing of only 2,500 yards of fill during reconstruction of the road in 1928. It had been necessary every year since that time to restore the roadway to grade by the addition of one to three feet of material, depending on the severity of the season.

Since the completion of the new contract at that location in 1959 no settlement has occurred. Corrective measures at this location consisted of a stabilization trench, horizontal drains into the hillside, and strut material placed on the downhill side of the fill.

#### Runaway Truck Hazard

After the Gibbons & Reed contract at Shotgun Creek, construction was shifted to the Dunsmuir area due to the desirability of eliminating the hazards of runaway trucks through Dunsmuir as soon as possible. This section was built by McCammon & Wunderlich. The design of this section was on the basis of a full freeway.

The typical section included a 16-foot median, 2 12-foot lanes of 8-inch portland cement concrete in each direction, and 10-foot shoulders on the



*Looking north along the new freeway toward Mount Shasta with the City of Dunsmuir in the middleground.*



**BEFORE.** Section of old highway near Sweetbrier. Mount Shasta in background. Note retaining walls on right to prevent encroachment on railroad.



**AFTER.** Same section as above after freeway was completed. Sweetbrier Interchange in background. Clouds veil Mount Shasta in distance.

right of traffic paved with asphaltic concrete. The remaining two sections in the canyon were designed to the same standards. The section between Sweetbrier and one mile south of the Shasta county line was constructed by Gibbons & Reed and the last section, between Shotgun Creek and Sweetbrier, by Slate-Hall & Hamilton.

The concrete pavement on these three contracts was placed by Gordon H. Ball, Inc., using the slip-form paver.

Several large slides developed during construction which required extensive corrective measures. These consisted of flattening cut slopes; unloading the tops of the slides; installing horizontal drains; and in one instance, where the foot of the slide was on stable material, placing a rock buttress for additional support. In some cases a combination of all these measures was necessary to stabilize the slides.

At one location the existing highway was cut in a steep sidehill section on the left side with retaining walls on the right side. This was to prevent encroachment on the main line of the Southern Pacific railroad which was approximately 125 feet below and immediately adjacent to the Sacramento River.

#### **350-foot Cut**

The new construction entailed a 350-foot cut on the left with 20-foot wide benches at 40, 100, and 180 feet above roadway grade. Cut slopes were  $\frac{3}{4}$  : 1 to the first bench and 1 : 1 slopes above.

When construction had progressed to within 100 feet of grade, what appeared to be a small slide developed in the cut slope between the 100- and 180-foot benches. As work continued in the cut it became evident that the slide was quite extensive and would require major corrective action. Large cracks had developed in the hillside approximately 850 feet from centerline and 550 feet higher in elevation. The first proposal to flatten the cut slopes and unload the slide area, was not deemed feasible for the following reasons:

Although large amounts of ground water were present, it was not believed that horizontal drains would be

effective. The movement, while aggravated by the wet conditions, was primarily a bedding plane slide. The district drill crew took borings above the cut slope to determine the extent of the unstable material. This investigation disclosed that the conditions were more critical than originally anticipated. Flattening the cut slopes would require from 600,000 to 1,000,000 cubic yards of excavation, with no assurance that this would stabilize the slide. In addition no disposal areas were available for this large amount of material without excessive haul over existing roads.

#### **Railroad Alignment Shifted**

It was then decided to investigate the possibility of moving the new location away from the slide area. In order to accomplish this it would be necessary to move the main line of the Southern Pacific railroad and construct a new channel for the Sacramento River. A preliminary study by the district design department indicated that it was feasible to shift the alignment approximately 150 feet away from the hill and move the railroad tracks and the river. The material removed from the new channel could be used to construct the new railroad grade, and since the new alignment of the freeway was primarily in fill it would permit the unoriginally designed cut slope to obtain loading of the slide area above the the necessary material for the embankment.

This solution to the problem was chosen because it provided slightly improved alignment and grade on the new freeway, eliminated the large excess of material for which insufficient disposal areas were available, eliminated a future maintenance problem by creating a storage area between the unstable cut slope and the new roadway, and was an overall economy over other corrective measures.

#### **Traffic Also a Problem**

In addition to the problems encountered due to unstable terrain, the handling of traffic throughout, presented quite a problem. In general the specifications provided for a two-lane paved road for traffic at all times.



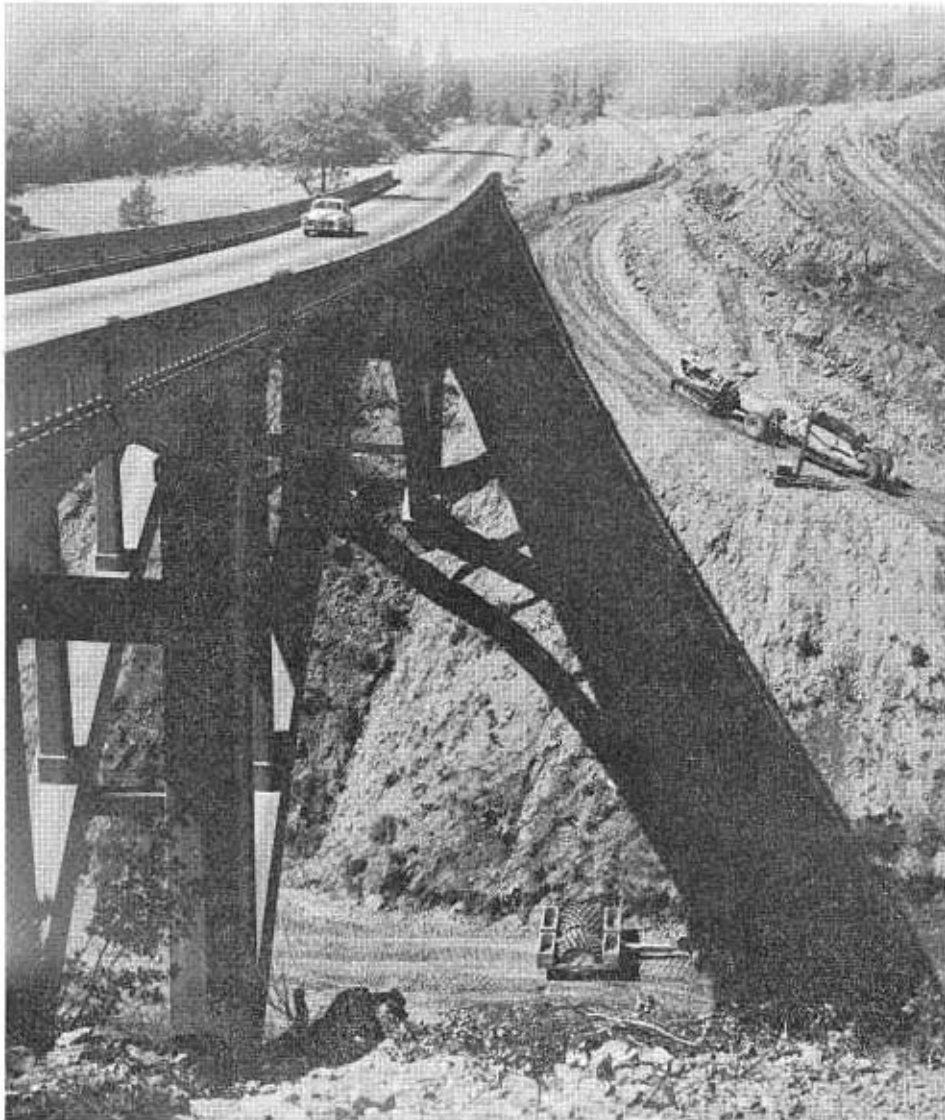
*Slide removal operations at site of big slide. Railroad has been relocated from original location at base of bluff under retaining walls.*



*Vertical drainwell installation in Dunsmuir. Pipes were capped and a pervious blanket placed over area.*



Looking north along the new freeway toward Castle Crags State Park (left). Castella and the old highway are to the right. Grading operations underway at Pollard Gulch approximately two miles north of La Moine. Concrete arch bridge replaced with 6-foot reinforced concrete arch.



While it was necessary for the contractors to stop traffic for short periods of time, it soon became apparent that it was to the contractors' advantage to keep traffic moving as the delays to their operations were extensive in trying to clear long lines of traffic.

In general the system used was to construct the cuts or fills to the level of the existing road, pave these portions, and then shift traffic to the outside, thereby providing room for the construction of the remaining two lanes of the freeway to grade. These were then completed through the leveling course stage on the projects paved with asphaltic concrete, and traffic was again shifted to allow the completion of the remaining lanes. On the projects paved with concrete, temporary surfacing was placed over the subbase to carry traffic while completing the remainder of the roadway grading.

Work is continuing at present on the conversion of the two-lane highway around Shasta Lake to modern four-lane standards. Piombo Construction Company is constructing several underwater rock fills where the new embankments encroach on small inlets of the lake. When this work is completed additional contracts will be let to complete the section between the Pit River Bridge and the completed work in the canyon, a distance of approximately 14 miles.



# CANYON ROUTE HISTORY

*Continued from page 17 . . .*

was such a great traveler in Europe, it is reasonable to assume that he also used the Sacramento River canyon in his travels. But it was not until one Michael LaFamboise in 1837 pioneered the first trail that this route became an accepted highway of commerce. To call this first trail a highway would seem to be stretching the point a bit, but soon after its opening it did become an important commercial route.

In 1841, Lieutenant George F. Emmons, U.S.N., a member of the official U.S. Government Around the World Exploration Party under Lieutenant Charles Wilkes, explored and mapped this trail from San Francisco Bay to the mouth of the Columbia River. It is interesting to note that Lieutenant Emmons gave the Sacramento River the name Destruction River from its junction with the Pit to its source. At first glance of the canyon through which the Sacramento River passes in this portion, it is not hard to see how he came by this name.

In 1854, the first toll company franchise was granted for a portion of this route north of Soda Springs. With the opening of the so-called stageline between Shasta and Yreka in 1858, travel over this route so increased as to warrant the construction of more of these toll roads, some of which must have been successful commercial ventures. (The phrase "so-called" is used with reference to the first stageline because the portion between the Pit River and Soda Springs was traversed by mule back instead of by coach. This portion being about 40 miles in length over very rough country, there is much speculation as to the condition of the passengers when they arrived at Soda Springs. To say that they must have been sorely worn is surely an understatement.)

## Bridges Washed Out

In 1861, this portion of the road was completed, only to have its eight bridges washed out by the great flood of the 1861-62 winter. Even in those days inadequate hydrologic data was the bane of the roadbuilder.

In 1860, Ross McCleod, the operator of the Soda Springs Resort, pro-

moted the survey and construction of a road from Soda Springs to Yreka.

The standards adopted by these early highway builders were a full 8- to 11-foot roadbed with maximum grades of 25 percent. Construction costs were estimated to be in the neighborhood of \$300 per mile. An occasional turnout was provided to facilitate passing, and the great clouds of dust that were stirred up by traveling vehicles were ample warning of approaching traffic. Meetings at these turnouts gave welcome excuse to rest a traveler's team and exchange news. The time required to traverse the canyon was between two and four days, depending on the load carried and the amount of news exchanging that went on during these rest periods. By 1914, the road had deteriorated so badly, because of lack of maintenance, that it became impassable for long periods of time and traffic had to be diverted over longer routes. Such were conditions in the Sacramento River canyon when the California Highway Commission was formed.

## Route Recommendations

The first duty of Mr. T. A. Bedford, district engineer of the newly formed District II, was to make recommendations as to the best route between the Town of Redding in the central valley and Yreka on the northern plateau. In 1913, there was considerable agitation for this route to be constructed west from Redding through French Gulch, Trinity Center, and Carrville, over Scott Mountain, through Fort Jones to Yreka. Mr. Bedford ruled out this route as being considerably longer with more adverse grade, making it much more expensive. In addition, the traffic on this route did not warrant making it the primary route.

In the years between 1914 and 1919, construction of the road between Redding and Dunsmuir was carried on at a feverish pace. The new road, to quote from a preliminary report of that era ". . . has a very good alignment considering the character of the country which renders it impossible to procure a more direct line. The minimum radius of curvature is



*The original state highway through the Sacramento River Canyon was constructed nearly 50 years ago with pick and shovel labor and horse-drawn scrapers.*



Looking north from top of large slide at Sweetbrier. Bulldozer approximately 500 feet above grade. This was area where channel change was made and railroad relocated.

60 feet. The maximum grade is 6.7 percent." This in contrast to another report describing the condition of the old road, "... the existing road has a very crooked alignment with curves as sharp as 20-foot radius and many pitches of grade running up to 20 percent."

#### Early Contracts

These early contracts seemed to have been plagued with the same troubles as those of the present day, *i.e.*, too much subsurface water and slides. In the final report of one of these contracts, it was found that about one-fourth of the total earth

moved came from slides occurring in the winter.

#### Two Concrete Sections

From 1923 to 1929, surfacing and realignment contracts were let on this portion of the route, even to the extent of paving two portions with portland cement concrete pavement. But for the most part, this surfacing consisted of gravel which the maintenance department later oiled.

By 1932, conditions of the route had improved to the point that when Mr. F. W. Haselwood succeeded Mr. H. S. Comly as district engineer, the latter remarked that there was noth-

ing to worry about in the canyon since that highway was completed and would need no more attention.

#### Shasta Dam Construction

The construction of Shasta Dam, the largest unit of the Central Valley Project, initiated another era of road improvement in the canyon. The construction of the dam made necessary the relocation of 19.5 miles of highway through rough, forbidding terrain which earlier locators did not have the temerity nor the need to attempt. A note of interest is that this relocation follows the old Oregon Trail road. This section of road is a highly improved two-lane section with moderate grades and curvature, but it contains some of the heaviest grading undertaken on a two-lane highway in District II. This section, completed in 1943, is still in fair condition and may be traversed by the traveling public with very little delay.

#### Older Portions Improved

With the tremendous increase in traffic on the highways of California following World War II, it became increasingly more apparent that the older portions of the highway in the canyon would soon need improvement. Therefore, in the autumn of 1951, a special projects section was organized in District II to begin preliminary studies and prepare plans for the realignment and reconstruction of U.S. 99 in the Sacramento River canyon to a multilane facility.

#### Same Problems

"It soon was discovered that the same problems were still there, namely the river, the Southern Pacific railroad, and the springy, unstable areas," to quote R. H. Twaddle, design engineer for this section. By 1954, plans had progressed to such a point that the first section was begun, starting at Dog Creek near the head of Shasta Lake. Each successive year as more funds became available, additional sections were let to contract.

The section between the north end of Shasta Lake and Dunsmuir has now been completed providing 30 miles of freeway and expressway through this scenic but extremely rugged canyon.

# Bay Area Report—1963

By J. P. SINCLAIR, Assistant State Highway Engineer



The best descriptive phrase that can be applied to highway development within the San Francisco Bay area in recent years is that of "reaching out." Where less

than two decades ago we found traffic inching along historic routes designed for traffic conditions of the 1930's, today many

of these routes have been improved to high-standard freeways connecting the important residential, commercial and industrial centers of the Bay area.

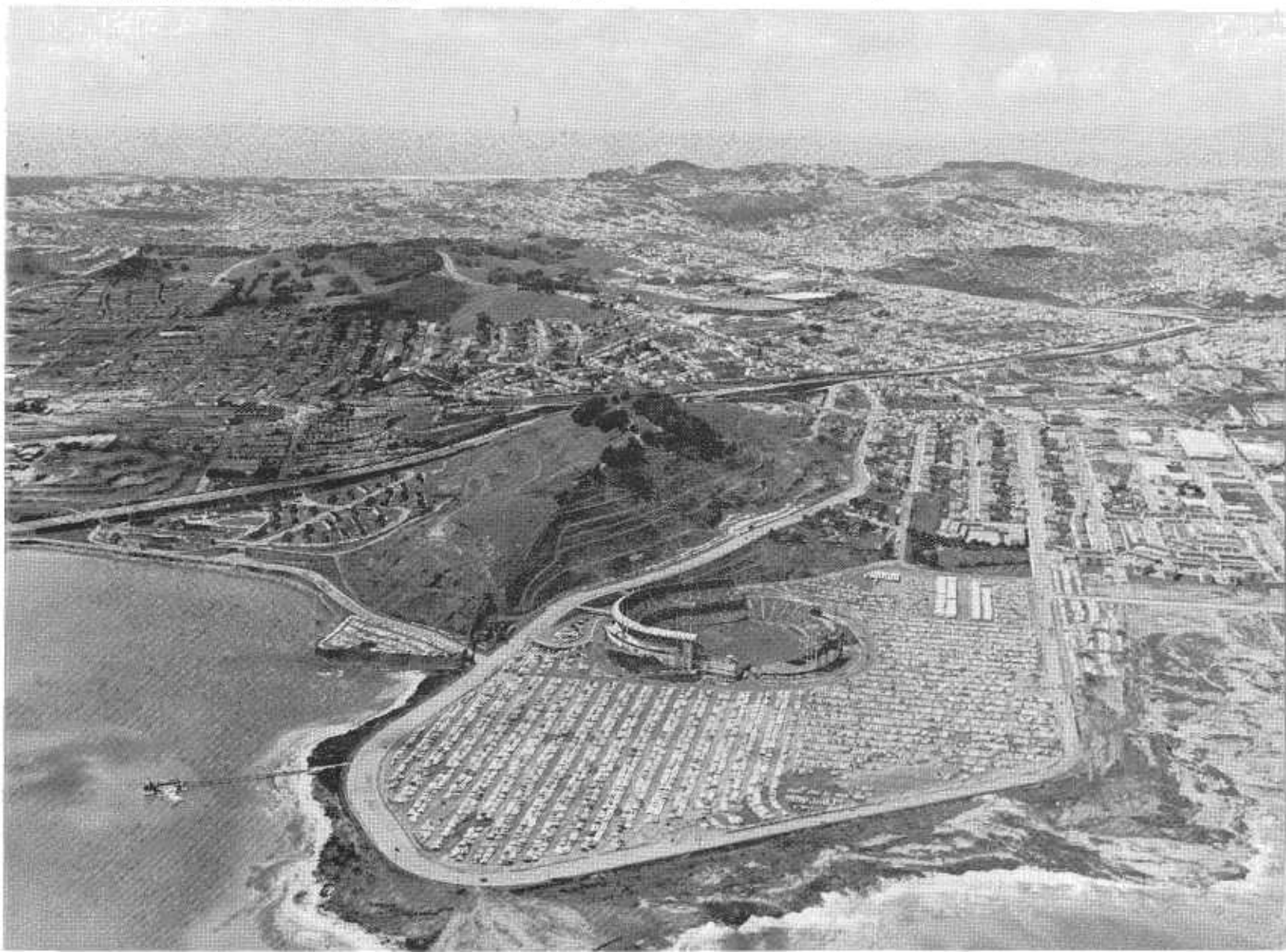
To visualize these improvements, think of the conditions existing at the close of World War II. The Bay area, which for almost five years had served as an important center for support of military operations, was long overdue for improvements in its transportation system. Peaceful suburban towns surrounding the financial centers of the Bay, San Francisco and Oakland, were about to explode into densely populated and highly developed areas.

## Old Highways Congested

Highway facilities in the area, in the main, consisted of two-lane, at best four-lane, roads connecting the Peninsula, Marin and East Bay communities. Within the cities, streets served as arteries for highway traffic which was continually hampered by traffic to and from adjacent commercial properties.

On the Peninsula, two main routes served the commuter and through traffic between South Bay points and San Francisco. One of these routes, Bayshore Highway, authorized by the Legislature in 1923, traversed the marginal tidelands on the west side of the Bay. Farther to the west, tree-lined

*Candlestick Park on the opening day of the 1963 baseball season. The view is westward across the peninsula with the Bayshore Freeway crossing in the middleground and the Southern Freeway-Alemany Boulevard interchange visible to the right.*





**BEFORE.** The Bayshore Highway in 1953 at the Third Street intersection. The view is northward. (See photo below.)

El Camino Real wound its way along the base of the hills connecting communities and serving as their main street. Skyline Boulevard, along the spine of the Coast Hills, and the Coast Highway (State Sign Route 1), winding along the Pacific shore, generally served the weekend travelers seeking recreation and the wonders of nature.

In the East Bay, city streets such as San Pablo Avenue and East 14th Street served north-south traffic including heavily traveled U.S. 40 through Richmond. Farther south, Hesperian Boulevard, little more than a country road through the fields, and Mission Boulevard, along the east foothills, connected Oakland and San Jose. MacArthur Boulevard served traffic to and from the Livermore Valley and points east. Ashby Avenue and Broadway were the thoroughfares to the walnut groves east of the Berkeley Hills.

#### Right Angle Turns

North of the Golden Gate, U.S. 101 wound lazily through the communities of Marin and Sonoma Counties while State Sign Route 1 hung tenaciously to the cliffs above the Pacific. The remaining routes within Marin and Sonoma Counties were

little more than paved paths along land section boundaries with right angle turns every few miles.

Today, as one views the existing freeway and expressway system, the improvements in the past 15 years are almost phenomenal.

Commuter traffic is now rapidly distributed throughout the commercial and financial districts of the metropolitan area by the Embarcadero, Central and James Lick Memorial Freeways in San Francisco and the MacArthur and Nimitz Freeways in the East Bay.

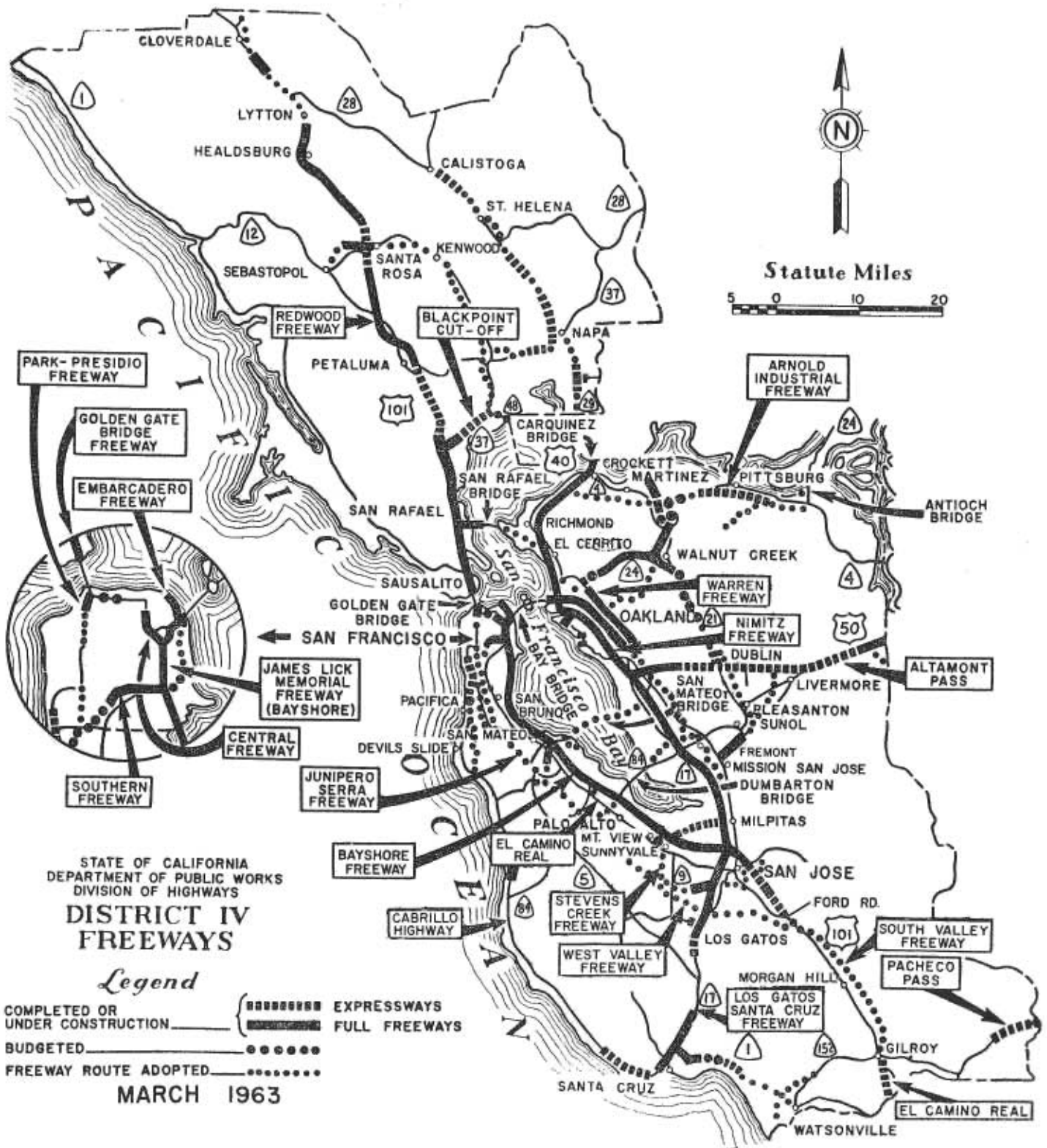
In San Jose, State Sign Route 17 handles much of the traffic that formerly was confined to city streets and Bayshore and Nimitz Freeways serve the outlying areas which are being rapidly developed. Routes have been adopted for the Guadalupe Parkway and the Route 5 Freeway which will serve traffic within the city core area. Also within San Jose, two units of the Junipero Serra Freeway, an eight-lane interstate facility connecting San Jose and San Francisco, are under construction and a third has been budgeted.

#### Becomes Freeway

Bayshore Highway has been developed into Bayshore Freeway, connecting San Francisco with San Jose and points south. This is a continuous six-lane, sometimes eight-lane, facility and further improvements are planned. Portions of El Camino Real have been improved to six-lane divided conventional highways with parking aprons



**AFTER.** The present Bayshore Freeway looking northward toward the Army Street interchange. (See photo above.)





New freeway section of U.S. 101 in Sonoma County at the East Fulton Road overcrossing, completed in 1962.



Traffic entering and leaving the recently completed Webster Street Tube between Oakland and Alameda. New tube is carrying two-way traffic during modification of the existing Posey Tube.

and sidewalks to serve an almost continuous community along its length. Skyline Boulevard for much of its length in San Mateo County will become the Junipero Serra Freeway. Along Cabrillo Highway, portions have been developed to expressway standards and the first freeway section in the City of Pacifica will be constructed shortly.

Cross-connections, east and west, have not been neglected. In the vicinity of San Jose, we find not only the aforementioned State Sign Route 17 but funds have also been budgeted for the first unit of the Stevens Creek Freeway in Sunnyvale and Route 113 is being developed to high standards in Mountain View. Northerly in San Mateo County, funds have been budgeted for a controlled-access artery in Redwood City on Legislative Route 214 and the first unit of the 19th Avenue Freeway connecting Half Moon Bay with the San Mateo-Hayward Bridge is nearing completion. A route has also been adopted in San Bruno between the Bayshore Freeway and Sweeney Ridge near Skyline Boulevard.

#### Four Major Projects

In the north, U.S. 101 is being developed to freeway standards with four major projects presently under construction, bringing closer the day when this route will be full freeway throughout both Marin and Sonoma Counties. State Sign Route 37 has been completed to expressway standards easterly to Sears Point and Sign Route 17 is a full freeway between the San Rafael-Richmond Bridge and the Redwood Highway. Construction is also under way on the State Sign Route 12 freeway between east of Sebastopol and Santa Rosa in Sonoma County and this entire route easterly to the Napa county line has been adopted as a freeway.

In Napa County there have also been considerable improvements to the highway system. Portions of Sign Route 29, south of Napa to Vallejo, were developed to expressway standards to handle heavy wartime traffic and this same type of stage construction is being used at the present time north of Napa. A portion of the freeway on this route has been completed in the westerly part of Napa.



U.S. 101 north of Santa Rosa near the off-ramp to Windsor where the new freeway section intersects the existing Redwood Highway.

In the East Bay, the Nimitz Freeway has been completed and in service for several years connecting Oakland and San Jose. Projects are presently under construction or planned to continue to improve this heavily traveled north-south artery. Radiating easterly from Nimitz is the recently improved Jackson Street widening on Route 105 and the four-lane freeway on Route 228 that for several years has connected Nimitz to U.S. 50. A third major east-west connection is the portion of Interstate Route 680 which is presently under construction between Mission Boulevard and Scott's Corner. U.S. 50 has been in service for several years as a combination freeway and expressway be-

tween Hayward and the San Joaquin County line.

#### Freeways in Oakland

Within the City of Oakland, approximately four miles of MacArthur Freeway, an eight-lane interstate facility, have been opened to traffic and construction is underway on this route southerly to San Leandro. Along the eastern foothills of Oakland, Warren Freeway has been completed throughout most of its length. North of Oakland, U.S. 40 has been completed as a full freeway, constructed to interstate standards, to the Carquinez Bridge.

In Contra Costa County, the last unit of State Sign Route 24 between the Caldecott Tunnel and Walnut

Creek is underway and an additional bore is being made at the Caldecott Tunnel. State Sign Route 21 (Interstate 680) has been developed to full freeway for the majority of its length north of Walnut Creek and the present gap is currently under construction. South of that city, approximately seven miles of this route is being built.

This, then, is a quick sketch of the freeway and expressway system as it begins to take shape in 1963. When viewed against the background of growth and development of the Bay area in the past two decades, the improvements listed below become a significant part of that growth.

## ALAMEDA COUNTY

One of the more significant improvements in Alameda County during the past year was the opening of the Webster Street Tube to traffic on February 13, 1963. But other developments of equal importance were the completion of four contracts on the MacArthur Freeway, continued improvement of the Warren and Nimitz Freeways and of State Sign Route 24 between Oakland and the suburban communities to the east and the beginning of construction on Interstate 680 east of Mission San Jose.

In addition to the above work, landscaping was planted and median barrier installed on completed portions of U.S. 40 and State Sign Route 17. Jackson Street (Route 105) was widened to a divided four-lane conventional street in the City of Hayward. Numerous other projects were completed or are currently underway throughout the county, including three additional contracts on MacArthur Freeway which will complete this facility through the City of Oakland.

Funds have been included in the 1963-64 fiscal year budget for additional freeway construction on Interstate 680 (State Sign Route 21), State Sign Route 24 and the Grove-Shafter Freeway. Landscaping projects on Warren and MacArthur Freeways are also budgeted.

#### MacArthur Freeway (Interstate 580)

Formerly known as Interstate 5W, this facility has been redesignated as Interstate 580.

Approximately 3.8 miles of continuous eight-lane interstate freeway



is in service between the Bay Bridge distribution structure and Park Boulevard in Oakland. Three contracts, from the distribution structure to Grand Avenue, were opened simultaneously on May 15, 1962 and the remaining portion was completed on November 30, 1962.

A total of 18 overcrossings and undercrossings for the freeway and ramps were included in the first three contracts which cost approximately \$11,600,000. Interchanges were constructed at existing MacArthur Boulevard, Oakland Avenue-Harrison Street and at Grand Avenue. Construction also included the substructures for the future MacArthur-Grove Shafter Freeway Separation. C. K. Moseman and Son, Guy F. Atkinson, and Peter Kiewit Sons Company, respectively, were the contractors on these projects.

The contract between Grand Avenue and Park Boulevard cost approximately \$4,392,000 and was constructed by Peter Kiewit Sons Company. Six bridges were constructed on the project. One of them, the separation constructed over Park Boulevard, will not be placed in service until the freeway contracts presently underway to the east have been completed and opened to traffic.

Interchanges were constructed at Park Boulevard and in the Grand Avenue-Lakeshore area. Eleven retaining walls were built throughout the project

to minimize the right-of-way requirements through the sidehill terrain which the freeway traverses.

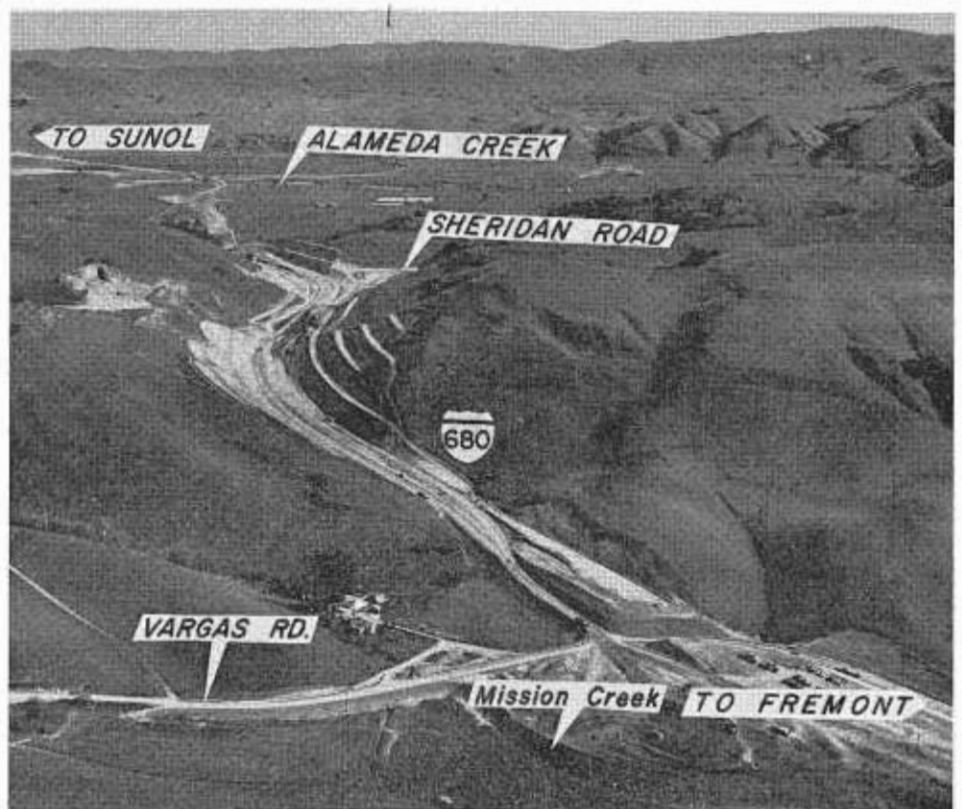
#### Units Under Construction

Construction is underway on three major projects between Park Boule-

vard and Sybil Avenue in San Leandro. More than \$24,600,000 has been allotted for these contracts which involve the construction of eight lanes of freeway for a distance of approximately 11 miles.

The first of these contracts, between Park Boulevard and Buell Street, is being performed as a joint venture by Stolte, Inc. and Morrison-Knudsen Company Inc. Interchanges are being constructed at Bruce Street, Fruitvale and Coolidge Avenues, 35th Avenue, High Street and at MacArthur Boulevard near Mills College. In addition, a pedestrian separation is being built in the vicinity of Redding Street, and 19 retaining walls are required to minimize right-of-way requirements. Overcrossing structures at 13th, Ardley, Sheffield, 35th and 38th Avenues have been completed and opened to local traffic. This project is expected to be completed in early 1964.

The second project, which extends from Buell Street to the east city limits of Oakland near Durant Avenue, is on new alignment superimposed upon Calaveras Avenue and a portion of Mountain Boulevard. A sum of \$11,-



Construction operations on Interstate 680 viewed northeasterly through the Mission Pass area along the former alignment of State Sign Route 21. Vargas Road interchange in the foreground.



920,000 has been allotted for this 4.5-mile contract which is being constructed by Gordon H. Ball, Inc. Interchanges will be constructed at Edwards, Kuhne, Keller and 106th Avenues and at Golf Links Road (98th Avenue). In addition, a full directional interchange will be constructed at Calaveras Avenue to provide connections to the Warren Freeway; and rough grading for a portion of the Warren Freeway is being performed.

South of the above project, 1.9 miles of freeway is being constructed by Guy F. Atkinson between Durant Avenue in Oakland and Sybil Avenue in San Leandro. The major interchange on this unit will be at the intersection with existing MacArthur-Foothill Boulevard at the northerly end of the project. Seven undercrossings will be built for city streets and ramps in addition to two bridges to be constructed over San Leandro Creek and the Grand Avenue Overcrossing.

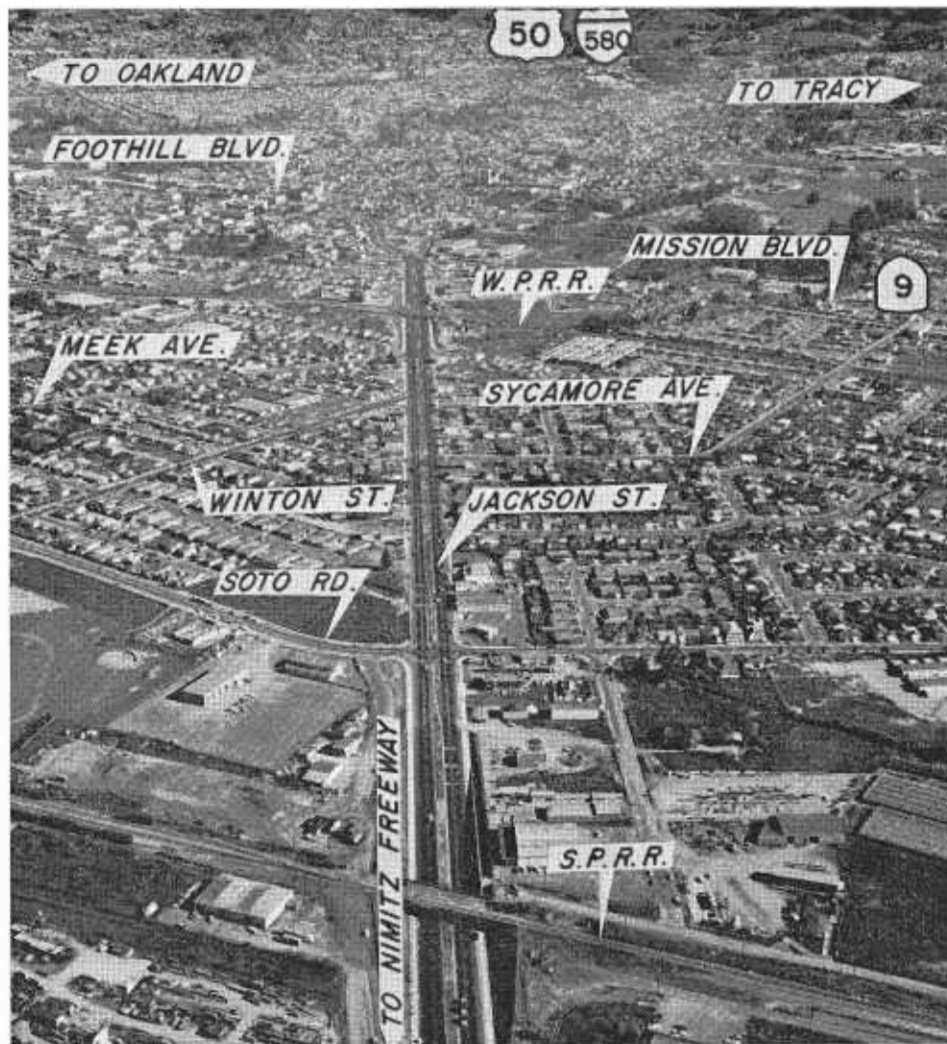
#### Landscaping Projects

Bids were opened on March 27, 1963 for a contract to landscape 2.3 miles of the completed section of MacArthur Freeway between Hannah Street and 0.3 miles west of Grand Avenue. \$170,000 has been budgeted for this work which includes the planting of over 950 trees, 10,400 shrubs and 20,300 ice plant and ivy for ground cover.

Funds in the amount of \$195,000 have been budgeted for landscaping 1.5 miles of MacArthur between Grand Avenue and Park Boulevard and this project should be advertised in the near future. A sum of \$360,000 has been included in the 1963-64 budget for landscaping the 2.6-mile portion between Park Boulevard and Buell Street when that portion of the freeway has been completed.

#### U.S. 40 (Interstate 80)

A contract for five miles of median barrier, consisting of both cable chain link and blocked-out metal beam guard rail, between El Cerrito Overhead and San Pablo Dam Road was completed in May of 1962. This contract cost approximately \$89,000. Within the same area, a \$191,500 landscaping project, between 0.3 mile south of the overhead and 0.3 mile south of



Recently completed widening of Jackson Street (State Highway Route 105) in Hayward between the Nimitz Freeway and Mission Boulevard. Southern Pacific Railroad underpass in foreground.

Jefferson Avenue was completed in March of 1962.

A contract to widen the Oakland approaches to the San Francisco-Oakland Bay Bridge is expected to be completed in the near future. Improvements to the toll gates on the north side of the plaza are included in this \$380,000 project.

#### Nimitz Freeway

Two projects were completed on Nimitz Freeway, (State Sign Route 17) in the fall of 1962. Cable chain link median barrier was installed between Jackson Street (Route 105) and Washington Avenue (Route 288). This contract, which cost approximately \$72,800, was completed in October. A month earlier, Watkin & Sibbald completed an irrigation system and landscaping on 2.3 miles of free-

way between 0.7 mile south of Central Avenue in Fremont and 1.1 miles north of Thornton Avenue in Newark. The cost was \$87,200.

Currently under construction is the 5.6-mile widening contract between Fallon Street and Hegenberger Road in Oakland which, when complete, will provide 8 lanes on Nimitz Freeway between El Cerrito Overhead and Hegenberger Road. The work includes widening the High Street, Fruitvale and 5th Avenue Overheads and modification of interchange ramps at Hegenberger Road, High Street, 29th Avenue and 23d Avenue. The former left hand offramp at 42d Avenue is being replaced with a right side takeoff. Work on this \$4,441,000 contract is being performed as a joint venture by Dan Caputo, Dan Caputo Company and Cambrian Gateway.

Blocked-out metal beam guard rail is being erected as a median barrier as a part of the contract.

In San Leandro, a \$512,000 contract is being performed by Richard N. Moseman at Marina Boulevard (First Avenue) Interchange. Two diagonal ramps are being constructed and the existing two-lane overcrossing is being widened to four lanes. This work is expected to be completed this summer.

#### Warren Freeway (Route 227)

Construction is currently in progress on a \$1,292,000 contract to construct an interchange at Moraga Avenue, which will replace the last signalized interchange on Warren Freeway north of Redwood Road. The contractor on this project is Dan Caputo Company. Funds in the amount of \$45,000 are included in the 1963-64

budget for landscaping this interchange.

The rough grading for the Warren Freeway between Carson Street and the MacArthur Freeway near Calaveras Street is included in the latter freeway contract currently underway between Buell Street and Durant Avenue.

#### Sign Route 24

Funds in the amount of \$3,750,000 have been included in the 1963-64 fiscal year budget for construction of portions of this route between Lake Temescal and the Caldecott Tunnel. This work will complete a sizeable portion of the grading for the future eight-lane freeway through the rugged canyons of the Berkeley Hills. Included in the project is a partial interchange approximately one-half mile east of Lake Temescal and a signalized intersection on Tunnel Road

(Route 206), one-half mile north of Temescal. Easterly of this project, the current contract for the additional bore at the Caldecott Tunnel is underway. (See *Contra Costa County*).

#### Grove-Shafter Freeway

The 1963-64 budget includes funds in the amount of \$6,235,000 to construct the interchange connectors between the MacArthur and Grove-Shafter Freeways. Design studies on this project and for the remaining portions of the route between the MacArthur Freeway and east of Lake Temescal are underway but final preparation of plans will be delayed pending the determination of engineering and right-of-way requirements for rapid transit facilities adjacent to the freeway.

#### Webster Street Tube

The first step to relieve traffic congestion between the island City of Alameda and Oakland across the Oakland estuary was completed on February 13, 1963 with the opening of the new Webster Street Tube described in the March-April issue of *California Highways and Public Works*.

This \$17,000,000 facility required approximately 3½ years to construct and, including approaches, is 5,923 feet long. It was constructed by sinking precast tunnel segments in a dredged trench, aligning them accurately and connecting them underwater. This is the 12th underwater tube completed by this method, the adjacent Posey Tube having been the first. The contractor on this work was Pomeroy-Bates and Rogers & Gerwick.

For the next few months, the new tube will carry two-way traffic while the Posey Tube undergoes extensive modernization including interior tiling, improved ventilation equipment and fluorescent lighting. Funds in the amount of \$1,100,000 are allotted for these alterations. Upon the return of the Posey Tube to service, 35 years of single-tube operation between Oakland and the City of Alameda will be ended.

In June 1962, a sum of \$149,200 was expended to provide a protective blanket over the existing Posey Tube. The dredging and backfilling on this



Construction progress on Interstate 580 (MacArthur Freeway) viewed easterly from Maple Avenue towards Calaveras Avenue.

contract was performed by Healy Tibbitts Construction.

#### Sign Route 21

Six and one-tenth miles of four-lane (ultimate six-lane) freeway is under construction on Sign Route 21 (Interstate 680) between State Sign Route 9 near Mission San Jose and State Sign Route 84 at Scott's Corner. This contract has required the closing of the Old Mission Pass Road and through traffic is being detoured over Niles Canyon Road. Interchanges and traffic separation structures will be constructed at Mission Boulevard and Vargas, Sheridan, Andrade and Calaveras Roads on this \$6,200,000 project. Major structures will also be constructed over Alameda Creek. This work is being performed as a joint venture by Frederick & Watson Construction Company, Granite Construction Company, and Lew Jones Construction.

The completion of the Benicia-Martinez Bridge on September 15, 1962, and the subsequent opening of approximately eight miles of freeway southerly to Willow Pass Road were major steps in the development of the freeway and expressway system in Contra Costa County during the past year. Continued emphasis has been placed upon the improvement of Interstate 680 (State Sign Route 21) north and south of Walnut Creek and the completion of Sign Route 24 between the metropolitan communities and the rapidly expanding suburban areas east of the Berkeley hills. Two projects on these routes, currently under construction, will provide approximately 30 miles of continuous freeway from Caldecott Tunnel to U.S. 40 north of Vallejo via the Benicia-Martinez Bridge.

#### Sign Route 21

South of Walnut Creek, the largest freeway contract ever let in the Bay area is underway—\$13,750,000 for the construction of 6¾ miles of four-lane freeway on Sign Route 21 (Interstate 680) between Walnut Creek and one mile south of Danville, replacing the present congested two-lane highway.

The 1963-64 fiscal year budget contains funds in the amount of \$7,500,000 for the construction of three miles of six-lane freeway between south of Dublin and 0.7 miles north of the Contra Costa County line. This project will include a major interchange between Interstate Routes 580 and 680.

#### State Route 105

The contract for the widening of 1.7 miles of Jackson Street between Harder Road and Mission Boulevard in Hayward was completed on March 11, 1963. This \$2,143,000 project included overheads at the Southern and Western Pacific railroads. Jackson Street was widened to a four-lane divided arterial with parking lanes. This work was done by Gallagher and Burke.

The City of Hayward contributed \$74,400 and the Southern Pacific railroad \$73,400 to assist in the financing.

#### Other Projects

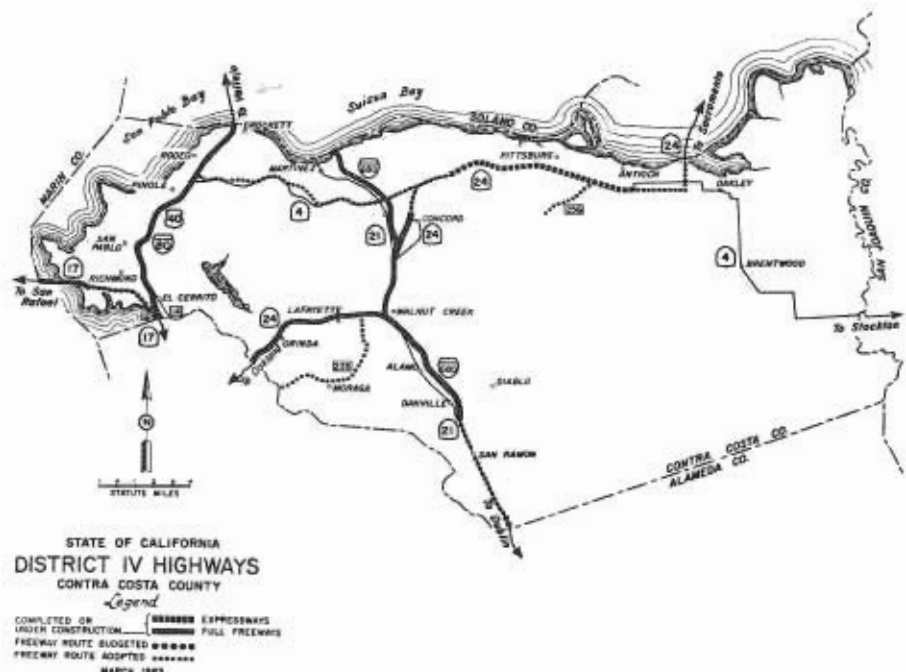
Many other projects were completed on State Sign Routes 9 and 84 in Alameda County during the past year. These included a \$71,500 contract for realigning curves and eliminating humps on seven-tenths miles of Vallejos Road (State Sign Route 84) between Alden Lane and El Caminito near Livermore. This project was completed in July of 1962 by Oliver de Silva Inc.

The remainder consisted of the installation of traffic signals and channelizations as well as resurfacing on the Dumbarton Bridge. \$13,400 of San Francisco-Oakland Bay Bridge funds were used for the latter contract. Traffic signals were also installed at five locations along Mission Boulevard (Route 105) in Hayward during the past year.

## CONTRA COSTA COUNTY

This project includes almost 6,000,000 cubic yards of excavation, the majority of which will be used to construct embankment within the contract limits. An excess of 400,000 yards is being used for bridge approaches and embankment on a contract currently underway on Sign Routes 21 and 24 in the vicinity of Concord.

A total of 13 major structures are to be completed, including four separate bridges over San Ramon Creek and an overhead over the Southern Pacific railroad, plus seven interchanges. Contra Costa County will contribute approximately \$343,000 towards the cost of county road construction and local drainage improve-



ments which include realigning 12,000 feet of San Ramon Creek in seven locations. Guy F. Atkinson is the contractor on the project.

In the vicinity of Concord, a portion of Sign Route 21 is included in the construction currently in progress on State Sign Route 24 between 0.2 mile south of Monument Boulevard and 0.1 mile south of Olivera Road. Gordon H. Ball, Gordon H. Ball Inc., and Price & Harris Construction Company are the contractors on this \$5,480,000 joint venture. This project will close the gap on Interstate 680 between Monument Boulevard and Willow Pass Road.

Interchanges are being constructed at Monument Boulevard on the combined routes and at Concord Avenue, Grant Street and Willow Pass Road on Route 24. Five undercrossings as well as structures over Walnut and

Pine Creeks and an overhead over the Southern Pacific railroad near Concord Avenue will be constructed. A "Y" interchange will be constructed at the intersection of the two routes.

#### Completed Projects

North of the above project, work was completed on January 8, 1963, on a portion of Interstate 680 between Willow Pass Road and State Sign Route 4 (Arnold Industrial Highway). Four interchanges were constructed on this \$3,984,000 contract. This project provides 2.3 miles of freeway on State Sign Route 21 and approximately 1.2 miles of freeway on Highway 4. In addition to those at the interchanges, structures were built on both routes across Grayson Creek and at Center Street. The contract was performed as a joint venture by

Gordon H. Ball and Gordon H. Ball Inc.

Between Arnold Industrial Highway (Sign Route 4) and the Benicia-Martinez Bridge, 3.9 miles of initial four-lane, future six-lane freeway was completed by Peter Kewitt Sons Company in September of 1962. This \$5,131,000 contract was financed from toll bridge revenue bonds. Overcrossing structures were completed at Blum Road and East Martinez interchange. An underpass was constructed at the Santa Fe railroad in East Martinez and an overhead structure was provided in the Mococo cloverleaf interchange over Escobar Street and the Southern Pacific railroad. An interchange was built at Arthur Road at the approach to the bridge.

#### Benicia-Martinez Bridge

Two separate contracts, one for substructure and another for superstructure construction, were required to complete this 4,500-foot-long high-level bridge. Revenue bond funds in the amount of \$14,238,000 were allocated to these contracts, which were both performed by Yuba Consolidated Industries, Inc.

The new bridge, about 200 feet downstream from the Southern Pacific railroad drawbridge across Carquinez Straits, was started in August of 1959. It provides an initial four-lane, future divided six-lane facility and toll collecting facilities are located on the Benicia side of the Straits. Upon the opening of the bridge to traffic, the last automobile ferry boat in the Bay area was retired from service.

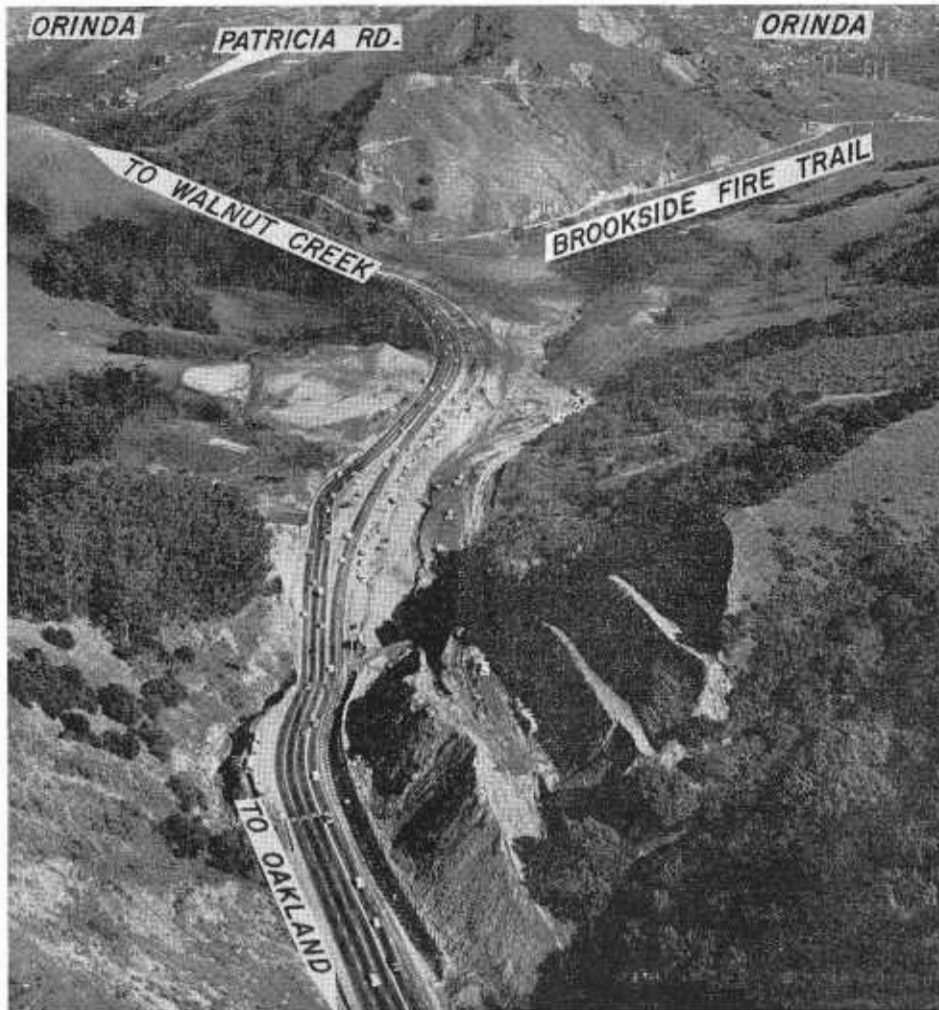
(An article in the Sept.-Oct. 1962 issue of *California Highways and Public Works* describes the opening of the bridge to traffic on September 15, 1962.

#### Sign Route 24

A 0.7-mile contract for the construction of an additional two-lane bore, paralleling the two existing bores of the Caldecott Tunnel, is being constructed as a joint venture by Connelly Pacific Company, Grafe-Callahan Construction, Brayer Electric Company and Charles Harney Inc.



Looking southerly from vicinity of Arthur Road to recently completed section of Interstate 680 between Willow Pass Road and Benicia-Martinez Toll Bridge.



Benching operations for the future eight-lane freeway on State Sign Route 24 in the rugged Berkeley Hills east of the Caldecott Tunnel.

This \$10,897,000 project will provide a 28-foot roadway and 4-foot sidewalk within the 3,371-foot tunnel. When completed, the new bore will carry westbound traffic and the southerly existing tunnel will carry

eastbound traffic with the center bore being used to provide an additional two lanes one-way in the direction of peak hour flow.

From the east end of the tunnel toward Orinda, work is in progress on

## MARIN COUNTY

### U.S. 101 (Redwood Highway)

North of Hamilton Field, construction has begun on the interchange between State Sign Route 37 and U.S. 101. When completed, this interchange will eliminate the major point of traffic backup for commute traffic and summer Sunday traffic returning from Sacramento, the Russian River area and Lake County resorts. Funds in the amount of \$4,278,000 have been allotted for this project which includes the construction of the Ignacio Overcrossing, the South Novato Overcross-

ing and multiple overheads over the Northwestern Pacific railroad tracks. Peter Kiewit and Sons is the contractor on this work.

Immediately south of this project, work is underway on the construction of 2.7 miles of six-lane freeway between Miller Creek Road and Entrada Drive. \$4,241,000 was allotted for this project which includes climbing lanes in both directions over St. Vincent's Hill north of Miller Creek Road. In addition, a bridge is to be widened and two interchanges are to

the construction of approximately two miles of eight-lane freeway. Approximately 1,800,000 cubic yards of roadway excavation is being removed from sidehill cuts which are several hundred feet high on this \$6,974,000 project. Another feature of this work is the installation of an extensive drainage system to carry the runoff from the entire watershed at the end of the tunnel to Orinda, a distance of two miles.

Interchanges will be constructed at East Portal and at Gateway Boulevard (formerly Sanborn Road). The project includes the installation of median barrier. Frederick & Watson Construction Company and Granite Construction Company are the contractors on this joint venture.

Bids were opened on May 1, 1963, for the construction of bus-loading facilities and sidewalks at Orinda, Acalanes Road and Pleasant Hills Road interchanges.

North of Walnut Creek, Sign Route 24 is being extended as a full freeway between Monument Boulevard and Olvera Road.

### Other Routes

A contract for approximately five miles of median barrier, consisting of both cable chain link and blocked-out metal beam guard rail, between El Cerrito Overhead and San Pablo Dam Road on U.S. 40 (Interstate 80) was completed in May of 1962 at a cost of \$89,000. Funds are budgeted for a \$420,000 project for the construction of the Barrett Avenue offramp in Richmond on this same route.

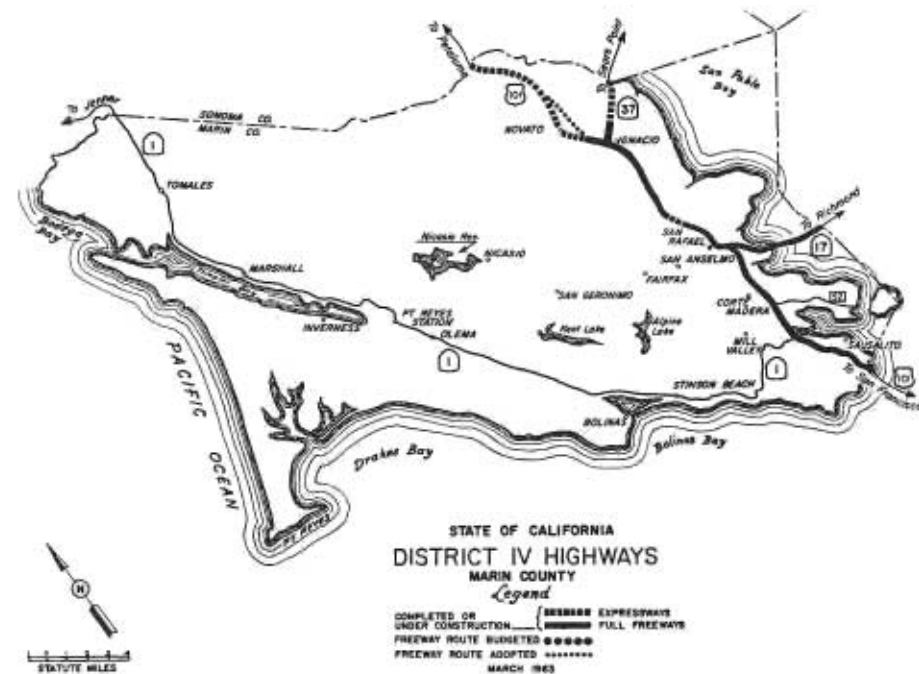
be constructed. Traffic to and from Hamilton Air Force Base will be served by a frontage road between the two interchanges. Syar & Harms and Gordon H. Ball, Gordon H. Ball Inc. are the contractors on this joint venture.

The completion of these two projects will eliminate the last remaining signals on U.S. 101 between the Golden Gate Bridge and Diablo Avenue in Novato.

Funds in the amount of \$300,000 have been budgeted for a project to restripe to four lanes and resurface uphill portions of U.S. 101 between the Golden Gate Bridge and Waldo Undercrossing. A sum of \$100,000 has been included in the 1963-64 fiscal year budget for landscaping Freitas Parkway Interchange (Terra Linda) north of San Rafael.

#### Completed Projects

In August of 1962, a contract to modify the Golden Gate Bridge approaches to meet structure widening being done by the bridge district was completed by Ghilotte Bros. \$225,000 was expended for constructing lane



transitions, installation of blocked-out metal beam median barrier between the bridge and the Waldo Tunnel, adding a northbound lane from the Vista Point to the Sausalito Road Un-

dercrossing and an improved Sausalito Road channelization.

At the Vista Point at the north end of the bridge, \$162,000 was expended on a project which included grading and surfacing of access roads and parking areas, the construction of walkways and planter boxes and landscaping. A combination rubble masonry and redwood guard railing was constructed on the perimeter of the sidewalk around the parking area. This contract was done by Watkin and Sibbald.

In the vicinity of San Rafael, \$116,000 was expended on the reconstruction of the Auburn Street Railroad Underpass in the San Quentin Wye area. This contract included rearranging a portion of the interchange frontage roads and the extension of Woodland Avenue under co-operative financing with the County of Marin. North of San Rafael, an additional northbound lane was added between Lincoln Avenue Undercrossing and San Pedro Road, at a cost of \$36,000. Blocked-out metal beam median barrier was recently installed from the San Rafael Viaduct northerly to Willow Avenue, almost two miles, costing \$106,000.



Looking southerly to the recently completed Vista Point and reconstruction at the north end of the Golden Gate Bridge. The City of San Francisco in the background.

A contract to landscape portions of the Redwood Highway between the Waldo Undercrossing and Miller Creek Road north of San Rafael was completed on March 6, 1963.

#### Additional Routes

Work is currently in progress for the construction of a four-lane di-

vided conventional highway between Alto Interchange and east of Strawberry Drive on Legislative Route 52. Included in this \$618,000 project is the installation of traffic signals.

Two separate contracts were completed on State Sign Route 1 between Stinson Beach and Bolinas. The first,

completed in July, 1962, cost \$137,692 for resurfacing and installing drainage facilities. In December, a \$90,700 contract for realigning portions of the route was completed. The latter contract also included drainage installations and slope protection. Brown Ely Company was the contractor on the above three projects.

Generally, major highway development in recent years within Napa County has been confined to initial stage construction of two- and four-lane expressways on adopted freeway routes in the vicinity of Napa. This steady improvement to modern highway standards is being continued by construction presently in progress on State Sign Route 29. In addition, contracts were completed during the past year for the improvement of conventional highways on State Routes 37 and 128.

#### Freeway Construction

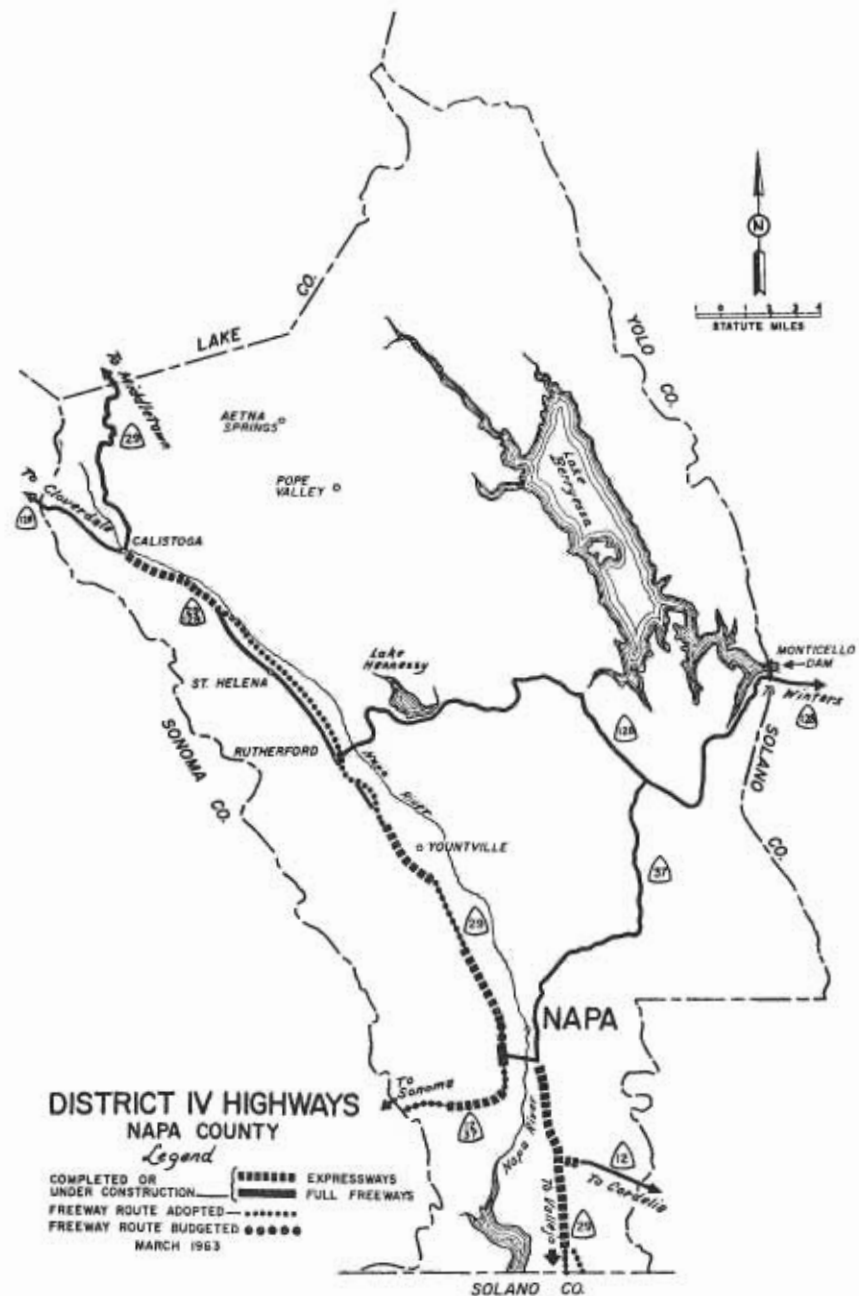
A contract was recently awarded to Lee J. Immel for the construction of a 2.2-mile section of Sign Route 29 between Old Sonoma Road and Redwood Road (Trancas Street). This project includes construction of a four-lane freeway from Old Sonoma Road to Napa Creek and resurfacing of the existing pavement between Napa Creek and Redwood Road.

Approximately 860 trees are being planted on a landscaping project on the recently completed freeway section between Imola Avenue and Old Sonoma Road.

#### Other Work

South of Napa, a contract to resurface 2.6 miles of the southbound lanes between Imola Avenue and Kelley Road was completed in June of 1962. Approximately \$104,000 was expended for this work. Northwest of Napa, a \$626,500 contract is in progress for the widening of the roadway between south of Yountville Road and Oakville. As a part of this contract, frontage roads and drainage improvements are being constructed between Dry Creek and California Drive. This work by Lee J. Immel is expected to be completed this summer.

## NAPA COUNTY





The first unit of the Napa Freeway was completed recently. Another project is about to be awarded to extend this freeway another mile north, toward Calistoga.

Three contracts are currently underway for the completion of the Southern Freeway within the City and County of San Francisco. In addition, funds have been budgeted for the first unit of the Junipero Serra Freeway (Interstate 280) in Daly City which will include a connection to the Southern Freeway in the vicinity of Orizaba Avenue. Work has also been started on the first unit of the Southern-Embarcadero Extension Freeway and funds are budgeted for an additional section.

#### Southern Freeway

The first usable project on the Southern Freeway, between Milton Street and the interchange with the James Lick (Bayshore) Freeway is expected to be opened to traffic late this year. The \$4,273,000 project is being constructed by Charles L. Harney, Inc., as are the other two units currently under construction. When completed it will provide 4.7 miles of six-lane (ultimate eight-lane) freeway. Two major overcrossing structures

## SAN FRANCISCO COUNTY

serving local traffic to and from Alemany Boulevard are included, as well as overcrossings for Mission Street, Justin Drive and a pedestrian bridge near Gladstone Drive.

The second contract consists of grading and paving for a six-lane freeway, constructing 13 traffic separations, pedestrian crossings and interchange structures and 9 retaining walls. Overcrossings are being constructed at Paulding Street and Baden Street and pedestrian overcrossings will be provided at Theresa Street and Lamartine Street. The remaining nine structures will be overcrossings and undercrossings in the vicinity of San Jose Avenue, to furnish traffic service to San Jose Avenue, Monterey Boulevard, Bosworth Street and Lyell Street. A sum of \$6,080,000 has been allotted for this contract.

The above project will not be usable for traffic until the third unit between Ocean Avenue and Orizaba Avenue has been completed, in the summer of 1964. Interchange facilities will be

A third contract for the improvement of Sign Route 29 over Mt. St. Helena was completed in July of 1962. This \$56,000 project provided three truck turnouts between Calistoga and the Lake county line.

#### Other Improvements

Present programming proposes the utilization of \$50,000 every other year for reconstruction of portions of State Sign Route 128 between Pope Valley Road and the Monticello Dam Road relocation. The third segment of such reconstruction was completed in December of last year.

East of Napa, the contract for the construction of a 26-foot all-paved section at several locations on existing State Sign Route 37 between Wooden Valley Road and Sign Route 128 was completed on January 31, 1963. This work cost approximately \$152,800 and was constructed by Reichhold & Jurkovich. In order to avoid an area in which repeated slip-outs have occurred, 0.2 mile of Sign Route 37 was realigned approximately 21 miles northeast of Napa, at a cost of approximately \$38,000.

constructed at Ocean Avenue and ramps will be provided for traffic to and from San Jose Avenue in the vicinity of Plymouth Avenue on this \$4,581,000 project. Major structures include overcrossings for San Jose Avenue in the vicinity of Broad Street and Mount Vernon, Geneva and Ocean Avenues. Overcrossing structures will be constructed for the freeway and ramps at San Jose Avenue and Sickles Avenue, and pedestrian overcrossings are being provided at Whipple Avenue and Havelock Street.

Also included in the work is construction of bus stop facilities at Ocean Avenue to permit passengers from express buses on the freeway to transfer to local buses on Geneva and Ocean Avenues.

As each construction phase on the Southern Freeway is completed, it is planned to landscape that project. Funds in the amount of \$110,000 have been included in the 1963-64 budget for one of these projects to landscape



the first section between Alemany Interchange and Milton Street.

Funds in the amount of \$10,000,000 have been included in the 1963-64 budget for a project which combines the completion of the Southern Freeway with the beginning of the Junipero Serra Freeway (Interstate 280) in San Mateo County. (For a discussion of this project, see San Mateo County.)

#### Embarcadero Extension

Construction is currently underway on the construction of the double-deck viaduct between James Lick Memorial Freeway and Newcomb Avenue. This project is being constructed by Peter Kiewit Sons Co. and costs approximately \$3,613,000.

It will not be usable until the second unit, from Newcomb Avenue to Army Street, is constructed. Funds in the amount of \$5,580,000 have been budgeted for this work and it should be advertised this summer. The ramp connections which will be provided from Evans Avenue to Army Street, as a part of this latter unit, are an integral part of the future Islais Creek Interchange. The second unit will provide a transition from the double-deck viaduct to a single-deck viaduct.

The remainder of the route has been adopted by the California Highway Commission and when complete, this freeway will provide much needed relief to the Bayshore Freeway northerly of its interchange with the Southern Freeway.

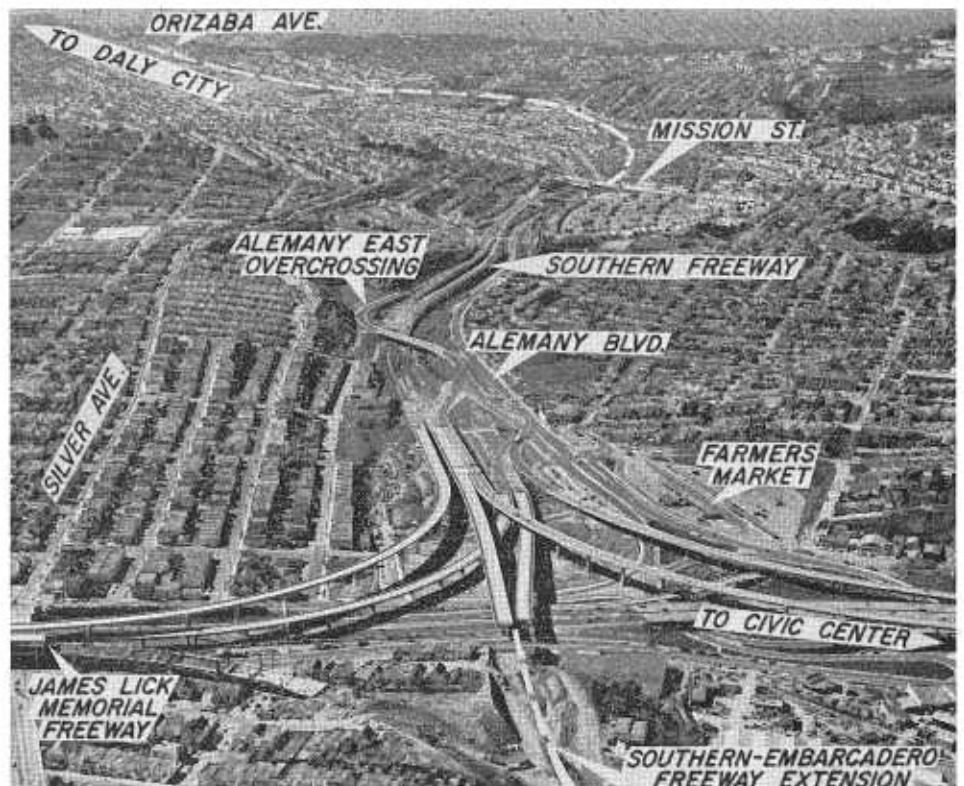
#### Embarcadero Freeway

In February, J. C. Johnson was awarded a \$50,000 landscaping contract for a project between First and Steuart Streets. Approximately 137 trees, mostly eucalyptus, and over 8,000 shrubs are to be planted on this job.

A project for the construction of the Clay-Washington Street ramps to the Embarcadero Freeway is tentatively scheduled for this fall. \$1,350,000 has been included in the budget for this work which will provide direct access to the Golden Gate redevelopment area. Advertising is dependent on removal of the remainder

**PHOTO RIGHT.** Construction work on the Southern Freeway and the Southern-Embarcadero Freeway extension viewed westerly from vicinity of Alemany Boulevard. Four separate contracts are in progress.

### STATE OF CALIFORNIA DISTRICT IV HIGHWAYS SAN FRANCISCO COUNTY



of the Wholesale Produce Market to the new Islais Creek site.

#### U.S. 101 Improvements

A sum of \$357,000 was expended for the resurfacing of Bayshore Freeway between 0.3 mile north of Butler Road in South San Francisco and 0.2 mile south of Third Street in San Francisco. This work was completed in November of 1962 by Pacific Pavement Company Ltd. The high volume of traffic on this route necessitated night paving and the detouring of al-

ternate directions of traffic to old Bayshore Highway between the hours of 8 p.m. and 6 a.m.

In July of 1962, a contract for the modification of Army Street northbound offramp and the installation of sign lighting was completed at a cost of \$29,000. Additional work on this facility included the installation of chain link mesh covering and railing fences on overcrossings at five locations between Silver Avenue and 18th Street.

Funds in the amount of \$5,100,000 have been budgeted for the construction of additional lanes and a median on the Golden Gate Bridge approach between Lyon Street and State Sign Route 1. This project includes the revision of the interchange at Sign Route 1. Within these limits, a contract was completed in November of 1962 for cleaning and painting the Presidio Viaduct between Marina Viaduct and the approach to the Golden Gate Bridge. This work cost approximately \$178,000.

The first steps toward meeting the growing need for high-standard north-south arteries through the central, hilly portion and along the ocean coast were taken this year with the budgeting of funds for freeway projects on Junipero Serra and the Cabrillo Highway. In addition, major improvements are currently in progress on El Camino Real, as well as on the east-west connection in the City of San Mateo, the 19th Avenue Freeway.

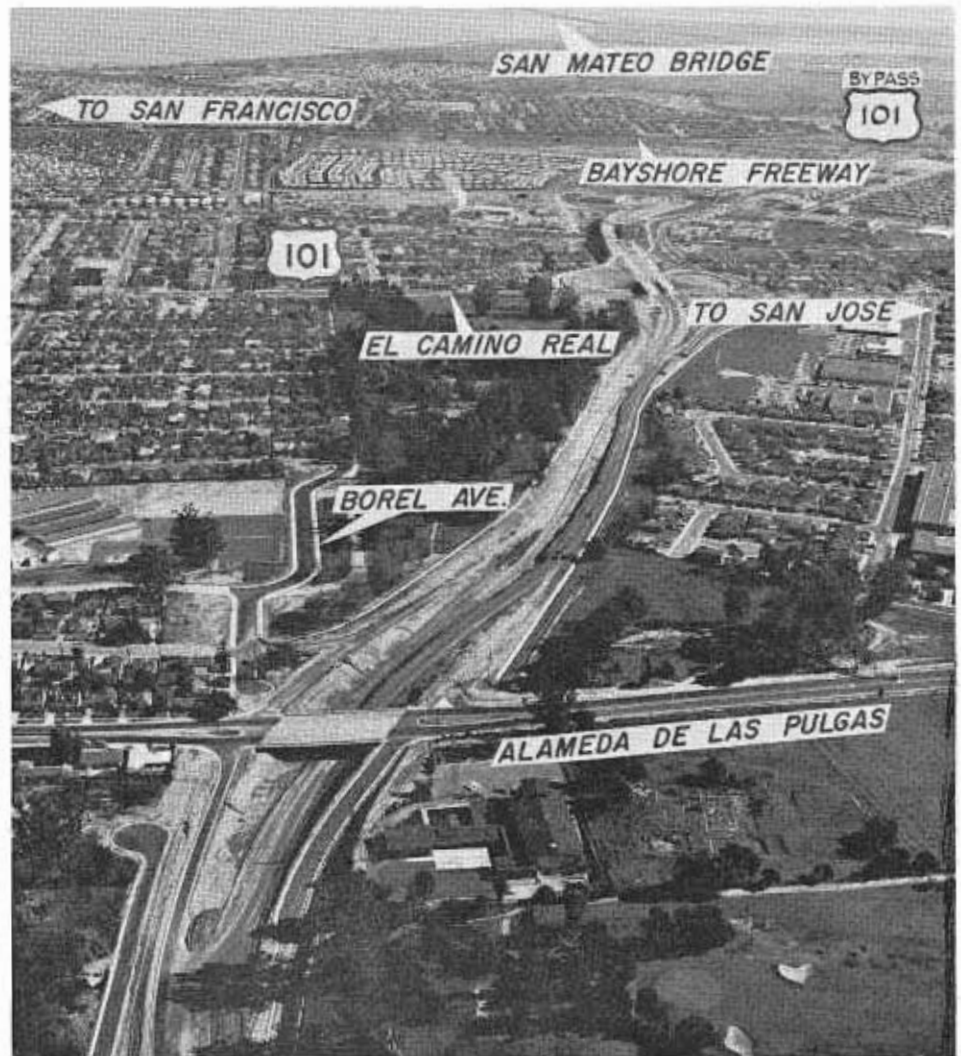
#### 19th Avenue Freeway

A \$4,652,000 project is currently in progress as the first unit of this freeway which will eventually extend from Half Moon Bay to Hayward via the San Mateo-Hayward Bridge. Extending 2.6 miles between West Hillsdale Boulevard and South Delaware Street, this unit will provide access to the new campus of the College of San Mateo.

Four lanes are under construction between West Hillsdale Boulevard and El Camino Real while easterly of El Camino a six-lane freeway is being built. Traffic separation structures and interchanges are being built at Alameda de las Pulgas, El Camino Real (U.S. 101) and South Delaware Street. This contract also includes an overhead crossing of the Southern Pacific railroad near Pacific Boulevard and an undercrossing at Palm Avenue. L. C. Smith and Concar Ranch and Enterprises are the contractors on this joint venture.

A sum of \$225,000 has been included in the 1963-64 budget for land-

## SAN MATEO COUNTY



Construction progress on the 19th Avenue Freeway in San Mateo viewed easterly from Alameda de las Pulgas.

scaping the above work when it is completed late this summer. In December the California Highway Commission adopted a portion of this

route westerly of the Junipero Serra Freeway between the latter facility and State Sign Route 5 on Cahill Ridge near Mountain House.

### Cabrillo Highway

Along the Pacific Coast, work will shortly be underway for the improvement of two and one-half miles of the existing highway (Sign Route 1) to freeway standards. Bids were opened on May 8, 1963, for the construction of a four-lane facility between Monterey Road and Westport Drive in Pacifica. A sum of \$4,055,000 has been allotted for this project which includes frontage roads through the Edgemar and Sharp Park areas and nearly a mile of reconstruction of the existing alignment from Westport Drive southerly.

Two pedestrian crossings, four traffic separation structures are included, and a full interchange at Sharp Park Road.

North of the above project, funds in the amount of \$270,000 have been budgeted for the initial construction of the Gateway Drive Undercrossing, approaches and ramps. Bids were opened on May 15, 1963, for this work. Within the same area, a contract was recently completed for the installation of 0.7 mile of blocked-out metal beam median barrier north of Monterey Boulevard. This contract by Wulfert Co. cost approximately \$37,800.

In the vicinity of Half Moon Bay, drainage improvements were constructed at Virginia Avenue (Moss Beach) during the past year and \$592,000 was expended to construct a new bridge across Tunitas Creek and improve the roadway approaches. Dan Caputo Company was the contractor on the latter project.

### Junipero Serra Freeway

Bids will shortly be advertised for a 3.9-mile project between Palmetto Drive in San Francisco and one-half mile south of Eastmoor Avenue in Daly City on the Junipero Serra Freeway (Interstate 280). Approximately \$10,000,000 has been included in the 1963-64 fiscal year budget for construction of this work. The first unit of this important interstate facility (Route 280) to be constructed in San Mateo County, the project includes rough grading, drainage and frontage road construction for the future State Sign Route 1 connection to Skyline Boulevard and Pacifica. The work

will also include the completion of the Southern Freeway in San Francisco between Orizaba Avenue and the Junipero Serra Freeway.

This project includes an interchange between the two freeways in the vicinity of Alemany Boulevard and the Knowles Avenue-Alemany Boulevard Overcrossing. Four other traffic separations will be provided, and two overcrossings to carry frontage road traffic over the freeway.

Also included in the 1963-64 program is a sum of \$500,000 for the construction of a bridge for the Junipero Serra Freeway over the Stanford University two-mile linear accelerator.

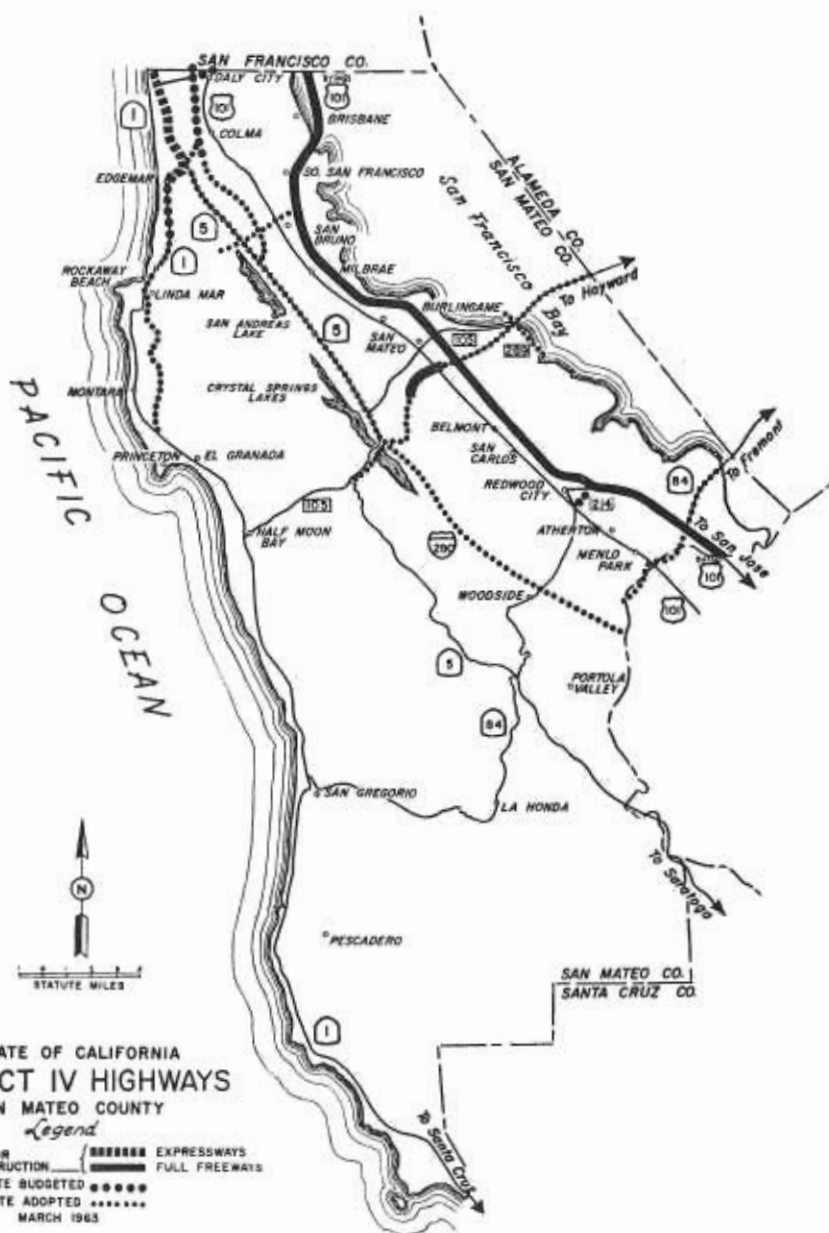
Although this portion will not be a usable unit, construction at this time is required to maintain close co-ordination with the work in progress on various projects of the university.

### El Camino Real (U.S. 101)

Work was started in January of this year on a 1.7 mile widening project on El Camino Real between Millwood Drive in Millbrae and Euclid Avenue in San Bruno. Lowrie Paving Company is the contractor on this project which will widen existing El Camino Real to a six-lane divided, conventional highway with parking aprons and sidewalks.

### STATE OF CALIFORNIA DISTRICT IV HIGHWAYS SAN MATEO COUNTY

Legend  
 COMPLETED OR UNDER CONSTRUCTION ——— EXPRESSWAYS  
 FREEWAY ROUTE SUGGESTED ——— FULL FREEWAYS  
 FREEWAY ROUTE ADOPTED .....  
 MARCH 1963



Funds in the amount of \$821,000 are allotted for this work, including \$160,000 from the City of San Bruno and \$26,400 from Millbrae for the parking aprons, sidewalks and street lighting.

**Bayshore Freeway**

Bids were opened on March 12, 1963, for a landscaping project at the South Airport Boulevard connection to Bayshore Freeway (US 101 Bypass). Funds in the amount of \$850,000 have been included in the 1963-64 budget for leveling and resurfacing portions of Bayshore Freeway between Fifth Avenue in San Mateo and Whipple Avenue in Redwood City.

A contract for \$280,000 for placing cable chain link and blocked-out metal beam median barrier between Sierra Point Overhead near South San Francisco and Redwood Creek Bridge in Redwood City was completed in July of 1962. This work completed the median barrier installation on Bayshore Freeway between Redwood City and the San Francisco-Oakland Bay Bridge. Sign structures and sign lighting systems were also installed on the 17.4 mile project.

In November a \$357,000 project was completed for resurfacing existing Bayshore Freeway between 0.3 mile north of Butler Road in South San Francisco and 0.2 mile south of Third Street in San Francisco (See San Francisco County).

Approximately 250 eucalyptus and flowering plum trees were planted on a landscaping project between 0.1 mile north of Spruce Avenue in Redwood City and 0.1 mile north of University Avenue in Palo Alto, a distance of 4.3 miles. Rudolph Watson was the contractor on this \$84,000 project, which also included planting shrubs and iceplant cuttings for ground cover.

**Other Routes**

On January 23, 1963, the California Highway Commission adopted the route for the future Route 229 freeway between Sweeney Ridge, west of Skyline Boulevard, and Bayshore Freeway, an important east-west connection in the City of San Bruno.

Funds in the amount of \$1,250,000 have been budgeted for the construc-

tion of 1.3 miles of four-lane expressway on Legislative Route 214 in Redwood City between Cypress Avenue, south of El Camino Real, and Bayshore Freeway. This project will include a railroad separation across the main lines of the Southern Pacific Railroad and a full interchange at El Camino Real. Access will be controlled between Middlefield Road and Broadway. The City of Redwood City is contributing approximately \$1,000,000 additional for this work.

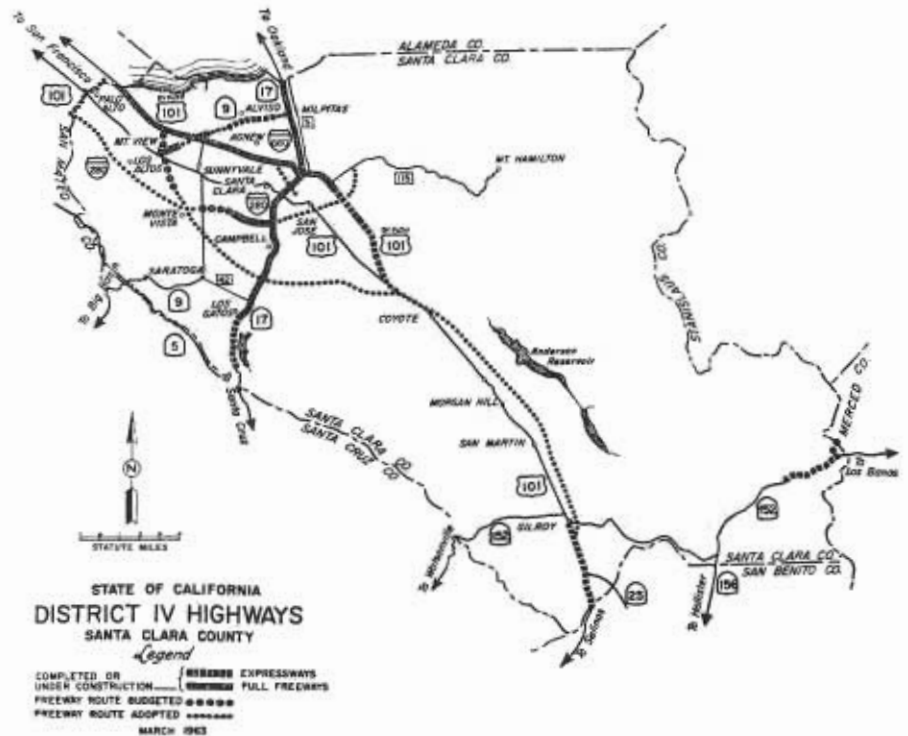
Work was completed in August of 1962 on the Division of Highways portion of the development of Thornton Beach State Park by the Division of Beaches and Parks. A total of \$119,000 was expended for this improvement, the highway allotment being \$25,000. The highway project consisted of constructing a two-lane access road, parking areas and a water and sewer system for this newly established metropolitan recreational area for picnicking, fishing, hiking and beach sport. The access road utilizes a large portion of relinquished State Sign Route 1.

With the completion of Bayshore Freeway in 1962 to full freeway standards between San Francisco and San Jose, the emphasis on highway development in rapidly growing Santa Clara County has turned to construction of the Junipero Serra and Stevens Creek Freeways. Two separate contracts are underway on the former and projects on each have been included in the 1963-64 budget. Other contracts were completed, are under construction or are budgeted on U.S. 101, State Sign Route 9, El Camino Real and Highway Route 113.

**Junipero Serra Freeway**

Work is expected to be completed by the end of this year on the first unit of Interstate 280. This project is 4.3 miles in length, extending from Forest Avenue to Doyle Avenue at Stevens Creek Boulevard in San Jose. Funds in the amount of \$4,754,000 are

**SANTA CLARA COUNTY**



allotted for this work which is being done by Gibbons & Reed Co. and Dan Caputo Co. The work includes the addition of lanes on the inside of State Sign Route 17 between Moorpark Avenue and Forest Avenue.

The existing Stevens Creek Boulevard Interchange is being modified to accommodate collector roads and direct connection ramps to Junipero Serra Freeway. This unit will be usable to Saratoga Avenue, with grading only being done westerly of that point to Stevens Creek Road in the vicinity of Doyle Avenue. Interchanges are being constructed at Santa Clara-Los Gatos Road and at Saratoga Avenue. Two pumping plants and two pedestrian separations are also being built.

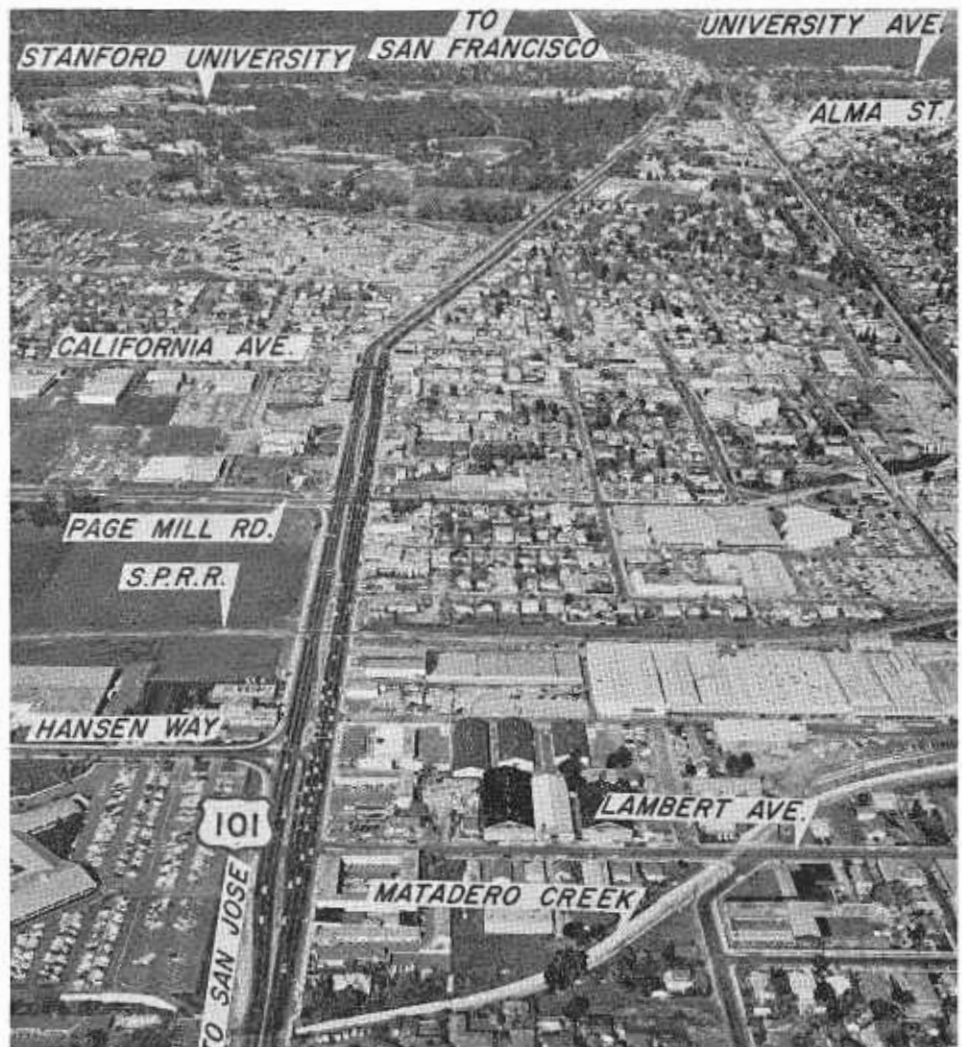
#### Sign Route 17

Also under construction by the same contractor is a 3.4-mile project for widening existing State Sign Route 17 between Bayshore Freeway and Forest Avenue. This work which includes adding one lane in each direction in the median and expansion of the Coleman Avenue Interchange will cost approximately \$1,124,000. Both types of median barrier will be installed as a part of this project.

A sum of \$4,465,000 has been included in the 1963-64 budget for the next unit of Junipero Serra Freeway. This project is a 4.7-mile portion extending westerly from the going contract in San Jose to Stelling Road in Cupertino. The freeway will be elevated in the vicinity of Lawrence Expressway-Stevens Creek Boulevard and depressed from Saratoga-Sunnyvale Road to Stelling Road. Three interchanges will be constructed, and one separation structure. That portion of the project between Saratoga-Sunnyvale Road to Stelling Road will only be graded on this unit.

#### Sign Route 9

Widening of the existing highway between the Southern Pacific Railroad at Azule in Saratoga and El Camino Real in Sunnyvale was recently completed. Funds in the amount of \$695,700 were allotted for this 5.4-mile project which will provide a four-lane arterial with channelizations at five intersections. Rights-of-way for this improvement were provided by the cities and county. The contractor



Recently completed widening on El Camino Real (U.S. 101) between University Avenue and Matadero Creek in Palo Alto.

on this project was Raisch Construction Co.

#### Stevens Creek Freeway

Funds in the amount of \$6,560,000 are included in the 1963-64 budget for construction of the first unit of the Stevens Creek Freeway. This initial four-lane (ultimate six-lane) freeway will generally parallel Stevens Creek and replaces existing Sign Route 9. The limits of this project are between Homestead Road in Cupertino and Bayshore Freeway in Mountain View just south of the Stierlin Road Interchange, 5.5 miles. The project includes seven interchanges, plus structures at three different locations on Stevens Creek and over the Southern Pacific railroad in the vicinity of Evelyn Avenue. Funds have also been budgeted for a co-operative project for the construction of an overcrossing at Mid-

dlefield Road within the limits of the above project.

#### El Camino Real

In Palo Alto, a 2.1 mile project, costing \$1,440,000 was recently completed by McGuire & Hester, between University Avenue and Matadero Creek. El Camino Real was widened from four lanes to a six-lane divided city street, including installation of a lighting system, longitudinal storm drains and landscaping median islands. The Mayfield Avenue pedestrian undercrossing was also extended.

Farther to the south, a contract was completed in September of 1962 by Leo J. Piazza Company to widen and reconstruct 10.9 miles of U.S. 101 between El Toro Avenue in Morgan Hill and Ford Road in San Jose. The project included installation of drain-

age facilities and construction of left turn lanes. \$887,000 was expended on this work.

Funds in the amount of \$200,000 are included in the 1963-64 budget for a 3.6 mile resurfacing project between El Toro Avenue in Morgan Hill and Llagas Creek. This work will include left turn storage lanes at the major intersecting roads.

#### U.S. 101 Bypass

Present development of this important artery contemplates the construction of interchanges at the several important intersecting roads in the next few years. The first of such projects was completed during the past year by Raisch Const. Co. An overcrossing was constructed at Tully Road over U.S. 101 and 1.3 miles of interchange ramps were provided at a cost of \$896,000.

A \$100,000 project has been budgeted for functional and three planting

of 2.2 miles of Bayshore Freeway between Morse Avenue and Agnew Road in the vicinity of San Jose. Bids for this work were opened on May 8, 1962.

#### Landscaping Jobs

In November 1962, a \$61,500 contract was completed for landscaping and the installation of an irrigation system on two miles of Bayshore between University Avenue and Madero Creek in Pal Alto. A similar project, between west of Brokaw Road and Coyote Creek in San Jose, a distance of 2.9 miles, was completed in September 1962. This work cost approximately \$103,000 and included the planting of almost 2,700 trees.

#### Other Routes

Work is underway on the construction of 1½ miles of State Route 113 between El Camino Real near Grant Road and existing Route 113 in the

vicinity of Bernardo Avenue. Funds in the amount of \$1,478,000 are allotted for the construction of this work which includes three structures. The project provides four lanes of a future six-lane freeway to Dana Street and two lanes from Dana Street to Bernardo Avenue.

#### Recent Adoptions

Of considerable importance to the continued growth and development of the metropolitan San Jose area are two recent route adoptions. The portion of the Guadalupe Freeway between Bayshore Freeway and Coleman Street was adopted by the highway commission at its September 1962 meeting; and the following month the route was adopted for new Route 5 through San Jose from Junipero Serra Freeway at Moorpark Avenue to Alum Rock Avenue east of Jackson Street. This latter routing generally proceeds easterly from Junipero Serra through the central San Jose area to Bayshore Freeway and swings northerly to Alum Rock Avenue.

#### Milpitas Hearing

Studies for the remainder of the route between Alum Rock Avenue and existing Route 5 in the vicinity of the Warm Springs area of Fremont have been completed and were presented at a public hearing in Milpitas on March 27, 1963.

Funds in the amount of \$350,000 have been budgeted for 5.9 miles of resurfacing and shoulder reconstruction on State Sign Route 152 (Pacheco Pass Road) between 2.9 miles west to 2.9 miles east of Bell's Station.

Work is presently in progress for grading, resurfacing and channelization for left turn lanes on State Sign Route 17 at Summit Road. In August, a project for landscaping this route between Bascom Avenue and 0.2-mile south of Route 68 (Bayshore Freeway) was completed at a cost of \$176,000.

**High Fashion Seat Belts.** In anyone doubts that seat belts are "in," the following information should set him straight. You can buy the belts in genuine ocelot (\$35), mink (\$50) and chinchilla (\$100) in a New York department store.



Construction in progress on the Sign Route 17-Route 239 interchange in San Jose. From this point, Interstate 280 starts toward San Francisco.

## SANTA CRUZ COUNTY

The second of several projects to convert the existing State Sign Route 1 expressway between Santa Cruz and Rob Roy Junction to full freeway standards is under construction by Granite Construction Company. The first of these contracts, 1.5 miles between Soquel Wharf Road in Capitola and Soquel Avenue, was completed in January of 1962.

On the work presently under way interchanges are being constructed at State Park Drive and Park Avenue. This 2.9-mile project includes the construction of frontage roads and will cost approximately \$1,372,000.

### Watsonville Bypass

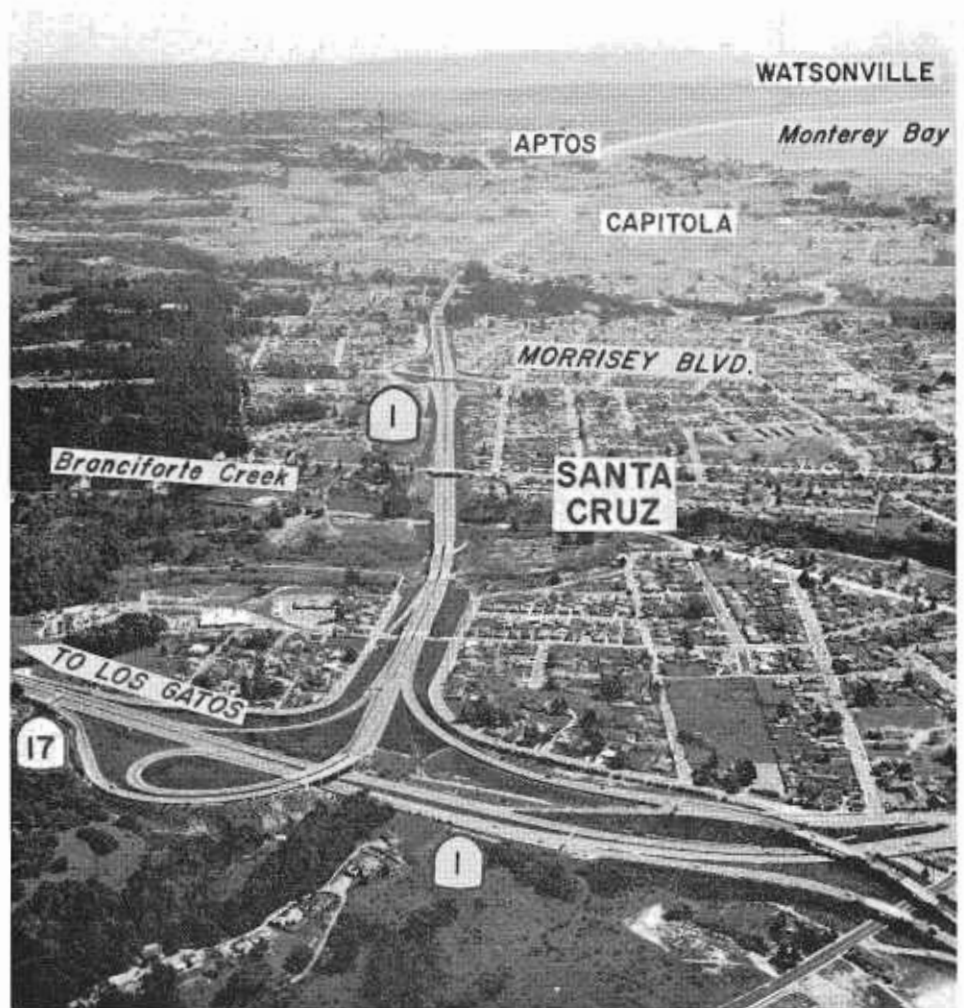
Plans are now complete for a \$2,700,000-project, budgeted 1963-64, for the rough grading and construction of the structures on the "Watsonville Bypass." This project will extend nearly four miles, from 1.2 miles south of the Pajaro River to 1.5 miles northwest of Buena Vista Drive on Cabrillo Highway, bypassing Watsonville to the west.

The initial work includes the placing of an embankment surcharge on the graded area to assist in the stabilization of the embankment through this marshy terrain. The surcharge will remain in place for approximately one year.

The project also includes rough grading on portions of Route 67 from the new alignment on Sign Route 1 to Main Street in Watsonville.

A future contract will remove the surcharge, pave four lanes of the ultimate six-lane freeway and complete the structures between the Monterey county line and 0.2 mile northeast of Roach Road.

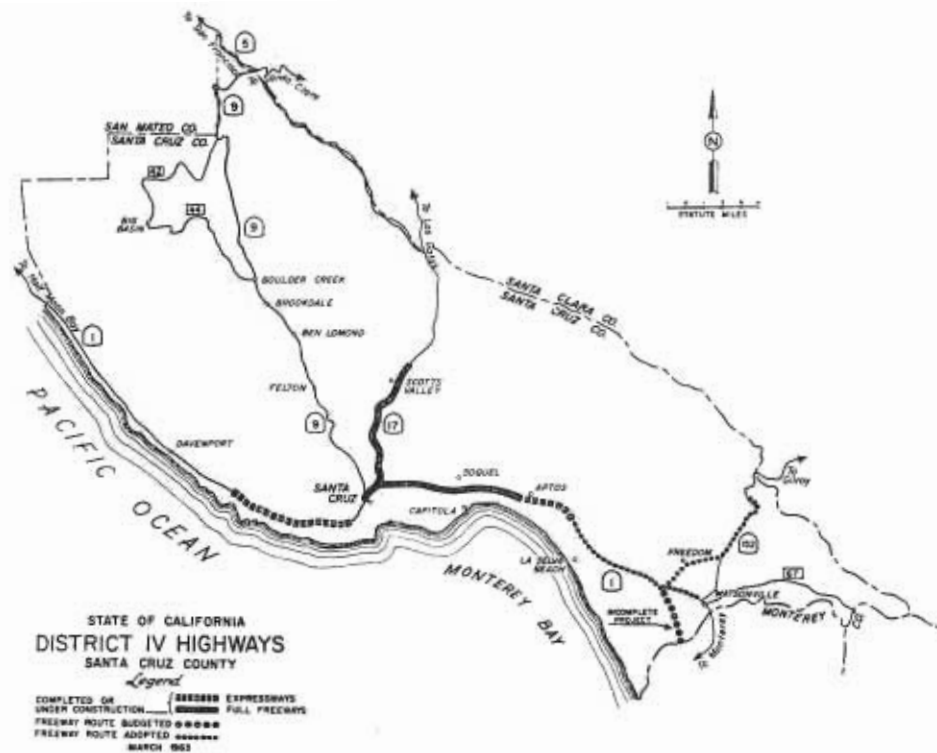
A contract was completed on January 31, 1963, for the modification of signal systems at five major intersections in Watsonville on existing Sign Routes 1 and 152 and Legislative Route 67. This work, performed by Steiny & Mitchell Inc., cost approximately \$24,500. In September of 1962, a \$208,000 project for the installation of drainage facilities and resurfacing of 7.1 miles of portions of the Cabrillo Highway between Main Street in



Santa Cruz and the beach communities of Capitola and Aptos to the east. Step by step, the former expressway east of Morrisey Boulevard is being converted to freeway.



A fine example of landscaping in District IV near the City of Santa Cruz. In the coastal air the iceplant is particularly well adapted.



Watsonville and Rob Roy Junction was completed. Granite Construction Co. was the contractor on this work.

#### Sign Route 17

A contract for functional planting of trees on State Sign Route 17 between new Sign Route 1 and Granite Creek Road is currently in progress. Edgewood Farms and Gardens is the contractor on this \$98,000 project.

A \$59,600 project is currently under way at the intersection of State Sign Routes 5 and 17 at Summit Road. This contract, being performed by Granite Construction Company, includes widening and resurfacing.

L. C. Smith completed a \$477,000 contract on Sign Route 17 in December. This work consisted of the installation of drainage improvements, and placing base and surfacing on 6.4 miles of the existing four-lane facility between the Santa Clara county line and 0.6 mile north of Granite Creek Road.

## SONOMA COUNTY

Freeway projects on U.S. 101 (Redwood Highway) recently completed, under construction or budgeted, to-

gether with the construction presently in progress on State Sign Route 12 in the vicinity of Santa Rosa, will

insure improved and safer travel conditions for the motoring public. Additional work on State Sign Route 12, west of Sebastopol, and State Sign Route 1 will also afford easier access to the recreational areas and scenic beauties of western Sonoma County.

#### U.S. 101 (Redwood Highway)

Two major projects on U.S. 101 were opened to traffic this past winter, completing the Redwood Highway to full freeway standards between the Marin county line and Lytton, northerly of Healdsburg, except for portions south of the Petaluma River and within Santa Rosa. A 9.6-mile contract, which cost approximately \$4,386,000, from the north city limits of Santa Rosa includes six interchanges. This work, performed by Guy F. Atkinson Company, included freeway paving to Windsor and rough grading from there to Grant Creek.

The second contract constructed five miles of freeway between Windsor and Healdsburg including paving of the aforementioned rough grading. Four structures were included. This work was done by Ball and Simpson at a cost of \$3,020,000. Trees were





planted on the completed freeway between the Russian River and Lytton Forestry Station at a cost of approximately \$12,000.

(See "Santa Rosa North," March-April 1963 issue of *California Highways and Public Works*.)

#### Under Construction

North of Healdsburg, a 3.6-mile project generally known as the "Asti Bypass" is being constructed. It will provide four lanes of an ultimate six-lane freeway between 0.8 mile south of Washington School Road and 0.6 mile north of Hiatt Road. Funds in the amount of \$2,297,000 are allotted for this work, which includes two interchanges. McNamara Ltd. is the contractor.

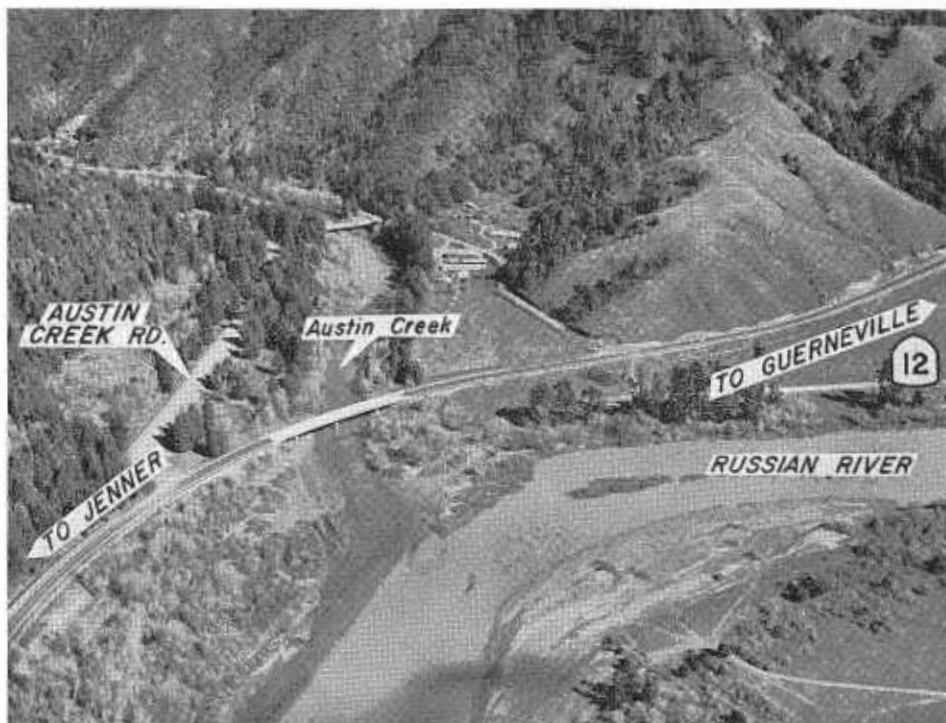
An additional project south of Washington School Road has been budgeted, and should be advertised this summer. It provides \$1,200,000 for construction of freeway between 1.7 miles north of Canyon Road and 0.8 mile south of Washington School Road. The 1.7-mile project includes the Chianti Undercrossing designed to provide separation for a connection between the frontage roads and bypasses the sharp curve known as Zanzi's Corner.

#### Santa Rosa Area

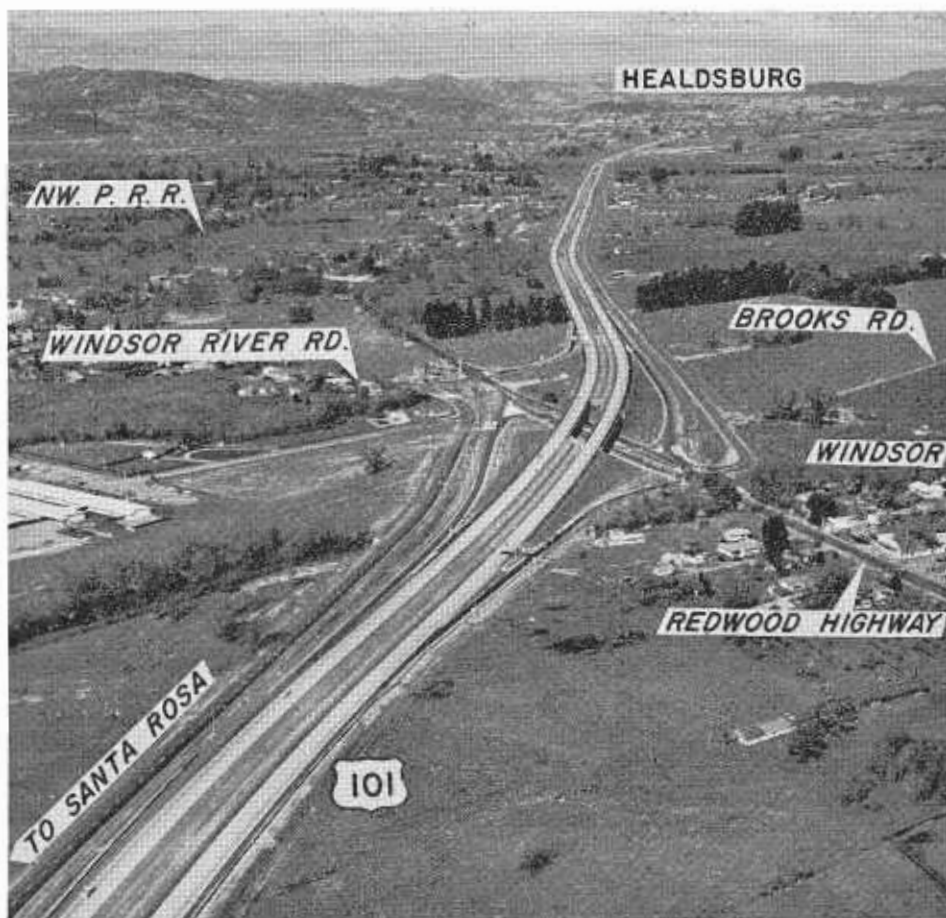
Five and one-half miles of freeway and expressway construction is underway on State Sign Route 12 between Occidental Road, east of Sebastopol, and South E Street in Santa Rosa. This project is being constructed completely on new alignment bypassing the roadside development in the Roseland area west of Santa Rosa.

The most prominent feature is the construction of the first interchange in Santa Rosa, the three-level separation at U.S. 101. Also being constructed across U.S. 101 is the pedestrian overcrossing in the vicinity of Earle Street. Five additional structures are being constructed. This work is being done by Peter Kiewit Sons' Company and is expected to be opened to traffic early in 1964.

A project for widening the existing two-lane facility on State Sign Route 12 between Farmer's Lane and Brush Creek in Santa Rosa was completed in January. The construction of this three-quarter-mile portion



Recently completed realignment of State Sign Route 12 in the vicinity of Duncan Mills. Austin Creek bridge in foreground.



Northeasterly to Healdsburg from Windsor. The Old Redwood Highway crosses under the freeway at Windsor interchange.



Construction progress on State Sign Route 12 in Santa Rosa viewed easterly from Dutton Avenue.

completed almost three miles of widening for this route along the city streets of Santa Rosa, east of U.S. 101. This interim project cost approxi-

mately \$259,000 and included construction of a bridge across Brush Creek. Necessary rights-of-way, in addition to \$20,000 for construction,

were furnished by the City of Santa Rosa.

Work was also completed on another interim project on this route in the vicinity of Kenwood. This work involved the reconstruction of three curves west of that locality. O. C. Jones & Company was the contractor on this \$24,300 project.

#### Other Improvements

A project for the relocation of nearly two miles of Sign Route 12 between Duncans Mills and east of Austin Creek, about three miles west of Monte Rio was completed on January 11, 1963. This work provides improved alignment and eliminates the narrow, tortuous Duncans Mills grade. It included the construction of a new reinforced concrete box girder bridge over Austin Creek. The cost of this two-lane construction was approximately \$680,000.

Alignment for a portion of the remainder of the route between Austin Creek and west of Monte Rio was adopted by the Highway Commission in December. This section will be developed as a two-lane conventional highway.

In March, the Highway Commission adopted a new route for Sign Route 1 between 0.5 mile east and 0.6 mile west of Fort Ross Road. This location bypasses the Fort Ross compound and has been suggested by the State Division of Beaches and Parks to allow better utilization of this historical area.

### STATUS OF DISTRICT IV—FREEWAY AND EXPRESSWAY PROJECTS

April 1963

Description	Total miles	Completed projects		Under contract		Budgeted		Right-of-way expended and budgeted
		Miles	Construction cost	Miles	Construction cost	Miles	Construction cost	
<b>U.S. 101 AND BYPASS</b>								
Bayshore and James Lick Memorial Freeway, U.S. 101 Bypass; Southern Freeway in San Francisco to Ford Road South of San Jose.....	52.9	52.4	\$60,738,000				\$1,874,000	\$27,934,420
Southern Freeway.....	4.7		7,366,000	4.2	\$14,960,000	0.5	2,050,000	20,428,120
James Lick Memorial Freeway.....	3.0	3.0	11,445,000					12,870,440
Central Freeway.....	1.8	1.8	11,653,000					8,533,099
Golden Gate Freeway.....	1.1					1.1	5,100,000	58,000
Southern Embarcadero Extension Freeway.....	4.4			0.5	5,500,000	0.9	6,143,000	7,614,653
Ford Road South of San Jose to San Benito county line. Redwood Freeway; Golden Gate Bridge to Mendocino county line.....	27.9	5.8	1,093,000					545,839
	84.3	69.0	\$51,961,000	7.4	10,316,000	1.6	1,740,000	19,131,667

STATUS OF DISTRICT IV—FREEWAY AND EXPRESSWAY PROJECTS—Continued

April 1963

Description	Total miles	Completed projects		Under contract		Budgeted		Right-of-way expended and budgeted
		Miles	Construction cost	Miles	Construction cost	Miles	Construction cost	
U.S. 40—San Francisco to Carquinez Bridge (portions).....	18.2	18.2	*62,065,000				420,000	13,432,537
U.S. 50								
MacArthur Freeway; Distribution Structure to Castro Valley.....	15.3	6.8	15,715,000	6.0	23,680,000		*6,960,000	59,778,664
Castro Valley to San Joaquin county line.....	31.4	31.4	11,647,000					4,105,337
SIGN ROUTE 17								
Nimitz Freeway, Distribution Structure to Bayshore Freeway at San Jose.....	41.3	41.3	55,860,000		4,912,000			22,522,792
Santa Cruz to San Jose (portions).....	16.4	16.4	17,728,000		98,000			4,805,101
U.S. 40 near Albany to U.S. 101 near San Rafael (portions).....	9.9	2.2	1,973,000					2,658,907
SIGN ROUTE 9 AND 21								
Warm Springs to U.S. 50.....	17.7			4.7	6,200,000			2,428,174
U.S. 50 to Walnut Creek.....	16.0	3.5	3,010,000	6.8	13,379,000	2.5	7,500,000	11,703,535
Walnut Creek to Monument.....	3.4	3.4	9,322,000					6,415,743
Monument to Solano county line.....	7.4	5.4	15,716,000	2.0	1,800,000			4,939,038
Sign Route 9 north of Route 21 in Fremont.....	4.4							583,594
GROVE-SHAFTER FREEWAY AND SIGN ROUTE 24								
Sign Route 17 in Oakland to Warren Boulevard.....	4.8							10,654,082
Warren Boulevard to Walnut Creek.....	11.0	6.4	9,725,000	3.1	19,084,000	1.5	3,805,000	5,590,041
North of Monument to Sign Route 4, Concord.....	3.4			3.2	3,150,000			1,822,278
EMBARCADERO FREEWAY.....	1.5	1.5	14,792,000				1,400,000	13,159,831
PARK-PRESIDIO FREEWAY, GOLDEN GATE BRIDGE TO FULTON ST.....	2.1	1.2	1,448,000					3,000
JUNIPERO SERRA FREEWAY, FROM BAYSHORE FREEWAY IN SAN JOSE TO SAN FRANCISCO COUNTY LINE.....	47.4			4.7	5,950,000	8.5	14,908,000	43,151,683
CABRILLO HIGHWAY								
Moss Beach to Lake Merced Boulevard in San Francisco.....	17.0	5.4	2,804,000			3.3	4,136,000	9,204,705
Watsonville to 4 miles south of Davenport (portions).....	22.8	13.9	*7,523,000	2.9	1,250,000	5.0	2,700,000	4,670,198
JUNIPERO SERRA FREEWAY TO NIMITZ FREEWAY								
Nineteenth Avenue Freeway, Junipero Serra Freeway to Alameda county line at San Mateo Bridge (portions).....	8.0			2.3	4,800,000		225,000	7,146,412
San Mateo county line to Nimitz Freeway.....	6.8							807,471
PACHECO PASS; 1 MILE EAST OF BELL'S STATION TO MERCED COUNTY LINE.....	5.3	5.3	1,301,000				350,000	12,393
WEST OF U.S. 101 TO BYPASS U.S. 101 IN REDWOOD CITY (ROUTE 214).....	1.1					1.1	*2,282,000	2,835,997
STEVENS CREEK FREEWAY, SIGN ROUTE 17 TO BAYSHORE FREEWAY AT MOUNTAIN VIEW.....	13.6					5.5	6,669,000	5,508,237
WEST VALLEY FREEWAY, U.S. 101 SOUTH OF SAN JOSE TO SIGN ROUTE 17.....	10.0							827,023
MOUNTAIN VIEW-ALVISO FREEWAY; EL CAMINO REAL TO NIMITZ FREEWAY.....	10.5	5.5	2,088,000	1.5	1,475,000			2,832,337
FREEWAY CONNECTION FROM NIMITZ FREEWAY TO U.S. 50 (ROUTE 228).....	2.2	2.2	2,803,000					2,236,000
BAY FARM ISLAND BRIDGE AND APPROACHES.....	0.6	0.6	2,062,000					165,000
WEBSTER STREET TUBE (AND POSEY TUBE).....	1.1	1.1	17,566,000		1,100,000			2,616,729
WARREN BOULEVARD FREEWAY; SIGN ROUTE 24 NEAR LAKE TEMESCAL TO MACARTHUR FREEWAY.....	5.6	4.1	15,654,000	0.6	1,919,000		45,000	2,489,099
TRACY TRIANGLE (ROUTE 110); U.S. 50 TO SAN JOAQUIN COUNTY LINE.....	0.4							367,005

**STATUS OF DISTRICT IV—FREEWAY AND EXPRESSWAY PROJECTS—Continued**  
April 1963

Description	Total miles	Completed projects		Under contract		Budgeted		Right-of-way expended and budgeted
		Miles	Construction cost	Miles	Construction cost	Miles	Construction cost	
SHEPHERD CANYON FREEWAY; WARREN BOULEVARD FREEWAY TO SIGN ROUTE 24.....	10.3							687,579
SIGN ROUTE 84; 2.6 MILES EAST OF DUMBARTON BRIDGE TO SIGN ROUTE 9 AT NILES.....	5.7							
EAST OF ROUTE 239 TO WEST END OF DUMBARTON BRIDGE.....	6.4							1,080,000
ROUTE 108, SIGN ROUTE 21 TO U.S. 50 NEAR LIVERMORE.....	9.7							
ARNOLD INDUSTRIAL FREEWAY; HERCULES TO ANTIOCH BRIDGE (SIGN ROUTES 4 AND 24).....	34.1	14.7	4,737,000					2,286,636
SIGN ROUTE 12; SEBASTOPOL TO KENWOOD.....	17.7			4.1	5,200,000			6,117,546
SIGN ROUTE 29; SOLANO COUNTY LINE TO CALISTOGA.....	36.9	23.2	4,703,000	2.2	1,625,000			4,934,581
SIGN ROUTE 12; SIGN ROUTE 29 TO SOLANO COUNTY LINE.....	3.3							
SIGN ROUTE 48; SIGN ROUTE 37 TO SOLANO COUNTY LINE.....	2.3							
SIGN ROUTE 37; FROM REDWOOD FREEWAY AT IGNACIO TO NAPA.....	13.4	7.2	5,900,000					818,007
ROUTE 229; SWEENEY RIDGE TO BAYSHORE FREEWAY.....	4.0							423,000
GUADALUPE FREEWAY; BAYSHORE FREEWAY TO COLEMAN MARKET.....	2.7							
Totals.....	683.2	352.9	\$420,398,000	56.3	\$126,398,000	31.5	\$68,307,000	\$362,936,530

\* Advertising of project depends on co-ordination with S.F.B.A.R.T.D.  
 † Includes \$300,000 contributed by co-operating agencies.  
 ‡ Includes total of \$1,600,000 by City of San Francisco.  
 § Includes total of \$5,000,000 by Golden Gate Bridge and Highway District.  
 ¶ \$29,117,000 toll bridge funds in this amount.

\* \$6,833,000 from toll bridge funds.  
 † City of Oakland and Alameda County contributions included in this figure.  
 ‡ Includes \$690,000 by District V.  
 § Includes total of \$1,051,000 by City of Redwood City.  
 ¶ County of Alameda contribution included in this figure.

## ANNUAL DISTRICT RIGHT-OF-WAY AGENTS MEETING HELD IN SACRAMENTO



Headquarters and district right-of-way agents held their annual meeting in Sacramento on May 2 and 3. Discussion of problems and exchange of information on recent studies were the chief topics of discussion.

District staff attending were (seated around table, clockwise): W. J. Kenney, Frank Kane and John Daniels, all District IV; Gilbert Mulcahy, District III; Clarence Piper, District II; William Sloane, District I; Glenn Hippensteil, District VI; Rudolf Hess, chief right-of-way agent (head of the table); Howard Chamley, District VII; John Ritz, District XI; Wayne Hubbard, District X; John Burke, District IX; Jack Asbill, District VIII; J. W. Groathead, E. P. Jones, and D. C. Gardner, all District VII; (seated, middle row right) Fred Moore, District V; (middle row sixth from right) Erwin Hovde, District IV; and (standing sixth from right) A. M. Lynch, District VII.

# New Striper

Improved Unit Faster,  
Safer, More Versatile

By R. C. GROUT, Assistant Equipment Engineer

In this age of missiles, booster rockets and possible interplanetary travel, we hear a great deal of news about guidance systems. While everybody shows plenty of interest in this system, perhaps they do not realize that one of the most used and possibly the primary guidance system for the major volume of traveling people in the world today is the traffic stripe. While ordinarily given very little thought, it probably is used and abused more than any other single guidance system which exists today.

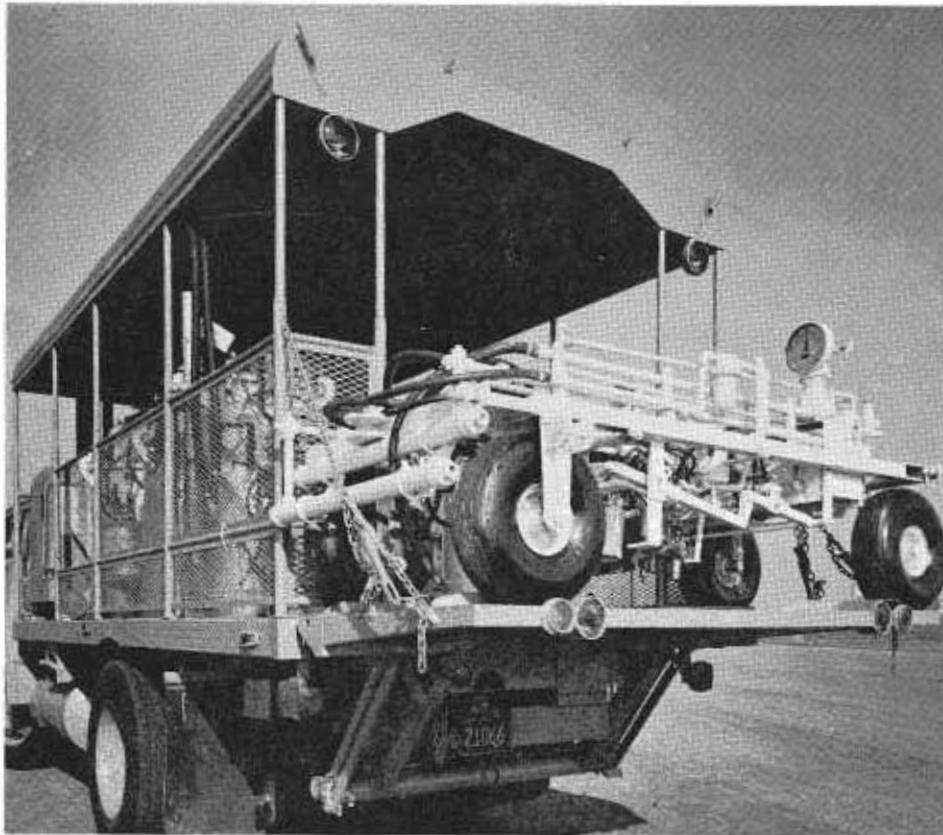
In order to provide the vehicle operator with the most economical and yet most acceptable guidance system, the equipment department and maintenance department of the California Division of Highways have constantly sought to develop a safer and more economical method of applying the various stripes to the pavement. The January-February, 1960, issue of *California Highways and Public Works* carried the first article dealing with our improvements to the traffic line marker. Again in the July-August 1961 issue, a second article described the new traffic line marker that had been developed. There are now further developments which have improved both the economics and and safety of operating the new striper.

## More Rapid Method Needed

Because of the increase in the number of miles of new multilane freeways, which usually at least doubles the mileage of stripe needed, as well as the necessity of maintaining existing highly traveled two-lane roads, a more rapid process of applying marking stripes was found to be necessary. After a thorough appraisal of the requirements of the operating departments involved, it was determined that the following items should be incorporated in the latest design of the traffic striper:



New unit in operation on U.S. 40 east of Roseville.



*Paint striping truck loaded and ready to move to a new location.*



*Paint guns and bead dispensers on the end of the lightweight extension arm.*

1. Safety for operators.
2. Maximum production.
3. Minimum traffic tie-up or hazard.
4. Overall efficient and economical operation.

A unit embracing the above requirements was designed by the equipment department, with advice and assistance from the maintenance department, and several such units were constructed and put into service in 1962.

#### **Models Carefully Studied**

The first models were carefully studied during the first few months of operation, and the results were compared with existing equipment used by California, other states and commercially obtainable units. The operators and crews working with the units were interviewed and notes were made of any improvements that they thought could be made. The final list of suggestions was prepared and incorporated the following ideas:

1. Elimination of carrying the reflectorizing materials (beads) on the sulky.
2. Better striping characteristics.
3. Safe flushing system.
4. Provision for offset painting.
5. Single gun application for an eight-inch-wide line.
6. Provision for a bonding agent.

These features were studied by the design section of the equipment department and suitable changes were made in the plans for new units.

Several of these units have been constructed and are now in service. Crews using the latest model were well pleased with the machine and quality of the work. The striper can now be operated entirely from the cab and is capable of not only painting four-inch and eight-inch stripes from the sulky located directly in front of the propelling vehicle but also is capable of painting stripes at a distance from four to thirteen feet from the machine. All materials are carried on the propelling vehicle, which provides for a more rapid and economical operation.

#### **Can Paint Three Colors**

Specifically the machine carries 300 gallons of paint and 750 pounds of re-

flecting beads. It will paint four-inch and eight-inch stripes in any combination of white and yellow paint. The AASHO standard, 9-foot long painted by 13-foot gap broken stripe, is painted automatically by using a sensing device operated from the driveline of the truck which electrically activates the valves on the paint guns. Provision is made to paint three colors—white, yellow, or black—and either single or double solid or broken lines, or triple lines.

When painting, this machine can travel at speeds up to 15 miles per hour. This essentially means that traffic and road conditions govern the speed that stripes can be applied.

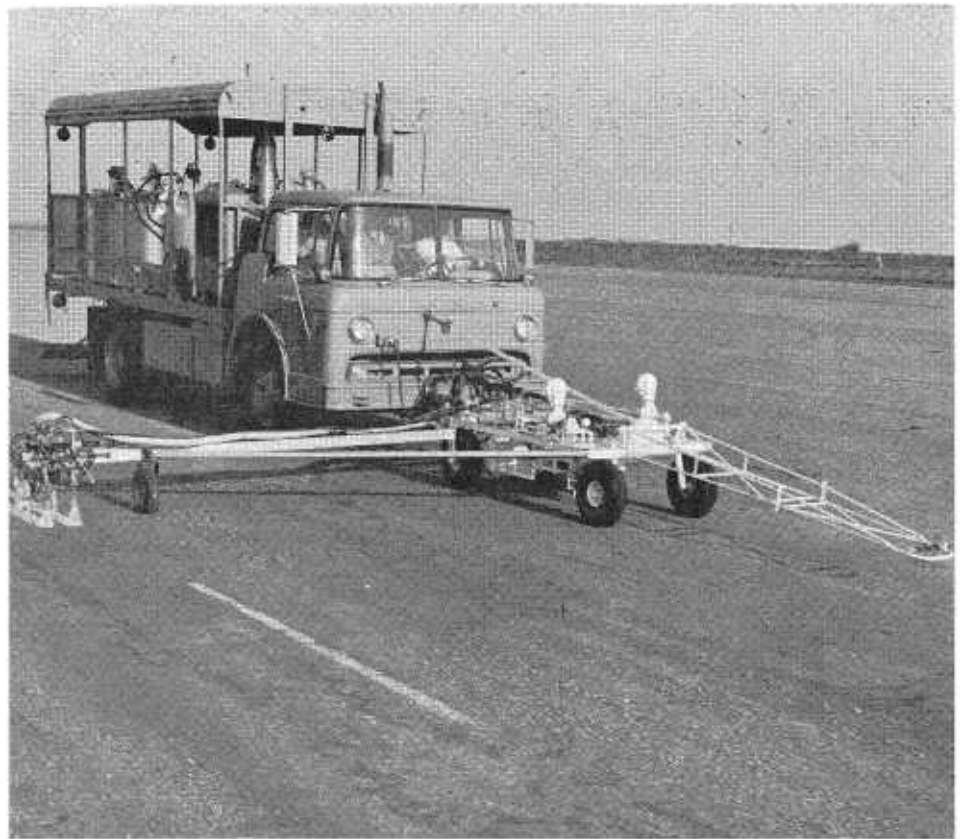
The provision of complete control from the cab of the truck is incorporated in the new machine and with the application of quick drying lacquers, we are now able to complete the work in a much safer manner.

As a result of several comprehensive articles concerning the development of this machine appearing in several trade journals, requests for plans and specifications of the units have been received from numerous state, county, city and foreign governments.

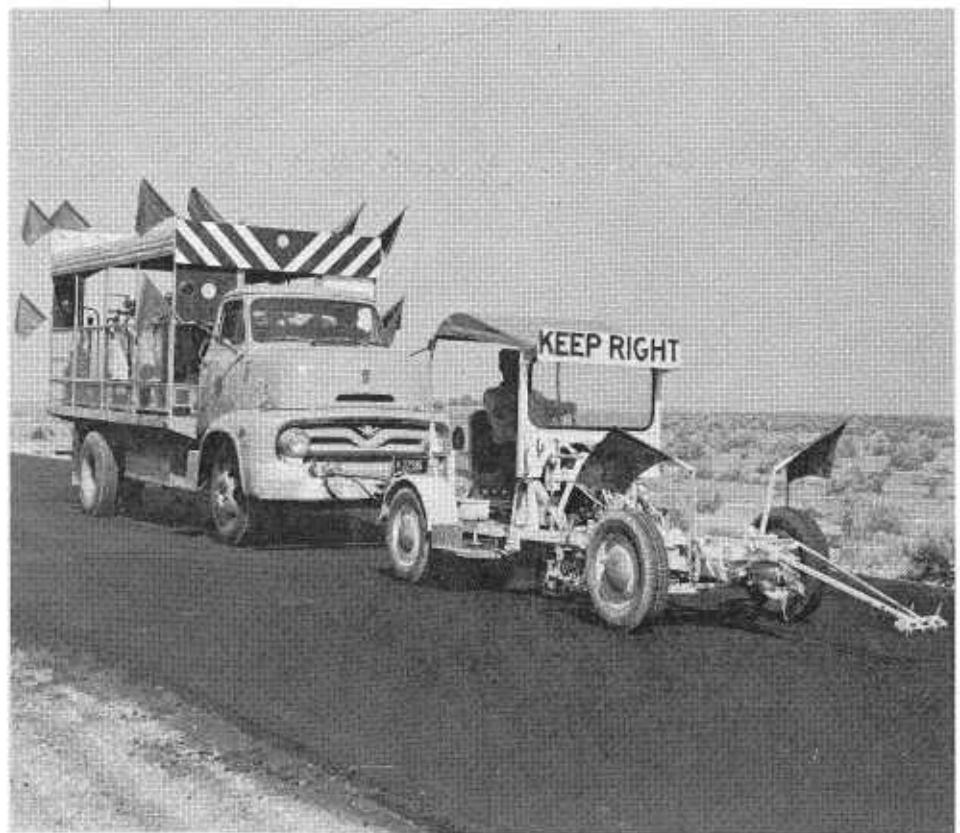
Reports from the district maintenance departments that have used the new model are quite favorable. Costs are comparable with the older model. The cost per mile per stripe should be reduced with these advantages.

## Storms, Snow, Slides Cause Road Closures

Heavy snow and blizzard conditions closed U.S. 40 over Donner Summit for seven hours on April 15 and eight hours on the 19th. High water in the Yolo Bypass closed State Sign Route 16, the River Road to Woodland, for 17 days starting the morning of April 8. The Emerald Bay section of State Sign Route 89 was closed for the last 24 days in the month. Rock slides closed State Sign Route 1 between Big Sur and San Carpojo Creek on April 6, 7, 26 and 27, and State Sign Route 128 at the Monticello Damsite on April 14 and 15.



*The new unit showing the extension arm in action.*



*The former sulky type unit.*

# Seismic Tests—2

Followup Report Compares  
1960 Prediction With Results

By DEWEY W. KNITTEL, Associate Engineering Geologist, and  
MARVIN L. McCAULEY, Assistant Engineering Geologist



In the May-June 1960 issue of *California Highways and Public Works* magazine, an article appeared entitled "Seismic Tests."

The use of seismic refraction data to predict the rippability of rock in proposed excavations was described in this article. The seismic survey was run along portions of the proposed relocation of U.S. Highway 6 through Escondido Can-

yon, Los Angeles County. The area is about midway between Palmdale and Saugus.

Grading on this portion of the Antelope Valley Freeway has now been completed, and this followup article will attempt to compare the predicted results from the seismic data with the actual excavation methods used during construction.

#### Area Geology

The area under discussion is located in the Soledad Basin, which lies north of the western San Gabriel Mountains

in the Transverse Range Province. The area is composed of both gently rolling hills and steep canyons with near vertical walls up to 350 feet high. The rock encountered along the seismic survey consisted of massive sandstones and torrential conglomerates of the Vasquez Formation (Oligocene) and the Tick Canyon formation (Lower Miocene), which is composed of green, buff and reddish

PHOTO BELOW. One of the seismic blasts set off along the relocation line of U.S. Highway 6 through Escondido Canyon in Los Angeles County.





brown siltstones, sandstones and conglomerates.

Pleistocene terrace remnants occur locally throughout the area and are composed of abundant rock clasts in a noncemented silty sand matrix. Minor folding and faulting was observed in the area of the seismic survey.

#### Seismic Theory

The theory of seismic refraction is based primarily on the measurement of the length of time required for a wave front to reach a point that is a known distance from the energy source. The waves may travel directly from the source to the detector, or at some critical angle they may be refracted and travel along the contact of two different velocity zones. Wavelets are generated which travel back to the detectors on the surface (Figure 1). The arrival time for various distances from the energy source are recorded (Figure 2) and a time-distance graph is constructed (Figure 3). This graph will show the velocities of the different zones, and the depth to the change in velocity can be computed by the formulas given in Figure 4.

A 12-channel portable refraction seismograph was used for obtaining the information on the job. Each geophone (essentially a magnet and a coil) when disturbed by the shock wave sets up a current which is amplified and then recorded as a separate trace on photographic paper. Elapsed times on these seismograms can be picked to the nearest millisecond. The minimum time segment imposes a limit of accuracy on the computations.

#### Rippability Factors

A material is considered rippable if, without being preblasted, it can be excavated by standard equipment. The velocities obtained in a seismic refraction survey cannot be used by themselves to determine rippability. The velocities, used as a guide, must be related to a number of other factors. These include the rock type, the degree of weathering, the amount and type of fracturing or jointing, the bedding, and other results of the tectonic history.

Nongeologic factors such as the type of equipment used by the con-

TABLE I  
ESTIMATED VS. ACTUAL CUBIC YARDS BLASTED

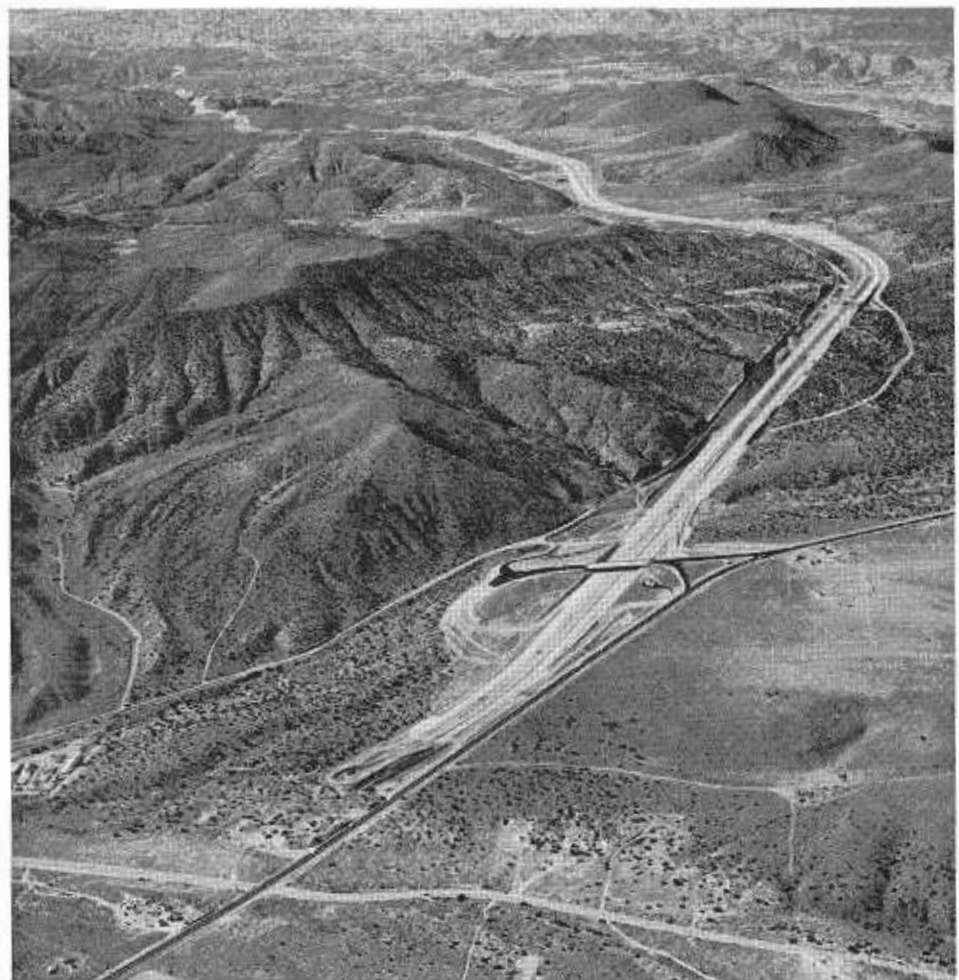
Station Limits Type of Material	Total cubic yards in cut *	Estimated percent requiring blasting **	Estimated cubic yards blasted †	Actual cubic yards blasted ‡	Actual per cent blasted
455 = 460 Cement conglomerate	904,600	55	497,500	488,000	54
470 = 483 Interbedded sandstone and siltstone	601,000	55	330,500	122,900	20
487 = 491 + 50 Interbedded sandstone, siltstone and volcanic intrusive	80,000	20	16,000	0	0
511 = 514 + 50 Interbedded sandstone and torrential conglomerate	156,800	15	23,500	11,300	7
525 = 563 Interbedded sandstone, siltstone and conglomerate	975,000	100	975,000	950,000	98
615 = 652 Basalt flows	605,800	45	272,600	236,700	39
	3,323,200		2,115,100	1,808,900	

Percent error—9.2 percent.

\* Calculated by district design department.

† Based upon seismic data.

‡ Figures supplied by contractor.



Looking west along the Antelope Valley Freeway construction. Interchange in the foreground is Ward Road with the existing Sierra Highway to the right and Econdido Canyon Road to the left.

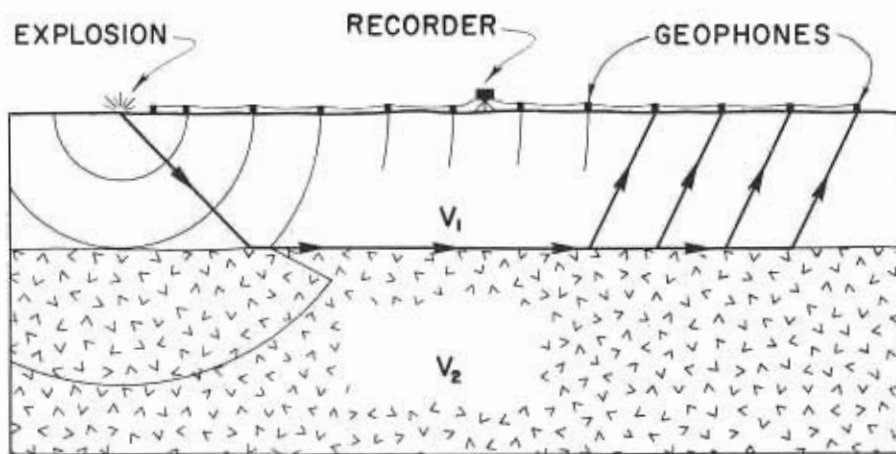


FIGURE 1. The placement of detectors (geophones) and possible wave paths.

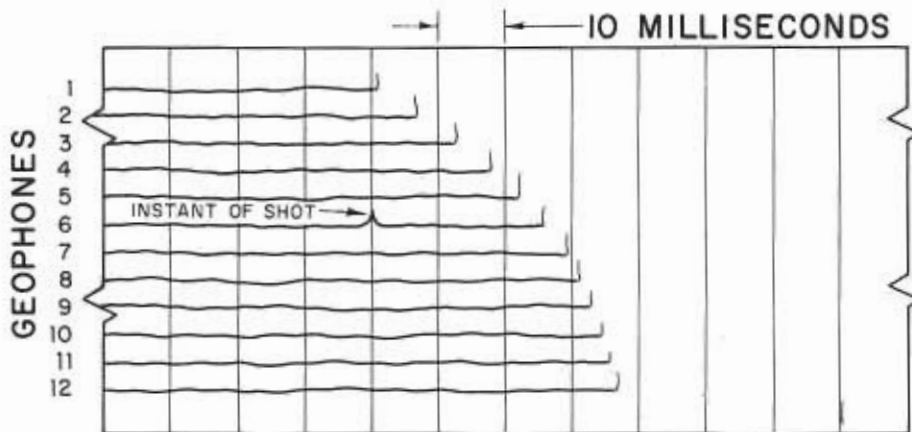


FIGURE 2. A seismogram showing the times recorded by each geophone.

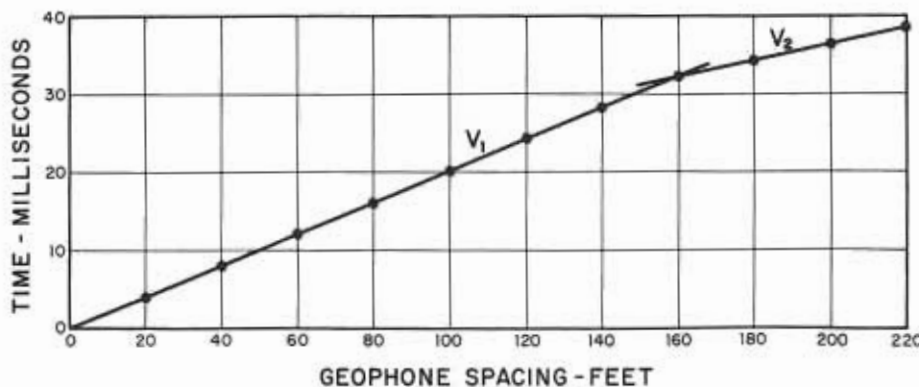


FIGURE 3. A time-distance graph constructed from the seismogram.

$V_0$  = Velocity of 1st material  
 $V_1$  = Velocity of 2nd material  
 $V_2$  = Velocity of 3rd material  
 $X_C$  = Distance intercept  
 $T_1$  = 1st time intercept  
 $T_2$  = 2nd time intercept  
 $Z_0$  = Thickness of 1st layer  
 $Z_1$  = Thickness of 2nd layer

Formula for two layer problem

$$Z_0 = 1/2 \sqrt{\frac{V_1 - V_0}{V_1 + V_0}} \cdot X_C$$

Formula for three layer problem

$$Z_1 = 1/2 \left( T_2 - \frac{2Z_0 \sqrt{V_2^2 - V_0^2}}{V_2 V_0} \right) \left( \frac{V_2 V_1}{V_2^2 - V_1^2} \right)$$

FIGURE 4. Depth formulas used in computations.

tractor will affect rippability. It can readily be seen that two D-9 tractors with mounted rippers used in tandem will succeed in economically ripping a higher velocity material than a D-8 tractor with a towed ripper. Even the skill and experience of the individual equipment operator will affect the amount of rock that can be excavated without preblasting. Also, it is the option of the individual contractor whether a borderline material should be ripped or preblasted. Therefore, the quantity of material requiring blasting is influenced by the amount and type of equipment owned by the contractor and by his method of operation.

#### Suitability of the Area

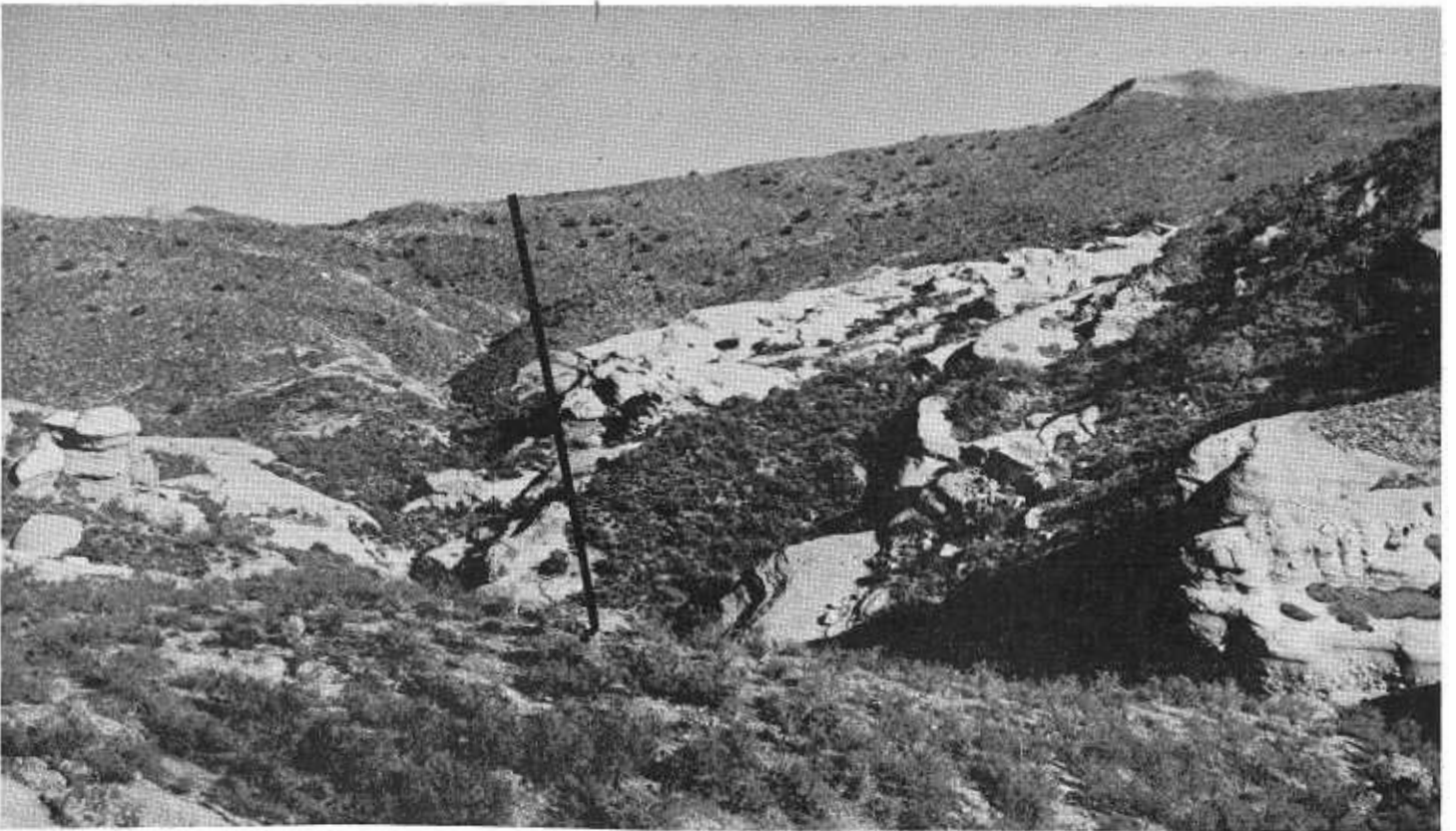
The theoretical conditions upon which seismic refraction is based are rarely found in nature. In this area the dip of the bedding planes had to be compensated for by shooting both updip and downdip from the recorder. These velocities were then averaged to obtain a representative velocity for the material since shooting in one direction only will give a false impression of the velocity and depth to the underlying material. Offset bedding created by minor faults along with associated jointing and the presence of volcanic intrusives added to the difficulty of interpreting the seismic records. The alternation of hard and soft beds must be taken into account since velocity waves cannot be recorded for a lower velocity material underlying a more dense layer. Thus, when the first high-velocity layer is recorded, it must be assumed that all material below that depth has an equally high velocity.

#### Unsuspected Source

In the cut area between Station 470 and Station 483 a large unsuspected source of perched water was encountered during the excavation. A saturated material will often have a seismic velocity of about 5,000 feet per second. Based upon hindsight it is now felt that the seismic interpretation was influenced by this water and probably accounts for the large percentage of error in this particular cut section.



A 1960 photo looking west along the proposed location of the Antelope Valley Freeway indicated by the superimposed line. Some 800,000 cubic yards of material were removed from the cut through this bluff.



1960 photo of the Antelope Valley location looking east toward the back of the rock bluff shown in the above photo. Centerline of the freeway is shown by the superimposed line.

Since field conditions were not ideal and because it was not known what type of excavation equipment would be used, a somewhat conservative velocity was chosen as the breaking point between ripping and blasting. All material having a velocity of 5,000 feet per second or higher was described as requiring blasting while that material with velocities below 5,000 feet per second was considered rippable.

Calculated in Table 1 are the figures showing the correlation between the anticipated yards of excavation needed to be blasted, based upon the seismic survey, and the actual amount pre-blasted during the construction with these station limits.

#### Conclusions

The velocities obtained in a seismic refraction survey can be a useful guide for estimating the amount of blasting that will be required. This information is of special value to prospective bidders and also to the design department. It must be stressed that the amount of information and the degree of accuracy are dependent upon the experience and skill of the operator-interpreter. This job shows that the method can be applied in areas where conditions are not ideal for seismic surveys provided the limitations of the method and the equipment are considered. Over-estimation of the amount of material requiring blasting by 9.2 percent is a reasonable error when all factors concerning this job are considered.

## Improvements Slated For Two Bay Bridges

A contract for \$950,462.50 was awarded on April 19 for resurfacing the upper deck of the San Francisco-Oakland Bay Bridge. This resurfacing is part of an overall \$35,000,000 reconstruction project to convert the structure to carry five lanes of one-directional traffic on each level. The changeover to one-way traffic is expected by early July although the new contract will require six months to complete.

## Governor Appoints New State Architect

Governor Edmund G. Brown on May 7 announced his appointment of Carl C. McElvy, 58, of the University of California at Los Angeles, as State Architect.

The Governor praised McElvy as "an outstanding architect and a proven administrator who will bring a fresh point of view and a sense of urgency to the task of making our state buildings the most beautiful in the country."

McElvy has been the principal architect at U.C.L.A. since 1946 during which time he did major planning, coordination and administrative work.



CARL C. McELVY

McElvy's office was created by the 1961 Legislature. His appointment is subject to Senate confirmation. A committee of eight architects and contractors, appointed by Governor Brown last July, recommended McElvy's appointment to the \$20,000-a-year job.

The Governor praised the work of the Division of Architecture and its acting chief, Earl W. Hampton, who has held this post since the division chief, Anson Boyd, retired last year.

"In our new position as the leading State in the nation we will seek to be first also in the beauty of our construction projects—buildings, freeways and recreational facilities," the Governor said.

McElvy was born in Los Angeles and educated in public schools there. He received his degree in architecture from the University of Southern California and has been a registered architect since 1939.

Prior to his appointment at U.C.L.A., McElvy worked for the City of Los Angeles and the federal government.

He is a member of the American Institute of Architects and received the Pasadena chapter's 1958 award for outstanding contribution to the advancement of the profession.

He and his wife, Ruth, have three children.

## District VII Loses Three Survey Supers

Three supervisors in District VII's survey section are retiring this summer. Two of them, surveys supervisor Wayne M. Blotter and chief of survey party Patrick Devine, have the longest state tenure in the district, with 44 and 43 years respectively, while surveys supervisor Henri Compagnon has 32 years.

Both Blotter and Devine helped align original roadways in District VII, including the Angeles Crest and Pacific Coast Highways. In recent years, Blotter has supervised construction survey work on the Golden State, Santa Ana, and San Bernardino Freeways, Devine has concentrated on projects in the West Los Angeles-Santa Monica area, including some six miles of the San Diego Freeway for which his survey party won the 1961 Bonneroo Award.

Compagnon has been chief of party or surveys supervisor for many of the largest projects in District VII, including the four-level interchange and the San Diego Freeway through the Santa Monica Mountains.

Blotter joined the Division of Highways at his hometown, Sacramento, in June 1919. He served a year with District III and three years with District XI, the balance of his time being spent in District VII. His wife Aimee works for District VII's advance planning department.

A native of Los Angeles, Compagnon joined the Division of Highways in District I and later transferred to District VII where he has been continuously employed except for World War II when he served with the U.S. Army Engineer Corps in Alaska. An amateur archeologist, he has donated to museums many Indian artifacts, skeletons, and fossils found while working on highway projects. His only son, Henry M., is assigned to District VII's traffic department.

Devine, born and educated in San Diego, worked with the San Diego Road Commission for a year and a half before transferring to Highways. His entire career has been with District VII.

# Wrong-way Drivers

One Out of Five Does It Knowingly

One out of five wrong-way drivers on freeways and expressways is knowingly and deliberately driving against oncoming traffic, and 60 percent of the wrong-way driving incidents resulted from entering the freeway via an offramp.

These are conclusions from a study by the Division of Highways of 500 wrong-way drivers cited by the California Highway Patrol in the first nine months of 1962.

Other findings revealed were:

Almost one-third of these drivers had been drinking.

An equal number of violators pleaded "honest confusion."

A greater percentage of men past 49 and women past 39 were involved than their proportion of the State's registered drivers would indicate.

One-sixth of the incidents were caused by carelessness.

Nearly half of the incidents occurred during daylight, including dawn and dusk.

Only 1 in 10 occurred in bad weather—rain, snow or fog.

Visibility was good in 84 percent of the incidents.

Traffic volume was light when 44.3 percent occurred; heavy for 7.8 percent.

Illiteracy, or the inability to understand signs, was responsible for only 2 percent of the incidents.

## Co-operative Study

The study was one of several research projects on traffic safety being administered by the Highway Transportation Agency and conducted by the Division of Highways, the California Highway Patrol and the Department of Motor Vehicles under a \$100,000 grant by the Legislature in 1961. The Division of Highways had the lead responsibility for this particular study.

"Since the average driver who encounters adverse conditions of lighting, weather, traffic, and even occa-

sionally confusing highway signing and design, still manages to drive in the proper direction," Hill said, "it seems that the most important cause of wrong-way driving is the mental condition of the driver himself."

The study classified drivers in each incident as either under the influence of alcohol (in four subclassifications); confused; careless; deliberately violat-

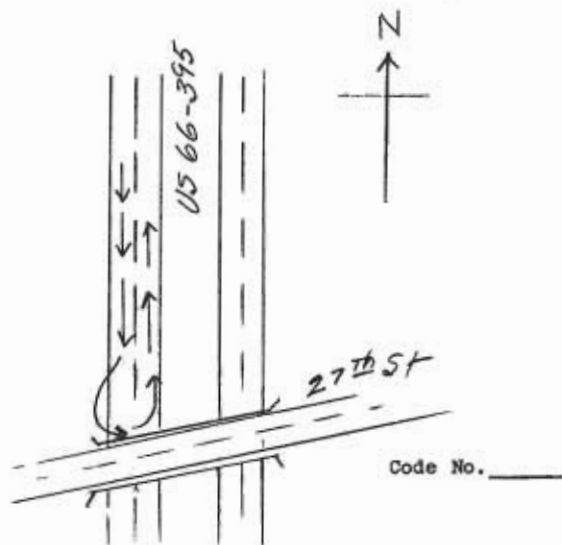
ing the law; or illiterate; although it was recognized that in many incidents a combination of factors was possible.

## Intoxicated Drivers

Of the 31.5 percent of the offenders who had been drinking, one-half of these were so obviously intoxicated that they could give no explanation for their behavior to the arresting officer.

WRONG-WAY DRIVING INCIDENT		Freeway	<u>X</u>
		Expressway	<u>    </u>
		Other	<u>    </u>
Co. <u>58d</u> Rte. <u>31</u> Sec. <u>A</u>			
Date <u>07/16/62</u> Hour <u>    </u>			
Location <u>US 395 5/8 lanes at 27th St Overpass</u>		Direction <u>N/B</u>	
How it occurred:	Driver data:	Other conditions:	
Entered from Off-ramp <u>    </u>	Sex <u>M</u> Age <u>51</u>	Light	<u>L</u>
Entered from undivided road <u>    </u>	Sobriety <u>    </u>	Weather	<u>L</u>
Entered from expressway <u>    </u>	Confused <u>    </u>	Visibility	<u>G</u>
Made U turn <u>    </u>	Careless <u>    </u>	Traffic	<u>M</u>
Unknown <u>    </u>	Intentional <u>8</u>		
Description: <u>Driver stated he was looking for US 99 and made U turn to go back because he thought he had gone too far</u>			

Diagram:



One of the forms used by the Division of Highways to record wrong-way driving accidents is shown above.

Another large group, equal in number to the drinking drivers, were motorists who claimed they were confused by unfamiliarity with the freeway, misleading signing, transitions from undivided roads to freeways involving detours or barricades, and confusing interchange or ramp designs.

"Drivers' complaints regarding confusing situations were carefully investigated by highway engineers," Hill said. "Such complaints may well offer the best leads to improved highway design and signing."

#### Confusion Amongst Elderly

The study indicated that confusion as a cause of wrong-way driving was more prevalent among the elderly offenders.

The deliberate violators comprised the third largest group. The commonest maneuver by this type of driver was doubling back against oncoming traffic after passing a desired offramp or intersection.

"One wrong-way driver in six is just plain careless," Hill said. "His typical statements to the arresting officer are, 'I didn't see any signs. I was looking at the ocean,' or 'I had been having an argument with my wife and was upset.'"

The seriousness of the wrong-way driving problem is indicated by accident statistics. During 1961, there were 13 head-on collisions on urban and rural freeways that resulted in death for 19 persons. There were 13 more in the first 8 months of last year with 17 killed and 17 injured.

#### Sign Effectiveness Studied

As 60 percent of the wrong-way driving incidents resulted from entering a freeway via an offramp, a second phase of the study is in progress at the Institute of Transportation and Traffic Engineering at the University of California, Los Angeles, to measure the effectiveness of various signs in preventing improper entry.

This study employs a "driving simulator" technique developed by the I.T.T.E. in which driver reaction to highway features is tested by projecting a motion picture of the highway onto a curved screen in front of and behind an automobile mounted on blocks and rollers.

#### Left Turns on Expressways

Unlike freeways, expressways have intersections at grade. The study revealed that nearly half the wrong-way movements on expressways were caused by drivers entering the intersection and making left turns into the nearest lanes, or by making right turns after proceeding through the opening between opposing lanes. This tendency is aggravated where there are service roads adjacent and parallel to the expressway.

According to the traffic engineer, "with a four-lane expressway and two two-lane frontage roads, for a total of eight roadway lanes—the outer frontage roads permitting driving in both directions and the center divided expressway one-way roadways—some drivers become confused trying to relate the various lanes with the correct direction of travel. They get in trouble by not keeping track of the lanes they have crossed."

#### Wrong Way From Onramp

A small number of wrong-way incidents resulted from drivers' leaving freeways via onramps after passing desired offramps, or from making a left turn at the end of an onramp when the motorists found the direction of travel on the freeway was not what they wanted.

"Some of these people claimed to be confused," said Hill, "but it's hard to believe that they could make the clumsy U-turn the ramp design would force on them without knowing they were making an illegal maneuver."

## Incorporated Cities Receive \$9,000,000

A total of \$9,986,507.61 in revenues from the five-eighths-cent-per-gallon gas tax was apportioned by the Department of Public Works to the 382 active incorporated cities in California in April under the provisions of the Streets and Highways Code.

The Cities of Vista and San Marcos, both in San Diego County, were incorporated during this quarter.

## Equipment Engineer McFadden Retires

William L. McFadden, supervising equipment engineer for the Division of Highways, will retire June 1 ending a 34-year career with the State.

As assistant equipment engineer in charge of administration, McFadden was in charge of the recent revision of the equipment rental system of the division's equipment department which is now responsible for some



W. L. McFADDEN

9,400 units worth more than \$34,000,000, ranging from jackhammers to rotary snow plows.

McFadden was born in Panaca, Nevada, and studied engineering at the University of Idaho. He began

his engineering career in 1919 as a rodman with the city engineering staff of Idaho Falls. In 1922 he joined the Nevada Highway Department and in 1926 was appointed City Engineer of Las Vegas. He went to work for the California Division of Highways as a resident engineer in 1928 and was assigned to projects in the Marysville, San Bernardino and Imperial Valley areas.

He was appointed assistant construction engineer for the San Diego area in 1933. He joined the staff of the highways equipment department in Sacramento in 1949.

McFadden is a veteran of the 1916 Mexican Border Campaign, the American Expeditionary Force and Army of Occupation during World War I and served with the Navy Seabees in the South Pacific during World War II, retiring with the rank of commander.

He is a member of the American Society of Military Engineers, the Reserve Officers Association, the American Legion, the California State Employees' Association (of which he was state president in 1941) and the Sacramento Stamp Collectors Club.

McFadden and his wife, Lula, live at 4625 Staggs Way in Sacramento.

# Merit Awards

Five Division Employees Receive Superior Accomplishment Awards

The California State Merit Award Board has announced approval of five superior accomplishment awards for employees of the Division of Highways—the first time that the division's personnel have been so honored.

The five so honored were senior bridge engineer Roger D. Sunbury, Route 2, Stockton; senior engineer welding technologist Paul G. Jonas, 3065 Stanton Circle, Carmichael; reproduction supervisor Ralph D. Chamney, 5100 Serrania, Woodland Hills; and a husband and wife team, John and Peggy Unruh, senior delineators, 1122 Bellhaven Avenue, West Covina.

Superior accomplishment awards are voted for achievements by employees which management recognizes as making an exceptional contribution to the efficiency or economy of state government, or to exceptional improvement in its operation.

Robert B. Bradford, Administrator of the State Highway Transportation Agency presented the awards to Sunbury and Jonas in Sacramento on April 8. Chamney and Mr. and Mrs. Unruh were presented their awards by Metropolitan District Engineer E. T. Telford in Los Angeles on April 22.

Sunbury and Jonas won the Dr. L. I. Hewes Award for outstanding contributions to western highway development last June. In his letter recommending them for the award, State Highway Engineer J. C. Womack praised Sunbury for combining steels, ranging from ordinary structural steel to the newest high strength steels, into long bridge structures with both marked economy and improved appearance.

"By his foresight," Womack said, "Mr. Sunbury has opened up new horizons for structural designers. He was able to effect an \$800,000 savings on the Carquinez Bridge by combining three different types of steel. This large, double cantilever bridge . . . established a new high standard for clean, uncluttered truss design."



LEFT TO RIGHT. Senior Bridge Engineer Roger D. Sunbury and Senior Engineer Welding Technologist Paul G. Jonas are presented their award certificates and gold watches by State Highway Transportation Administrator Robert B. Bradford while State Highway Engineer J. C. Womack looks on.



Ralph D. Chamney (left) shows sample kit explaining a composite photo system he devised to Division of Highways Metropolitan District Engineer E. T. Telford, who presented the award April 22d.

## K. A. MacLachlan

Kenneth A. MacLachlan, former economist with the Division of Highways and pioneer in the adaption of tabulating and computing machines for highway engineering purposes, died on April 18 in a Houston, Texas, hospital.

MacLachlan had been living in Santa Cruz, California, since he retired in 1958.

MacLachlan was born in New Haven, Connecticut, and obtained his education in England and at the University of California, graduating with a B.S. degree in 1921. He served with the Navy in World War I and then with the U.S. Bureau of Public Roads.

Early in his state career MacLachlan was one of the group who formulated a definite highway signing policy at the first step toward California's present well-defined system of warning, regulatory, and directional signs.

Soon afterward he was assigned supervision over the California Highway Transportation Survey of 1934.

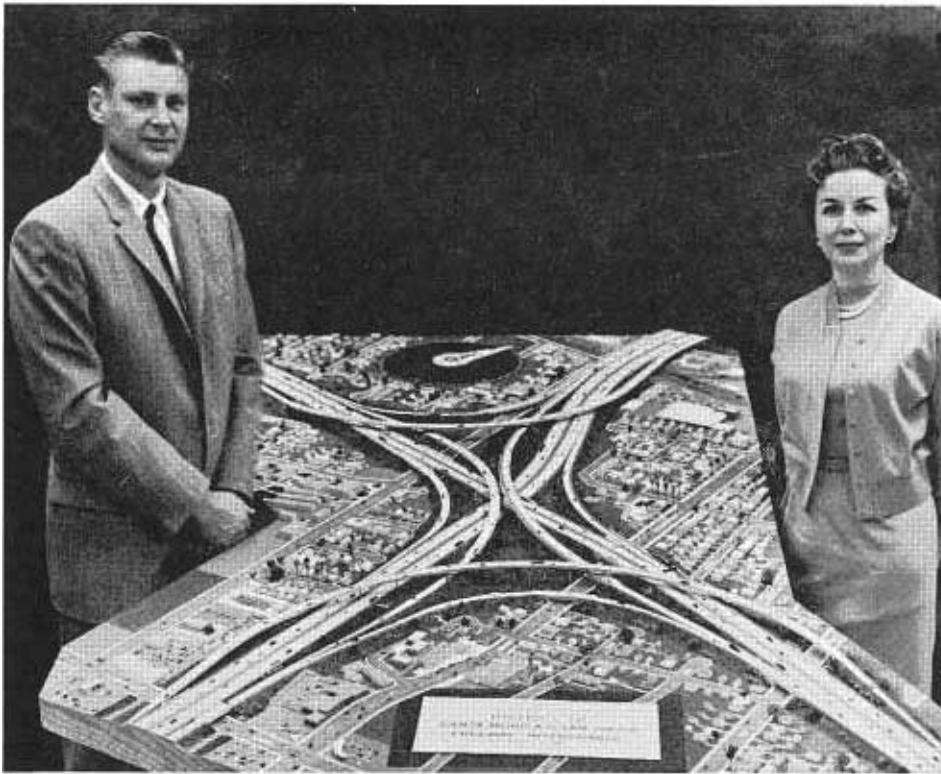
Under his supervision the Division of Highways was the first agency of its kind to use punched card equipment to analyze highway accidents and detect problem locations; to use the co-ordinate system of analysis for traffic data; to depict the results of origin and destination surveys in the form of "trip desire line" contours; and to adapt gyroscopic equipment for highway survey purposes by means of a specially equipped vehicle.

He is survived by his wife, Florence, of Santa Cruz, and a son, Donald, of Soda Springs.

### 52 JOBS ADVERTISED

The Department of Public Works advertised for bids in April on 52 projects at an estimated cost of \$39,428,900. There were 41 contracts for \$11,444,400 awarded during the month and 24 contracts for \$45,992,800 completed.

Bids from 221 contractors were opened on 36 projects, an average of 6.1 bidders per project.



A husband and wife team, John and Peggy Unruh, senior delineators of the California Division of Highway's District VII office in Los Angeles, pose with a scale model of the Santa Monica-San Diego Freeway Interchange which they constructed in their home on their own time and donated to the division. They will be presented a superior accomplishment award.

Praising Jonas for his work in advancing and standardizing the technological aspects of welding which make the use of high-strength steels practical and economical, Womack added that through the joint efforts of the two men, California has been able to set precedents in major, long-span highway structures that are now being duplicated throughout the nation.

Chamney devised a composite photographic system which permits the base maps and drawings prepared by the numerous departments involved in highway planning to be combined in an infinite variety of ways to suit the user's requirements, eliminating the need for costly and time-consuming redrawing.

"One example of Mr. Chamney's accomplishments," said Los Angeles Metropolitan District Engineer E. T. Telford, "lies in the development and use of overlays produced photographically which brought usable information to the right-of-way department from the design department many

months—possibly a year—before it would otherwise have been available."

The District VII Right-of-way Department estimated a 90-percent saving of time in preparing its maps by employing Chamney's techniques.

Mr. and Mrs. Unruh, working in their home on their own time, constructed a scale model of the Santa Monica-San Diego Freeway interchange, and donated it to the Division of Highways at a cost to themselves of approximately 600 man-hours of labor and a cash outlay of \$210.

The model proved of great value to design, bridge and maintenance engineers, prospective bidders, right-of-way appraisers and negotiators, and members of the Los Angeles City Engineer's staff.

It also was viewed by Los Angeles residents during months of public showings at the West Los Angeles City Hall and the Annual Home Show in the Los Angeles Memorial Sports Arena, as well as at other locations.



## Reed, Legal Chief, Dies in Sacramento

Robert E. Reed, Chief of the Division of Contracts and Rights-of-way, collapsed and died on a golf course in Sacramento on April 22. He had been head of the division since 1950.

Reed had charge of a staff of more than 80 attorneys dealing with the legal aspects of state highway construction including rights-of-way and contract negotiations. He also represented the Department of Public Works before legislative committees and as adviser to the Legislature in developing and amending the



ROBERT E. REED

Streets and Highways Code and other statutes.

Reed was born in Piqua, Ohio, in 1905. He graduated from the University of Idaho in 1926 and the Stanford University Law School in 1928.

Before entering state service as an assistant legislative counsel in 1930, he practiced law in Oakland. He joined the Department of Public Works in 1934 and became a deputy attorney general in the State Attorney General's office in 1944.

He returned to the legal division of the Department of Public Works in 1949 and was appointed division chief in 1950, succeeding the late Clifton R. Montgomery.

He was a member of the American and Sacramento County Bar Associations and from 1958 to 1961 was chairman of the legal affairs committee of the American Association of State Highway Officials. He was also a member of Phi Alpha Delta, the Commonwealth Club and the University Club of Sacramento.

Reed is survived by his wife, Mildred; son, Robert E., Jr., of La Canada; daughters, Jane of Oakland, and Mrs. John Spurlock, of Palo Alto.

The Department of Public Works has asked the State Personnel Board to schedule a civil service examination for the position of Chief, Division of

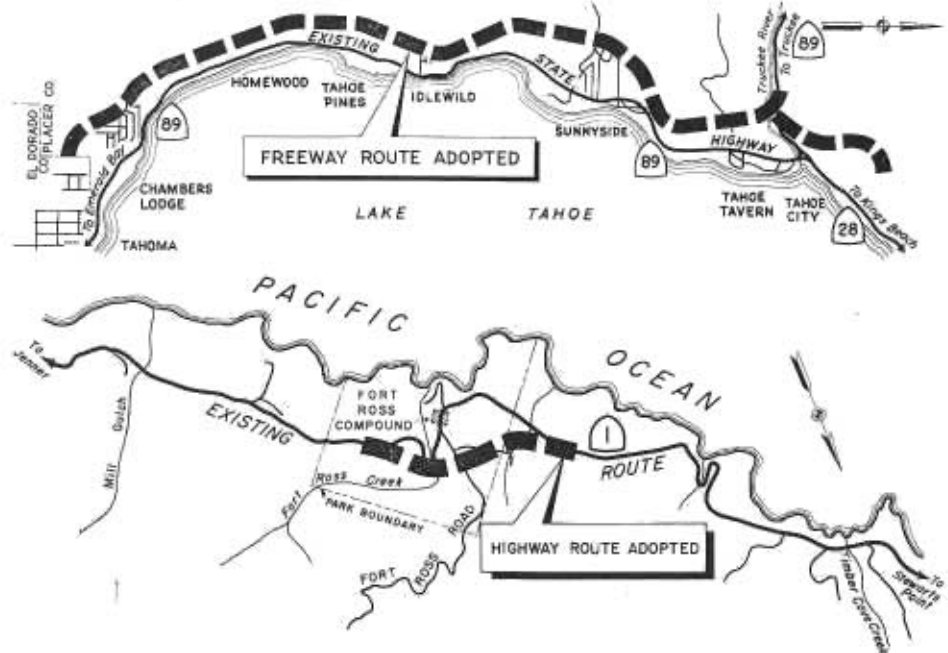
## COMMISSION ADOPTS FREEWAY, HIGHWAY ROUTINGS

Although it took a number of routings under consideration, the California Highway Commission adopted only three freeway routes and one conventional highway route at its March and April meetings.

Freeway routes were adopted in March for eight miles of Sign Route

In April the commission adopted a freeway routing for four miles of Sign Route 25 in the vicinity of Tres Pinos, San Benito County, between 0.1 mile south of Bolado Road and Fairview Road.

The adopted route follows the existing highway except for a slight



89 and one mile of Sign Route 28 in the Lake Tahoe area of Placer County.

### Sign Route 89

For Sign Route 89 the adopted route runs to the west of the present highway and generally parallel with it between the El Dorado county line and 0.2 mile north of the Truckee River, about a mile west of Tahoe City.

For Sign Route 28 the adopted route extends northerly from Sign Route 89 about a mile west of Tahoe City.

Plans of the Division of Highways call for the construction of a four-lane divided "scenic highway" type of highway facility.

Contracts and Rights-of-way, looking toward the selection of a successor to Robert E. Reed.

The duties of acting chief of the division have been assigned in the meantime to Harry S. Fenton, assistant chief.

swing to the north around Tres Pinos. The existing highway runs through the community.

### Conventional Highway

The conventional highway routing is for the relocation of 1.1 miles of Sign Route 1 in Sonoma County in the vicinity of Fort Ross. The adopted route skirts Fort Ross compound on the north and avoids areas of historical interest. The present highway runs through the compound of the historical monument.

The Department of Public Works has awarded contracts totaling \$9,291,324 for the construction of the Sierra Branch Conservation Center near Sonoma for the rehabilitation of prison inmates and the conservation of the State's natural resources. Scheduled to open in the spring of 1965, the new facility will house 1,216 inmates in two dormitories.

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HARRY D. FREEMAN . . . Deputy Director (Planning)

FRANK A. CHAMBERS . . . Chief Deputy Director  
T. F. BAGSHAW . . . Assistant Director  
JOHN H. STANFORD . . . Assistant Director

JUSTIN DuCRAY . . . Departmental Management Analyst  
S. ALAN WHITE . . . Departmental Personnel Officer

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CHAS. E. WAITE . . . Deputy State Highway Engineer  
J. P. MURPHY . . . Deputy State Highway Engineer  
J. A. LEGARRA . . . Deputy State Highway Engineer  
LYMAN R. GILLIS . . . Assistant State Highway Engineer  
J. E. McMAHON . . . Assistant State Highway Engineer  
GEO. LANGSNER . . . Assistant State Highway Engineer  
FRANK E. BAXTER . . . Assistant State Highway Engineer  
J. C. BURRILL . . . Comptroller  
JOHN L. BEATON . . . Equipment Engineer  
C. G. BEER . . . Urban Planner  
L. L. FUNK . . . Planning Engineer  
GEORGE A. HILL . . . Traffic Engineer  
F. N. HVEEM . . . Materials and Research Engineer  
J. F. JORGENSEN . . . Construction Engineer  
SCOTT H. LATHROP . . . Personnel and Public Information  
C. T. LEDDEN . . . City and County Projects Engineer  
H. C. McCARTY . . . Office Engineer  
E. J. L. PETERSON . . . Program and Budget Engineer  
R. V. POTTER . . . Systems Research Engineer  
E. L. TINNEY . . . Maintenance Engineer  
W. L. WARREN . . . Engineer of Design  
A. L. ELLIOTT . . . Bridge Engineer—Planning  
L. C. HOLLISTER . . . Bridge Engineer—Special Projects  
I. O. JAHLSTROM . . . Bridge Engineer—Operations  
DALE DOWNING . . . Bridge Engineer—Southern Area

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DEXTER D. MacBRIDE . . . Assistant Chief  
RAY E. O'BIER . . . Assistant Chief  
R. S. J. PIANEZZI . . . Assistant Chief  
JACQUES T. ZEEMAN . . . Assistant Chief

#### District I, Eureka

SAM HELWER . . . District Engineer

#### District II, Redding

H. S. MILES . . . District Engineer

#### District III, Marysville

ALAN S. HART . . . Assistant State Highway Engineer

#### District IV, San Francisco

J. P. SINCLAIR . . . Assistant State Highway Engineer  
R. A. HAYLER . . . District Engineer  
HAIG AYANIAN . . . District Engineer  
C. F. GREENE . . . District Engineer

#### District V, San Luis Obispo

E. R. FOLEY . . . District Engineer

#### District VI, Fresno

W. L. WELCH . . . District Engineer

#### District VII, Los Angeles

E. T. TELFORD . . . Metropolitan District Engineer  
A. L. HIMELHOCH . . . District Engineer  
A. C. BIRNIE . . . District Engineer  
A. W. HOY . . . District Engineer  
R. E. DEFFEBACH . . . District Engineer

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ARTHUR T. LUDDY . . . Sacramento  
ROGER S. WOOLLEY . . . San Diego  
ABRAHAM KOFMAN . . . San Jose  
FRANKLIN S. PAYNE . . . Los Angeles  
WILLIAM S. WHITEHURST . . . Fresno  
JACK COOPER, Secretary . . . Sacramento

#### District VIII, San Bernardino

C. V. KANE . . . District Engineer

#### District IX, Bishop

C. A. SHERVINGTON . . . District Engineer

#### District X, Stockton

JOHN G. MEYER . . . District Engineer

#### District XI, San Diego

JACOB DEKEMA . . . Assistant State Highway Engineer

#### State-owned Toll Bridges

CHARLES L. SWEET . . . Bridge Engineer

### DIVISION OF CONTRACTS AND RIGHTS-OF-WAY (LEGAL)

HARRY S. FENTON . . . Assistant Chief (Sacramento)  
HOLLOWAY JONES . . . Assistant Chief (San Francisco)  
GEORGE C. HADLEY . . . Assistant Chief (Los Angeles)

HARRY S. FENTON . . . Acting Chief Counsel

### DIVISION OF SAN FRANCISCO BAY TOLL CROSSINGS

NORMAN C. RAAB . . . Chief of Division  
BEN BALALA . . . Principal Bridge Engineer

### DIVISION OF ARCHITECTURE

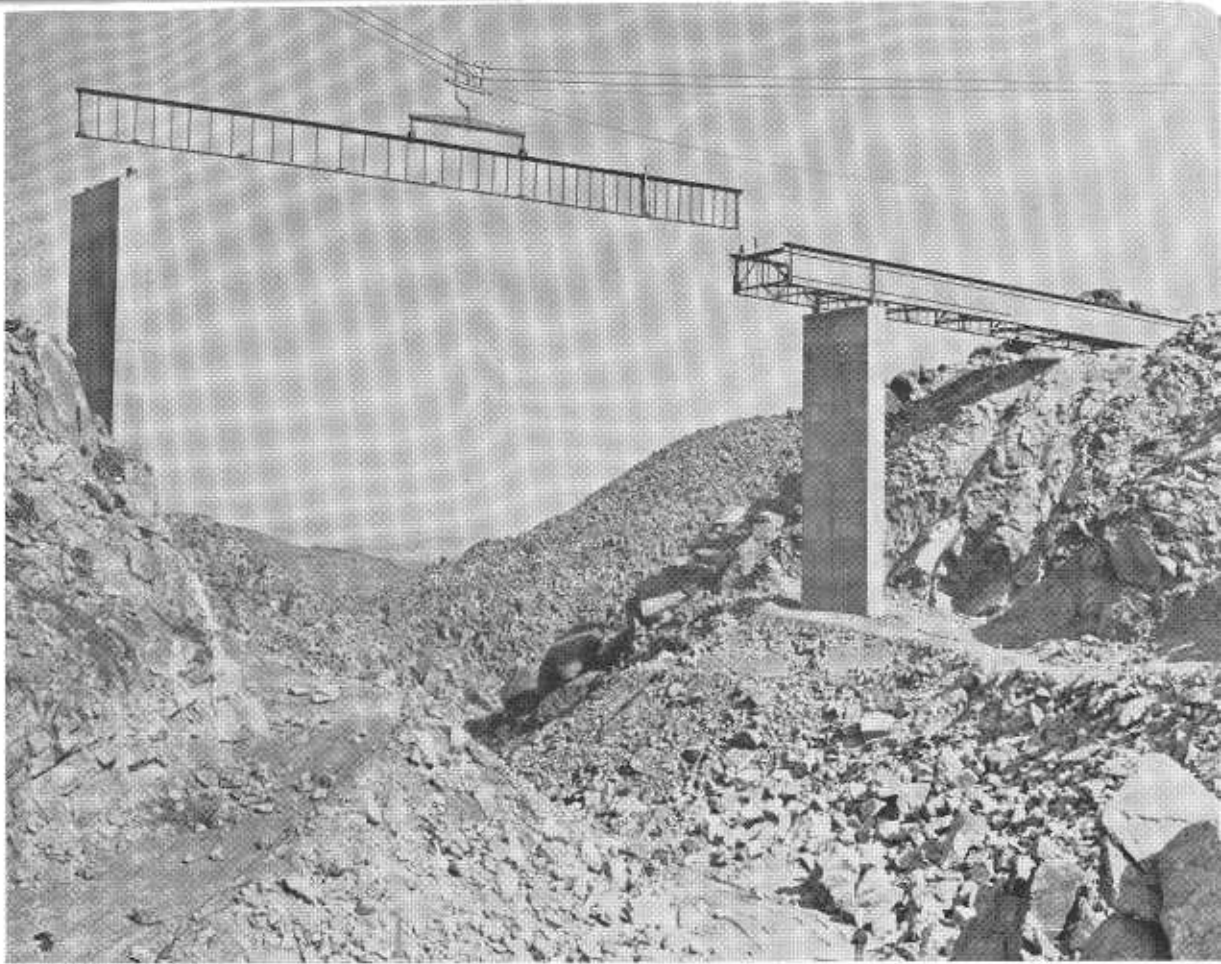
CARL C. McELVY . . . State Architect, Chief of Division

EARL W. HAMPTON . . . Deputy Chief, Architecture and Engineering  
HUBERT S. HUNTER . . . Deputy Chief, Administrative  
MERLE A. EWING . . . Chief Structural Engineer (Schools)

ARTHUR F. DUDMAN . . . Assistant State Architect (North)  
TOM MERET . . . Assistant State Architect (South)  
CLARENCE T. TROOP . . . Chief Construction Supervisor

### DIVISION OF AERONAUTICS

CLYDE P. BARNETT . . . Director, Chief of Division



View of girder placement from canyon floor.

(Continued from inside front cover)  
to move the heavy girders into place was decided on. Steel was moved by truck from the railroad at El Centro, the contractor constructing a special haul road for his vehicles.

The route is a historic one. For centuries Indians used it on their annual trek to the coast for salt. It was used officially for mail as early as 1858 after the federal government discovered the route previously in use passed through Mexico.

A full story on this project will be carried in *California Highways and Public Works* next year, after the job is completed. All photographs are by Robert Dunn, of the Division of Highways Photography Section.

Piers were slip-form construction.



Closeup of girder placement.



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