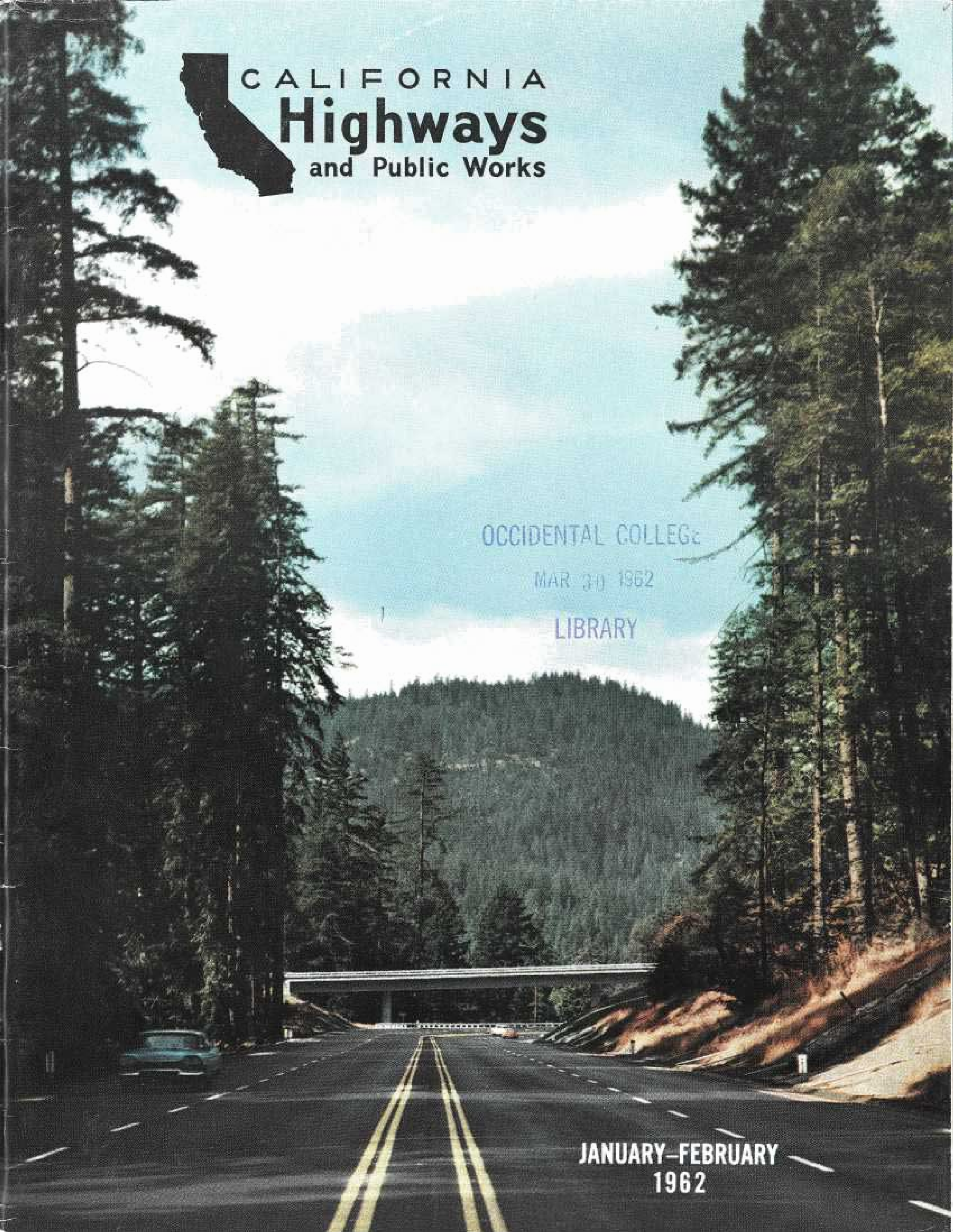
CALIFORNIA Highways and Public Works



JANUARY–FEBRUARY
1962

Advisors on Scenic Highways Study Confer

The Advisory Committee on Scenic Highways held its first meeting in the Public Works Building on December 12, 1961. At right, front to back: Robert W. Graver, representing Edwin S. Moore, San Francisco, Executive Vice President, California State Automobile Association; Charles Perry Walker, Manhattan Beach, immediate past president of the League of California Cities; and Robert Grunwald, Hanford, planning consultant. Seated at table, left, front to back: Deputy Director of Public Works Harry D. Freeman, representing the State's previously organized Inter-Departmental Committee on Scenic Highways, of which he is chairman; Lawrence Livingston, Jr., San Francisco, planning consultant; Dee W. McKenzie, Chief of the Highways and Bridge Division, Sacramento County Department of Public Works; and Harry Schmidt, Gustine, immediate past president, County Supervisors Association of California. (Procter Melquist of Menlo Park, editor of Sunset Magazine, was not present). In the background are staff members of the State Division of Highways, Department of Water Resources, Office of State Planning, Department of Parks and Recreation and the U.S. Bureau of Public Roads. The committee was appointed by the Speaker of the Assembly and the President pro Tempore of the State Senate in accordance with Senate Concurrent Resolution 39 of the 1961 Legislature. It is acting in an advisory capacity to a previously appointed interdepartmental committee which is preparing a report for the Legislature, to be submitted in March, 1962.

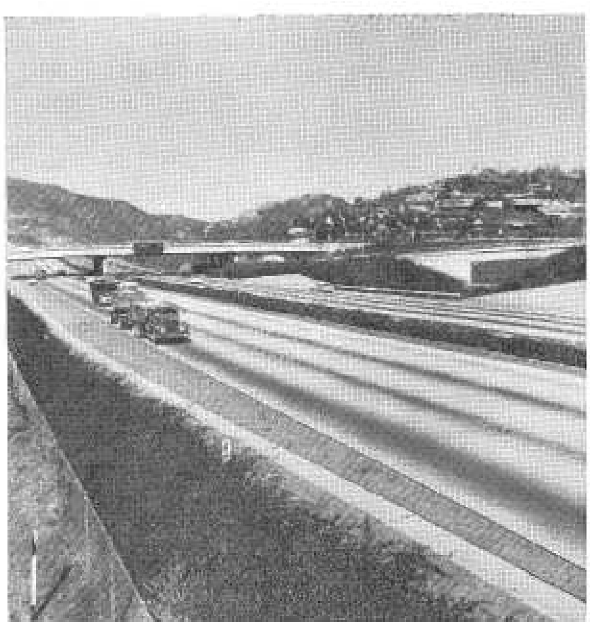
California Highways and Public Works

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

Vol. 41 January-February 1962 Nos. 1-2

FRONT COVER—Typical of freeway development in the scenic Redwood Parks area of US 101 in Humboldt County, is this view along the recently opened stretch between Myers Flat and south of Dyerville. The structure across the freeway is the Pesula Road Overcrossing. The old highway, located just west of the freeway and closer to the South Fork of the Eel River, remains in service for leisurely driving through the redwoods. (Article on page 3).

BACK COVER—Looking along a landscaped portion of the San Diego Freeway (Interstate Route 405) in the West Los Angeles area. The Sunset Boulevard overcrossing is in the center. Work is progressing to extend the freeway through the Santa Monica Mountains in the background. (Article on page 45). Both photos are by Bob Dunn.



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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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CONGRESSMEN INSPECT CALIFORNIA'S HIGHWAYS

Members of House Committee on Public Works on tour of inspection of civil works and highway projects in California during October of last year make a stop at Jackson, Amador County.

TOP ROW (left to right): A. Garbarini, Publisher, Amador Ledger; John Meyer, District Engineer, State Division of Highways; Howard Anderson and Sheridan Farin, U. S. Bureau of Public Roads; J. C. Womack, California State Highway Engineer; Joseph Brennan, Staff Engineer for Committee; and T. F. Bagshaw, Assistant Director, State Department of Public Works.

SECOND ROW: H. Sherwood, Division of Highways, Marysville; Chas. E. Gordon, President, Jackson Chamber of Commerce; Congressman Walter McVey, Kansas; Congressman Frank Burke, Kentucky; Congressman Harold "Biz" Johnson, California; Congressman Kenneth Gray, Illinois; and R. S. O'Connor, in charge of transportation.

BOTTOM ROW: Alan Hart, District Engineer, State Division of Highways, Marysville; State Senator John Begovich, Jackson; Mrs. Frank Burke; Mrs. Kenneth Gray; Mrs. William Harsha; Mrs. Joseph Brennan, Committee Staff Member; and Congressman William Harsha, Ohio.

Other Congressmen in party, but not shown in photograph: Clifford Davis, Tennessee; John Baldwin, John McFall, Clem Miller, John Shelley, and William Mailliard, all of California.

Franklin Payne Named to Highway Commission

Governor Edmund G. Brown has appointed Franklin S. Payne, veteran newspaper executive and former publisher of the Los Angeles *Examiner*, to the California Highway Commission.

Payne succeeds Robert E. McClure of Santa Monica, who had served on the commission since January, 1954.

The new commission member has been a resident of Los Angeles since 1933, when he was appointed to organize and direct national advertising on the West Coast for the Hearst publications. His overall career with Hearst Consolidation Publications, Inc., covers 41 years. His earlier posts were in Chicago and Detroit.

In 1955 Payne was named publisher of the *Examiner* and served in that capacity until the paper closed early in January 1962. He retired from the Hearst organization on January 15, but is still active in an automobile dealership in Glendale and in other business affairs.

A native of Richland, Iowa, he attended public schools in Chicago. He served in the Army Air Corps in World War I.

Funds Allocated for State Forest Roads

The California Division of Highways, the U.S. Forest Service and the U.S. Bureau of Public Roads have announced the allocation of federal forest highway funds for California for fiscal year 1963 (which begins July 1, 1962).

Funds were allotted for the following construction projects:

$1,200,000 to Forest Highway Route 2, Klamath River Highway, Humboldt County, for grading and surfacing of four miles of State Sign Route 96 between 8 miles and 12 miles north of Weitchpec.

$960,000 to Forest Highway Route 21, Butte County, for grading and surfacing on four miles of State Sign Route 32 between five miles and nine miles northeast of Forest Ranch.

$200,000 to Forest Highway Route 24, Sierra County, for surfacing of six miles of county road between Bassetts and Gold Lake.

$150,000 of additional funds to previously programmed project on Forest Highway Route 35, Calaveras County, for grading and surfacing of 6.8 miles of State Sign Route 4, Ebbetts Pass Highway, between five miles east of Dorrington and Ganns Meadows.

$1,300,000 to Forest Highway Route 48, Fresno County, for grading of 2.5 miles of State Sign Route 168 between Pine Ridge and 2.5 miles west.

$750,000 to Forest Highway Route 62, Los Angeles County, for grading and surfacing on 1.7 miles of State Sign Route 39 near Crystal Lake.

The number of abstracts of court convictions of persons found guilty of violations of traffic laws received by the Department of Motor Vehicles during November was 238,266.

Redwood Freeway

7½-mile Section Offers Convenience, New Vistas

By H. W. BENEDICT, Resident Engineer

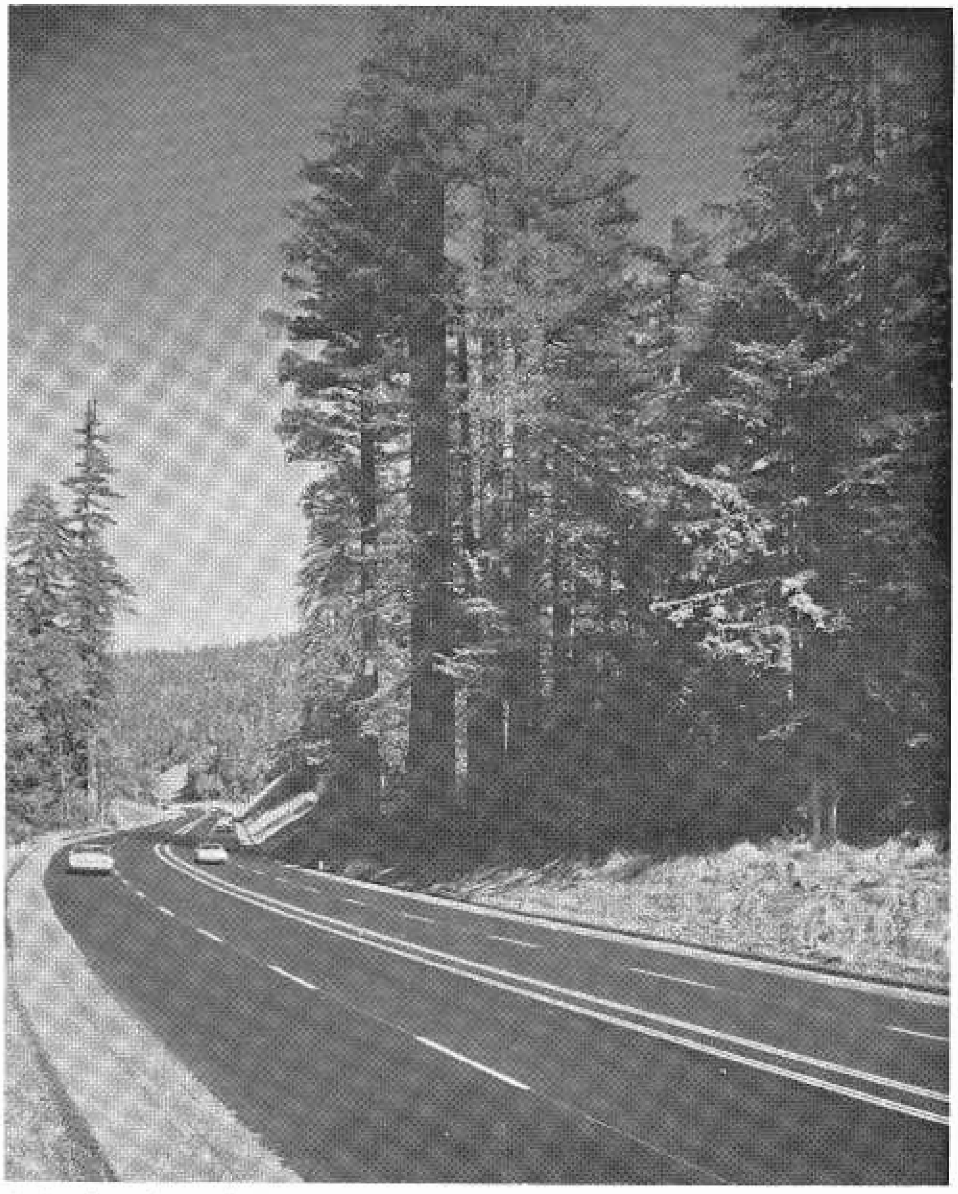
On October 18, 1961, impressive opening ceremonies, attended by many local and State dignitaries, marked the sucessful completion of the second unit of the Redwood Parks Freeway. This unit, extending from Myers Flat on the south to 0.6 mile south of Dyerville, provides an additional 7.5 miles of modern freeway through the beautiful redwood region. Connecting as it does with the first unit of the Redwood Freeway on the north, it provides the highway user with a continuous 12 miles of high-speed four-lane highway, superseding a portion of the originally constructed Redwood Highway.

An over-all picture of the Redwood Parks Freeway was given in an article by Sam Helwer, District Engineer, in the July-August, 1958, issue of *California Highways and Public Works.* As pointed out in this article, the ultimate completion of the Freeway will provide a 44-mile drive of scenic highway through the Redwood country extending northward from the Mendocino-Humboldt county line. This facility will not only provide greater safety, comfort, and convenience for the traveler but also new and exciting vistas of the world-famous redwood groves. Frequent connections to the former two-lane highway, now designated "Avenue of the Giants," will give opportunity for the more leisurely traveler to travel this picturesque route through the groves.

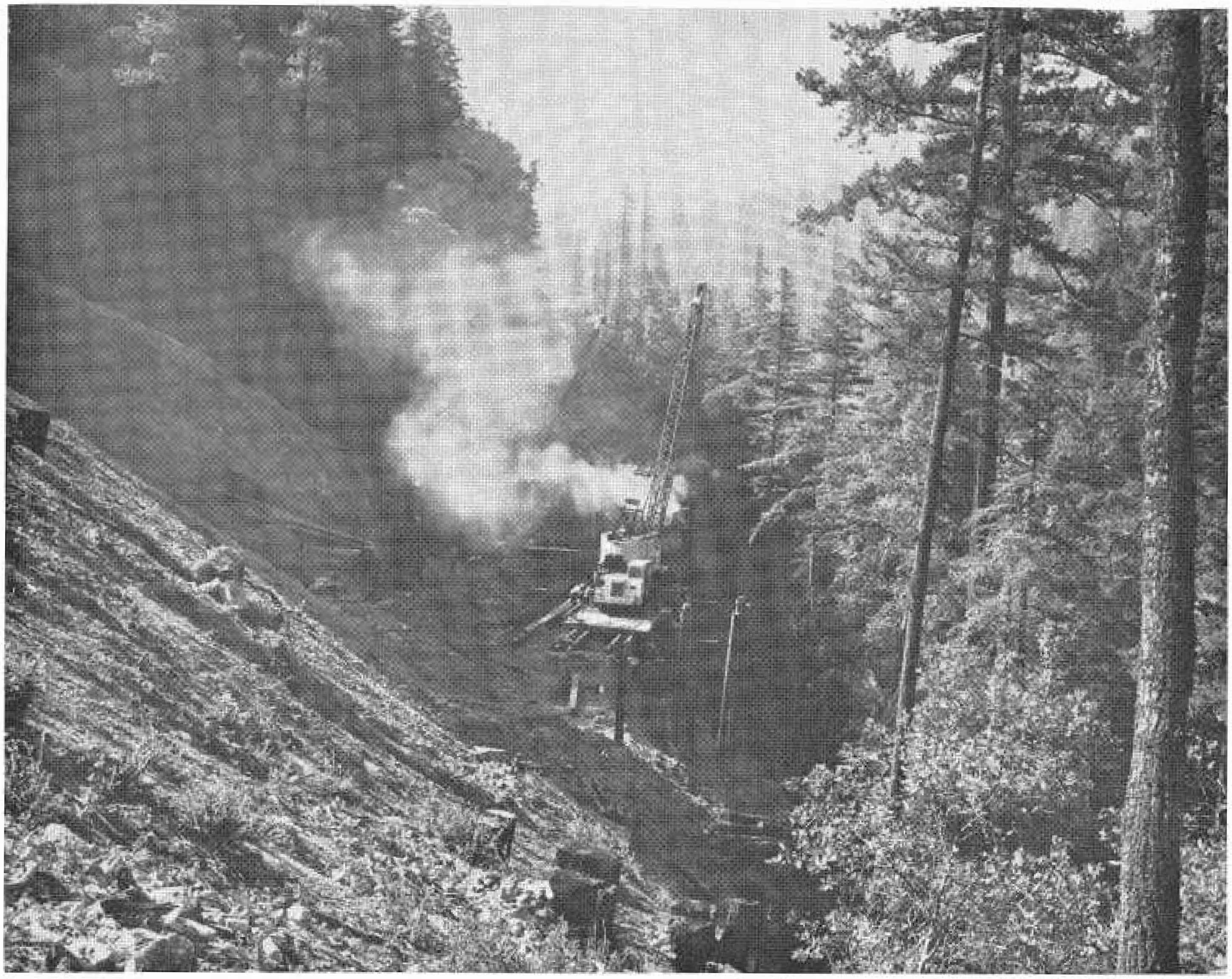
Second Unit Completion

Three contracts were required to bring the construction of the 2nd unit to completion. The first, awarded to Don F. Shuster Co. in August of 1958, provided for the clearing of the right of way. This contract was let separately for several reasons. Primarily, it allowed specialist logging contractors to bid on the complex and difficult "logging" contract.

Some idea of the enormity of this phase of the work is obtained from the quantities involved in the contract; over 160 acres to be cleared and over 6 million board feet of Douglas fir and redwood logs to be removed from the right of way. It also allowed for more balanced financing of the project and insured an earlier completion of the entire facility since it enabled the contractor to work through the winter season of 1958-1959.



A view of recently completed unit No. 2 of the Redwood Parks Freeway (US 101) in Humboldt County between Myers Flat and Dyerville. The traveler now enjoys the comfort and convenience of a modern freeway for 12 continuous miles through the redwood empire as well as spectacular new vistas.



Construction begins on the Eagle Point Viaduct section of the Redwood Parks Freeway south of Myers Flat.

This contract was completed in June, 1959 at the final cost of $251,000.

The second contract was let to John W. J. Petersen and provided for the construction of a 540-foot-long reinforced concrete arch culvert in Mowry Creek. This contract was let in September, 1958 and was completed in July, 1959 at the final cost of $125,690.00.

Mowry Creek is the largest drainage area on the 2nd unit of the freeway and is the site of the largest through fill on the job.

Major Contract Let

The major contract to grade, pave and construct the structures on the 7.5-mile stretch of freeway was let in June, 1959 to Morrison-Knudsen Company, Inc., Seattle District. This firm successfully completed the work a month ahead of schedule. This contract, completed with the expenditure of over $5,600,000, provided for all the remaining work not covered in the two preceding contracts.

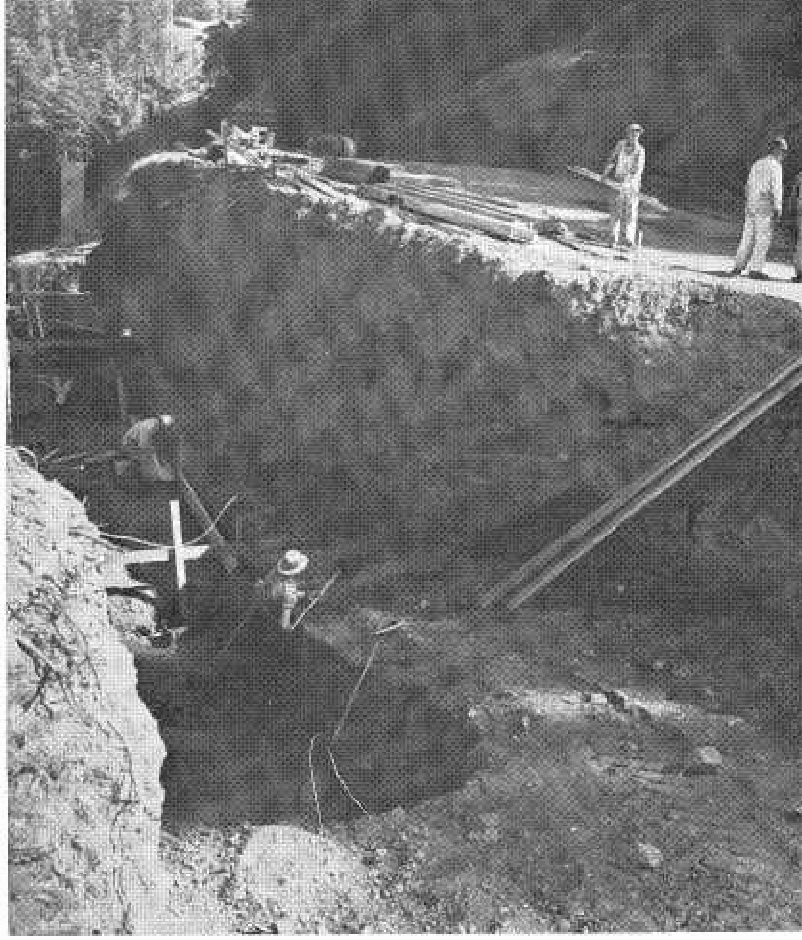
The typical section is the same used on the first unit of the Redwood Freeway and on all mountain sections in District I. Basically, it is the 60-foot all-paved section with modifications for special drainage conditions. Structurally, the constructed section consists of 1.00 foot of imported pervious subbase, topped with 0.66 foot of cement treated base with 0.29 foot of plant mixed surfacing completing the section.

The alignment of the newly completed unit traverses the South Fork of Eel River canyon and is easterly and upslope from the old road. Particular care was taken in the selection of the alignment so as to pass through the many redwood groves in the area with the least disturbance to these last remaining monarchs of a former age. This essential of location, coupled with the extreme rugged nature of the terrain and its generally unstable structure led to many difficult problems in the design and construction of this unit.

Unstable Ground

The unstable nature of the ground traversed by this facility is attested by the quantities involved in stabilization of the embankment areas. Approxi-

A girder is hoisted into position on the new bridge being constructed across the South Fork of the Eel River.



A view of construction now under way on a section of the Eagle Point Viaduct on US 101 south of Myers Flat.

This photo gives some idea of the amount of subsurface water that must be contended with in areas of heavy rainfall such as this section of US 101. Here horizontal drains in a potential slide area carry off water to relieve hydrostatic pressure and lubrication of the earth mass.

mately 545,000 cubic yards of trench and stripping excavation were required to provide for better fill foundations, and over 245,000 tons of filter material was placed for this same purpose. Final quantities show that over 10 miles of perforated metal pipe were placed and over 95,000 linear feet of horizontal drains were installed in the wet sidehill slopes.

To complete the grading on the contract it was necessary to move over 2,800,000 cubic yards of roadway excavation. This material, ranging from soft clays to fractured sandstones, was used to construct the large embankments on the work; in so doing over 30,000,000 station yards of overhaul was performed by the hauling equipment. Approximately 58,000 tons of aggregates were mixed with 2,750 tons of paving asphalt to make the plant mixed surfacing for the project.

Four bridges were constructed, all being separation structures at the various crossroads and at the Weott interchange area. Two of the structures are three-span box girder bridges, one a tee beam and the last a flat slab structure. The Weott Undercrossing forms an integral part of the Weott interchange, the only complete interchange on the contract. The total cost of the four structures is slightly over $435,000.

Another interchange is planned at the south end of the facility near the town of Myers Flat. All grading and a part of ramp construction was completed in this area under this contract. In addition to the interchanges, private access roads were reconstructed and frontage roads were built.

Construction Restricted

With the exception of private holdings near the towns of Myers Flat and Weott, the new construction traversed lands under control of the Division of Beaches and Parks. Construction through this area was restricted to the cleared area to protect the adjacent forest cover and giant redwoods from damage. Despite the obvious handicaps to normal construction, the contractors were able to maintain these high standards of protection and to preserve the famous groves from damage.

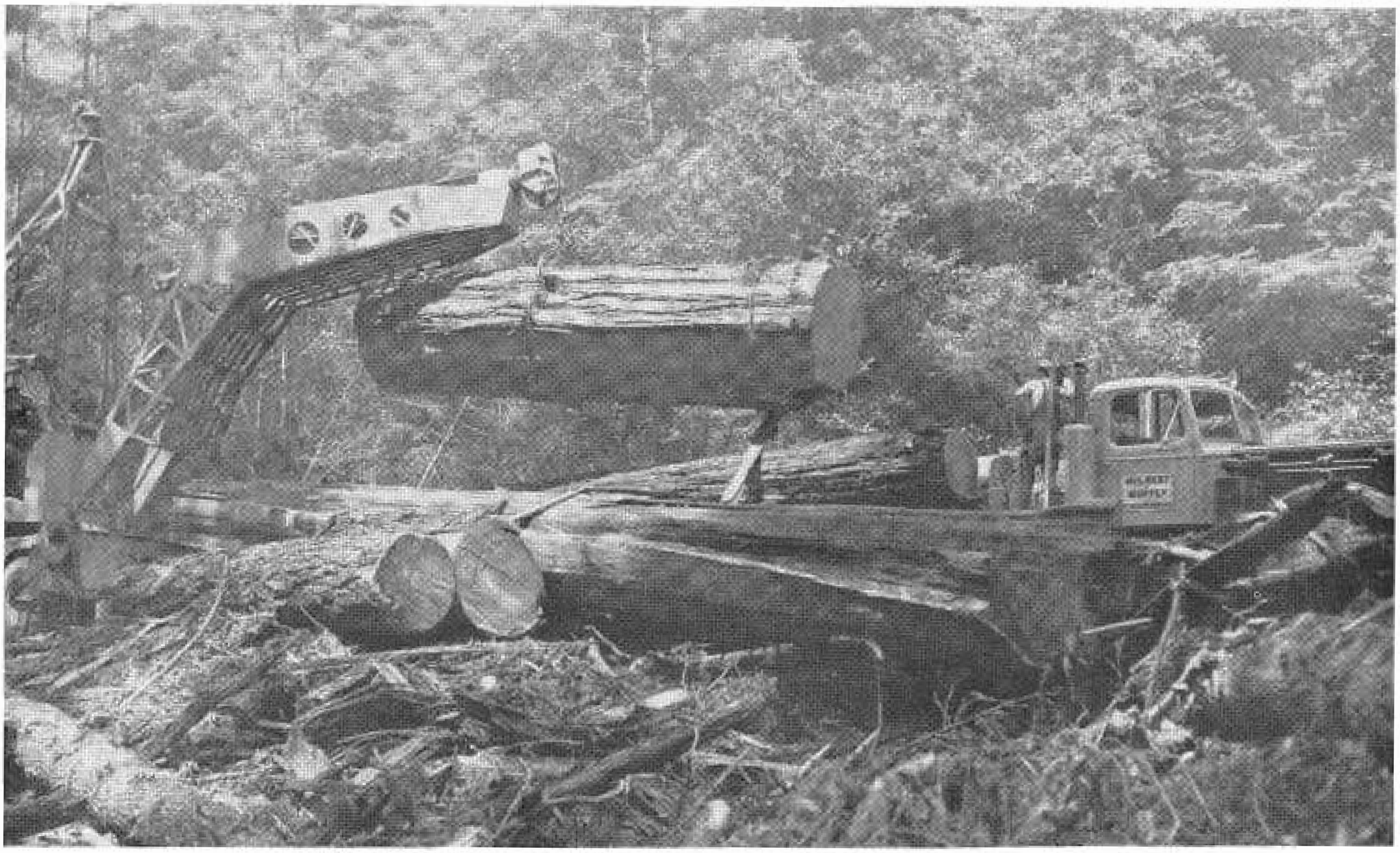
The project schedule carried the work through the winter seasons of 1959-1960 and 1960-1961. Heavy winter storms, particularly in the first winter season, coupled with the generally unstable nature of the terrain, caused heavy slides in practically all the major excavation areas. Over 500,000 cubic yards of slide material was removed from the work and disposed of in various areas.

Extensive reconstruction of failed slopes was necessary and in several areas weakened slopes were reinforced with buttresses of heavy cobble rock. This method of construction, though not new, was unique in that it effectively used the large reject boulders from the contractor's screening plant, material that is ordinarily wasted. In brief, the method of reinforcing the slopes was as follows:

Slopes Undercut

The cut slopes were undercut by at least 10 feet normal to the slope. In all instances, heavy ground water was present in these cuts; consequently, a 3-foot layer of filter material was then placed on the slope, draining to perforated pipe placed in trenches at the normal toe of slope. The slope was then reconstructed with the cobble rock, placed by loaders, clamshell cranes or other convenient methods. The filter blanket is considered essential to the treatment as the cobble rock would probably become contaminated in but a short period of time without this protective blanket.

Rainfall is heavy in this section, averaging between 60 and 70 inches a year. Consequently, particular attention was paid to the design and the installation of drainage facilities. In addition to the concrete arch in Mowry Creek, four other major drainage channels were provided with field assembled metal plate culverts ranging from 5 feet to 6½ feet in diameter. Several miles of conventional corrugated metal pipe culverts were installed to take care of the customary relief drainage. In several areas, extensive ditches, shoulder widening, and



Construction of the freeway involved heavy clearing and the use of heavy logging equipment.

special collecting structures were constructed to minimize the damage from winter runoff.

Even before the completion of this important second link of the Redwood Parks Freeway, work was under way on the third unit. This third unit, extending from Sylvandale on the south to Myers Flat will add another 11 miles of four-lane freeway to the system when completed. For the same reasons of financing, orderly construction, etc., this unit was also divided into several contracts.

Bridge Contract Awarded

The first, for construction of a bridge across the South Fork of Eel River at Myers Flat, was awarded to Stolte Company in July, 1960. This contract, in the amount of $1,100,000, provides for the construction of a welded steel girder bridge over 825 feet in length and also for construction to subgrade stage of 2,000 feet of roadbed to serve as a southerly approach to the structure. Work on this contract, under the direction of L. C. Allen, Bridge Department Resident Engineer, is well ahead of schedule with completion expected early in the 1962 construction season.

The second contract, for clearing that portion of the third unit covered with heavy timber, was let in August, 1960. Don F. Shuster Co. was again successful in bidding for this work and completed the contract in October, 1960 at the final cost of $70,000.

The third contract was awarded to Ball and Simpson in June of 1961. Work on this $6,000,000 contract is being completed by a joint venture of Ball & Simpson and Slate-Hall Co. This contract, when completed, will extend the freeway southerly to Maple Hills bridge, near Miranda, where a temporary connection will be constructed to connect the new facility to the old road. This temporary connection will utilize an existing county-owned bridge across the South Fork of Eel River at Maple Hills.

Work is progressing rapidly on this 5.6-mile section of the third unit, with completion possible late in 1962. Over half of the 2,200,000 cubic yards roadway excavation has been moved and work is ahead of schedule on the five structures on the job.

The freeway traverses rugged and heavily wooded terrain as can be seen from this aerial photo.

Viaduct Structure

Of particular interest on this contract is the Eagle Point Viaduct structure. This bridge, made necessary when designs studies showed that neither cuts nor fills could be constructed in a steep sidehill location without astronomical costs, is located about a mile south of Myers Flat. Its south abutment is on Eagle Point ridge, the site of the largest cut on the contract where approximately 800,000 cubic yards of material will be removed.

The 1300-foot-long steel girder bridge also has an unusual bent design. Each bent consists of two columns 5 feet square. These columns, due to poor foundation conditions, extend as much as 40 feet into the ground in lieu of the conventional pile or spread footing foundation treatment. In each case, the extended columns were poured against the natural ground in holes dug to neat lines and extending well into bedrock.

The State Highway Commission has included in the 1962-63 budget funds for the final and southernmost contract on the third unit of the freeway. This contract will provide for the construction, including bridges, from Sylvandale to the southerly end of the Ball and Simpson contract at Maple Hills, a distance of about six miles. It is expected that this work will be let to contract early in the 1962 construction season.

In the May-June, 1958, issue of *California Highways and Public Works*, Norman G. Larsen, Project Designer on the first unit of the Redwood Parks Freeway, explained why it was necessary to route the new freeway so as to avoid the level river flats, the location of the stately redwood groves.

As a result of this radical departure from the old highway, that winding, scenic road was left untouched. Consequently, it furnishes an alternate to the new freeway, available to those travelers who wish to travel a more leisurely pace through the beautiful redwood forests. Recognizing the scenic beauty of the superseded portion of the Redwood Highway, the California State Legislature has aptly designated this route as the "Avenue of the Giants."

However, this is not to say that the new freeway is not without beauty. In fact, the more breathtaking vistas of the beautiful redwood forests furnished by this facility have proven to be an extra bonus. Due to the higher elevation of the freeway and its width of clearing, the traveler is able to view new, exciting panoramas of these mighty monarchs. Thus, an early prediction of the original designers has been proven correct; that mountains can be removed, rivers changed in their course, and some redwood giants removed to provide a full freeway and still preserve the awe-inspiring scenic wonder of the area.

Scene during construction, Donner Lake Undercrossing, US 40 and Interstate 80, on new alignment north of Donner Lake.

US 40

Sacramento to Nevada Section Now Has 99 Miles of Freeway and Expressway

By ALAN S. HART, District Engineer

Since our last report on the conversion of US 40 to freeway between Sacramento and the Nevada state line (November - December 1959 *California Highways and Public Works*), two more sections of divided freeway totaling 13 miles have been completed.

Of the total 120 miles, 99 are now four or more lanes on the former emigrant wagon trail which is now a part of Interstate 80. And all 99, except for 14 miles from Auburn east are full freeway. That section requires about a dozen interchanges to provide complete access control and elimination of intersections at grade.

Opened November 1960 was the 7.8-mile project from east of Baxter to west of Emigrant Gap. A. Teichert & Son, Inc. of Sacramento was contractor for the $6,000,000 undertaking.

In November 1961 the 5.1-mile stretch from west of Monte Vista to east of Baxter was opened. Its cost was $5,300,000 and Madonna Construction Co. of San Luis Obispo was the contractor.

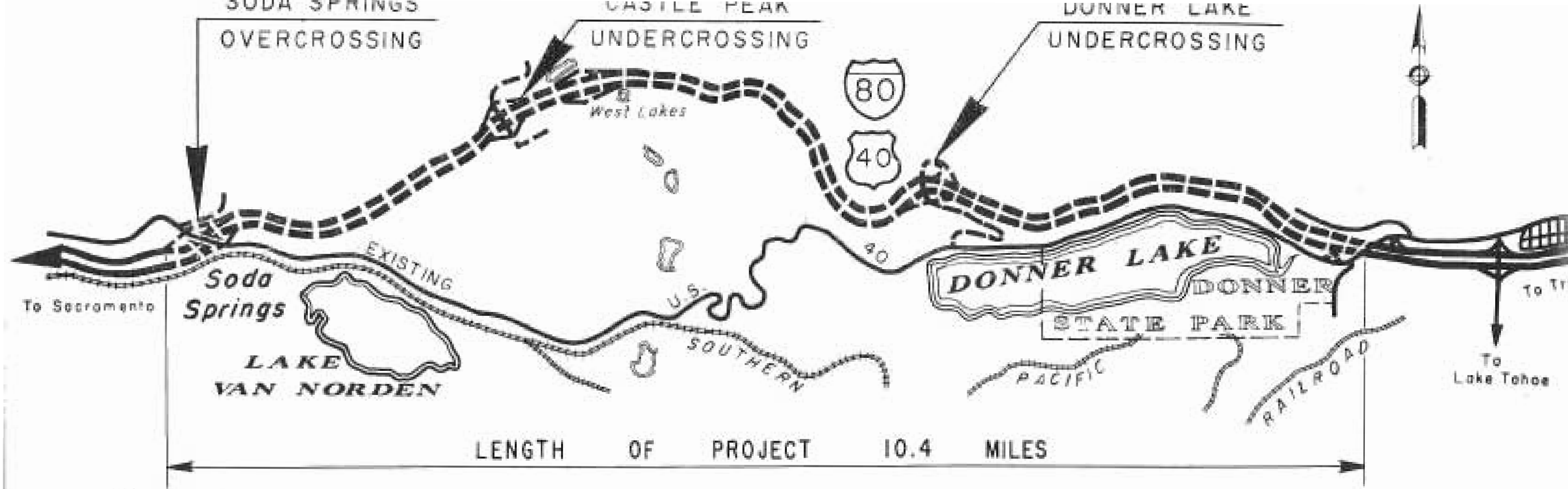
With the completion of these two sections, the California motorist can now enjoy a total of 72 miles of uninterrupted freeway and expressway of four or more lanes from Sacramento to Emigrant Gap.

26 Miles Converted

Of the 48 miles from Emigrant Gap to Nevada, 26 have been converted to freeway and construction or clearing is now underway on all the remaining 22 miles.

The 5.4-mile section from Emigrant Gap to the junction of State Sign Route 20 started in July 1961 on the

Recently opened new Interstate Section of US 40/Interstate 80 just above Monte Vista. Southern Pacific Lines run diagonally across photo above highway, in foreground is Towle interchange.



Map of new alignment for Donner Pass. New route crosses summit about two miles north of present summit, in vicinity of West Lakes. Diamond interchange at this point is provided for access to roadside rests at either side of highway when funds are available.

Looking west from outskirts of Truckee along US 40 Donner Lake at left and old Donner Summit upper left. Old roadway closely follows northern shore of lake, new alignment gradually gains altitude up ridge at right, then swings north and west again.

$7,983,500 low bid of Guy F. Atkinson Co. of South San Francisco—the largest contract ever awarded in this district.

Like the completed Hampshire-Rocks-to-Soda-Springs job, this section and the adjacent one will feature two separate roadways mostly on two levels, with the median width varying with the terrain. A full interchange will be built at the SSR 20 junction. Present estimates place completion in the latter part of 1963, depending on weather and availability of materials.

Clearing is in progress on the adjoining 6.3-mile stretch from the SSR 20 junction to Hampshire Rocks. This is a separate $273,000 contract with Hubner & Michner, Inc. of Denver to take advantage of the winter-spring burning season.

For construction, $10,400,000 has been set up in the 1962-63 State Highway Budget, and bids are expected to be advertised some time this spring. At least two and probably three construction seasons will be required to build this section of freeway through the rocky, mountainous country.

Most Challenging Problem

Most challenging as a design problem and most spectacular as an engineering and construction feat is the 10½-mile realignment over the formidable Sierra summit from Soda Springs to the east end of Donner Lake about two miles west of Truckee.

The 21 miles from there to the Nevada line has been completed.

Divided into three contract units for construction purposes, and underway for over a year, the summit section will replace the famous, although narrow and circuitous Donner Summit Highway which winds steeply up the easterly face of the solid rock spine of the Sierra ridge.

Work started May 1961 on the grading and structures of the 3.4 miles from the freeway at Soda Springs to the summit under a $2,377,700 contract with Guy F. Atkinson, and work has been going since July 1960 on the seven miles from the summit to the freeway at the east end of the lake. The joint venture firm of J. W. Briggs of Redding, and J. N. Conley and G. D. Dennis & Sons, both of Portland, Oregon, holds this latter $7,423,100 contract. Both jobs are expected to be completed before the end of this year.

Third phase will include the base and surfacing of the entire summit crossing for which an estimated $5,500,000 is required. Present scheduling calls for completion of the entire section in 1965.

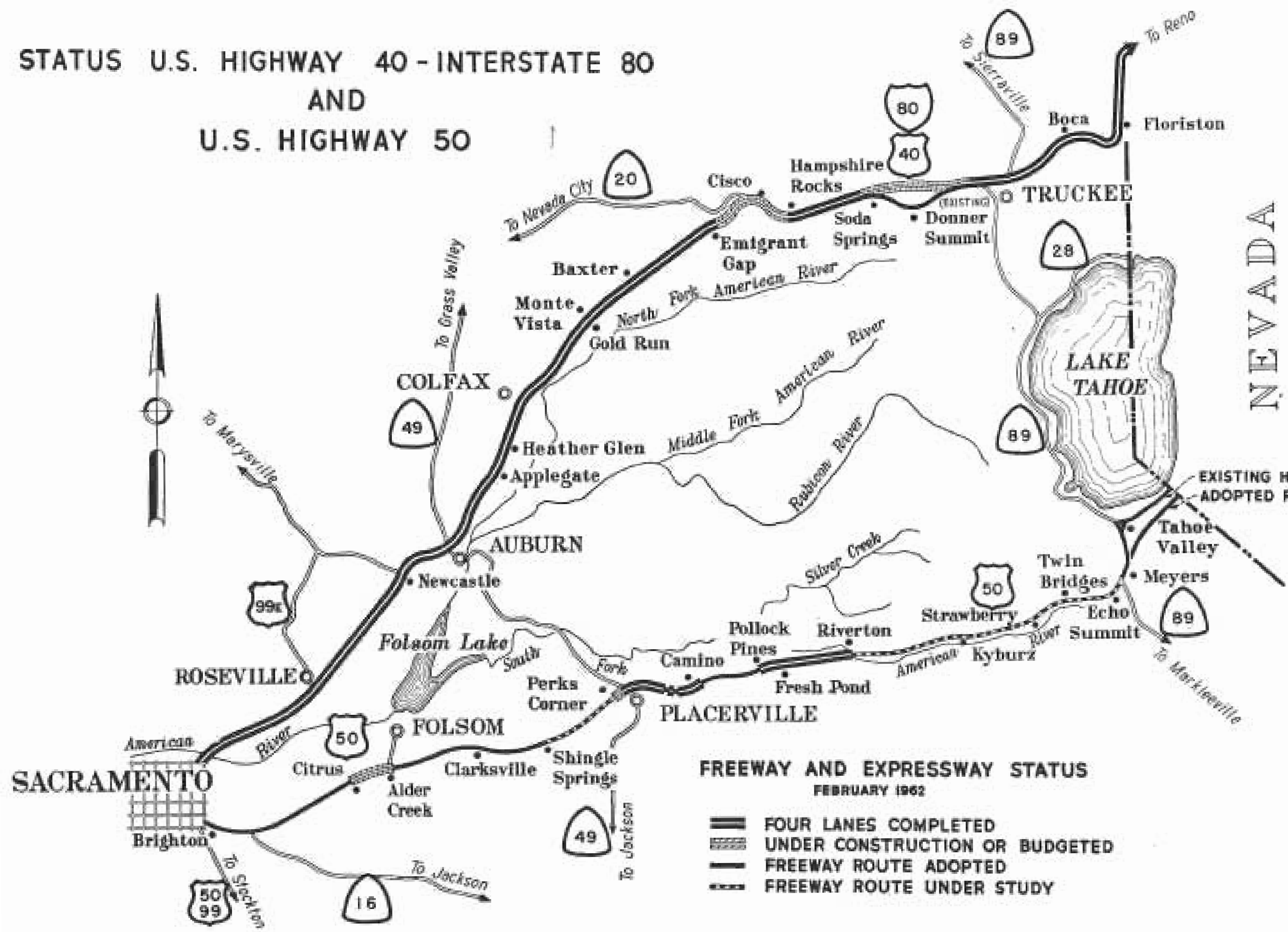
Separate Roadways

At its farthest point the new route will run about 1½ miles north of the existing highway on sweeping curves with a maximum 5 percent grade uphill and 6 percent down. Each two-lane roadway will be a separate highway with varying vertical and horizontal distances between centerlines.

A third lane will be built for slow-moving uphill vehicles, and a view-point vista will offer a dramatic view of Donner Lake and the craggy face of the Sierra.

Although it will peak 100 feet higher than the present road (7,135 vs. 7,239), the new alignment will be more sheltered from the high winds often encountered at the Sierra top,

Aerial view in reverse to one on opposite page shows new alignment swinging north and climbing ridge, while old alignment, just visible middle right continues over summit.

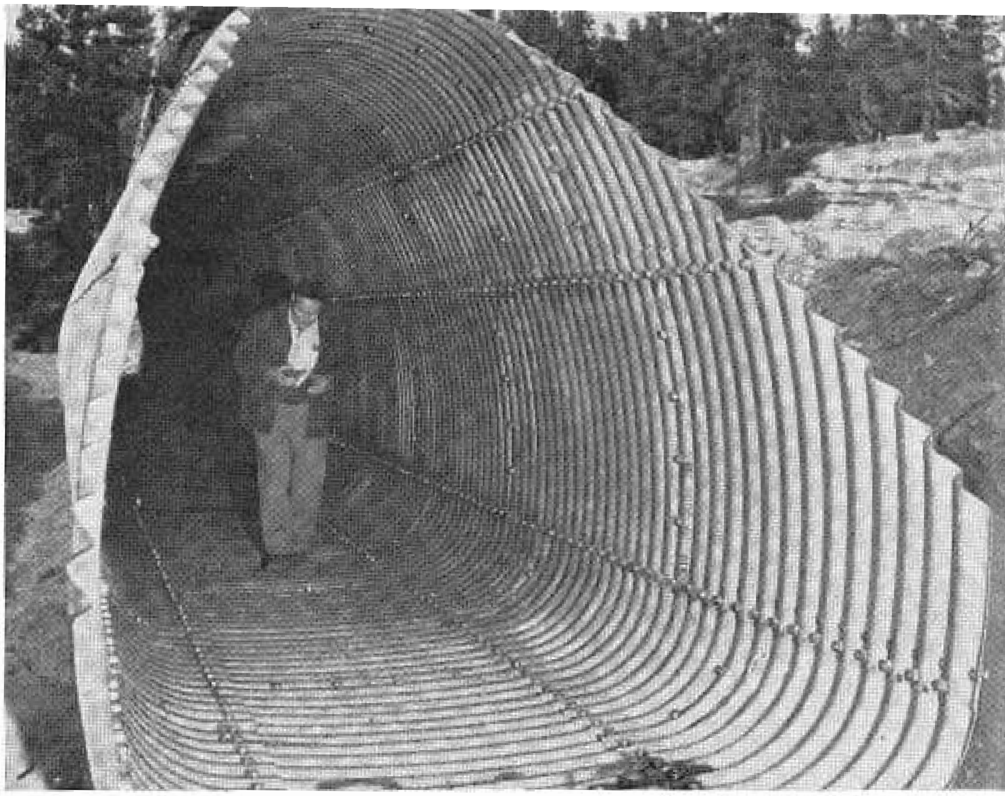


which cause a serious snowdrift problem in winter.

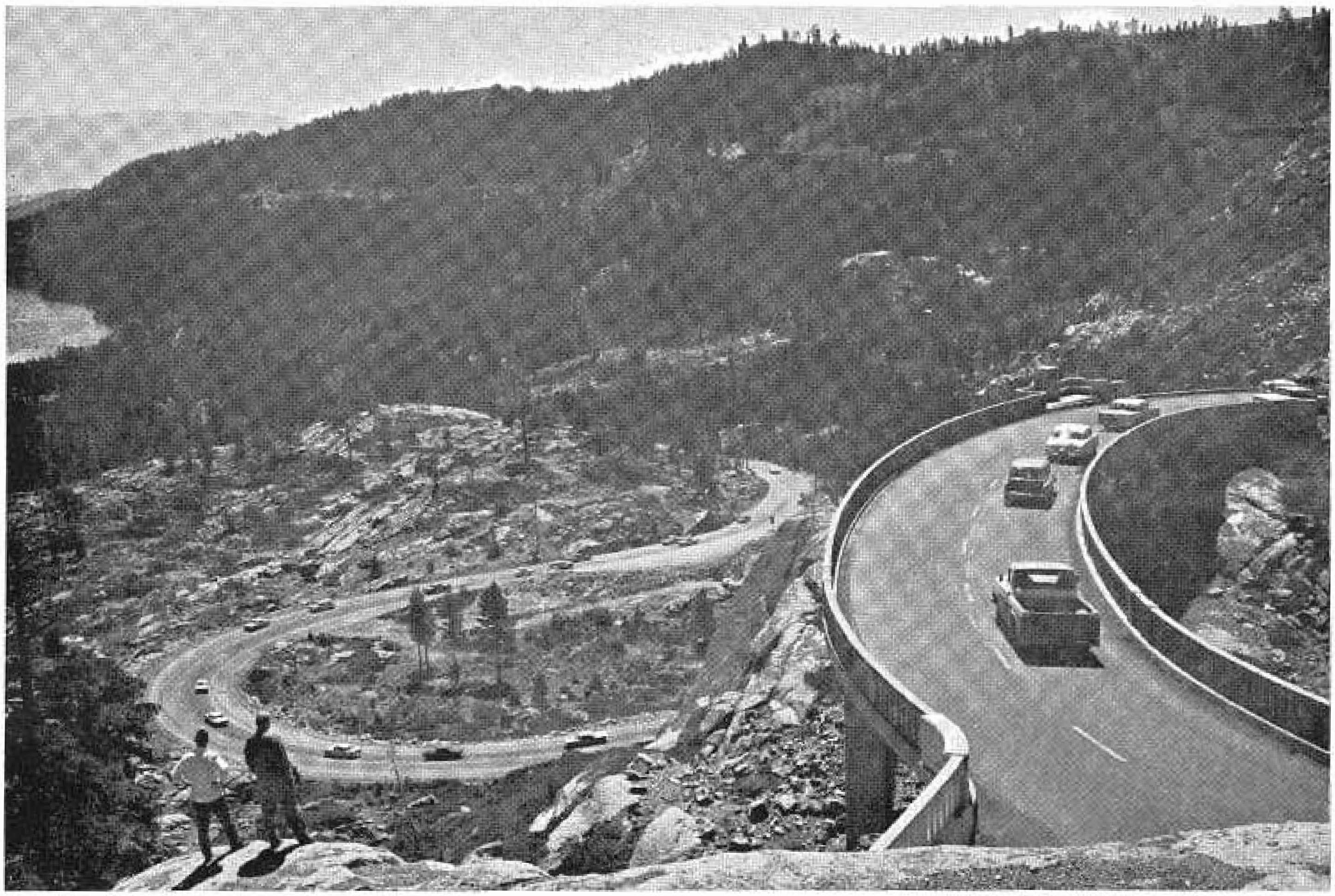
Other recent activity on the transcontinental highway was the million-dollar widening project on the North Sacramento Freeway completed in December. This work expanded the facility to eight lanes between Arden Way and El Camino Avenue, and to six lanes from there to Marconi Avenue, a total of 1.6 miles.

Underway at the present time are two contracts totaling $37,233 for median planting and trees at seven structures on 7½ miles from Roseville to Penryn Road, and for landscaping at the Colfax interchange.

In addition to the conversion of the expressway north of Auburn to freeway, long-range future planning also includes widening the entire route to a minimum of six lanes from Sacramento to the vicinity of Weimar.



Bolted steel plate undercrossing, 7 feet wide, 9 feet high, goes beneath both lanes of freeway near summit, serving riding and hiking trail. Bottom will be paved.



Old Donner Summit road climbs sheer scarp in series of tortuous S-curves, difficult to negotiate and dangerous in winter.

San Gorgonio Pass

New $5,500,000 Freeway Ends Traffic Problem

Completion of a $5.5 million project for freeway construction by Matich Constructors and W. F. Maxwell Co. ends a recurrent traffic problem in San Gorgonio Pass.

Peak flows between the Los Angeles metropolitan area and the Palm Springs-Coachella Valley resort areas have suffered congestion in the pass area, because of the necessary traffic signal controls through Beaumont. This project, which extends the freeway westward from Banning to the junction of U.S. 60 and U.S. 70-99 just west of Beaumont, provides six lanes of pavement for these major transcontinental routes. It is also a portion of Interstate 10.

With completion of this project, Interstate 10 is now built to full freeway standards for the 85 miles from Los Angeles to Banning, with the exception of 11 miles under construction in the Redlands area. The two contracts under way in and near Redlands are expected to reach completion in September 1962.

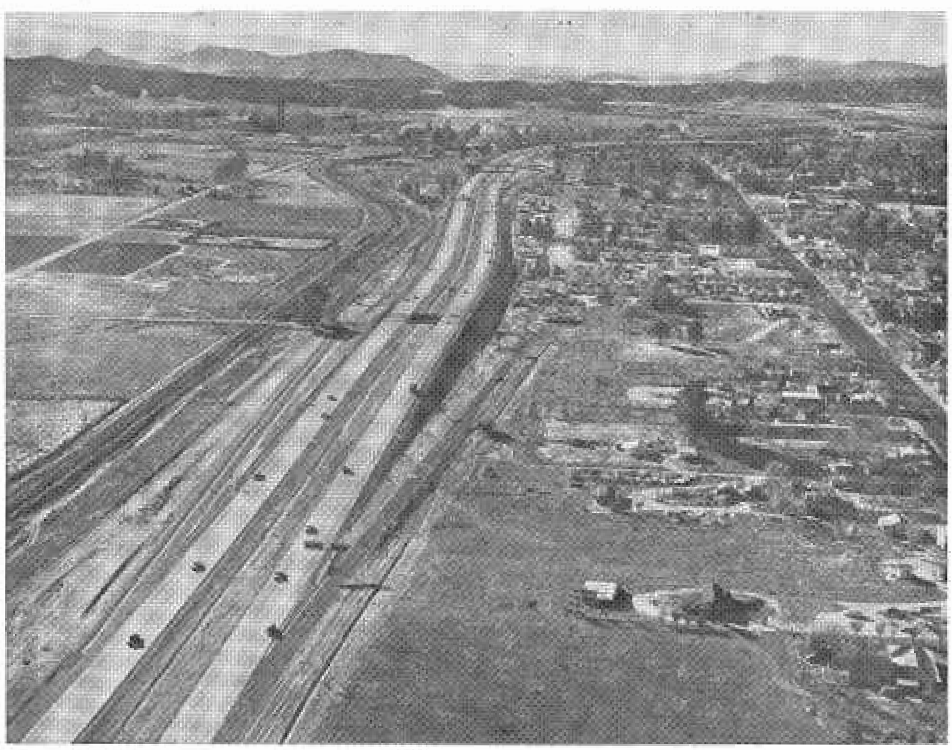
Extension of the freeway for six miles east of Banning is provided in the current state highway budget, with construction expected to begin this summer.

The new freeway lanes were opened to traffic in August 1961. A short detour has remained in place near the Ramsey Street Interchange in Banning, while modifications were made to convert the former left side off-ramp to a right side off-ramp for eastbound traffic. The conversion was completed in January 1962.

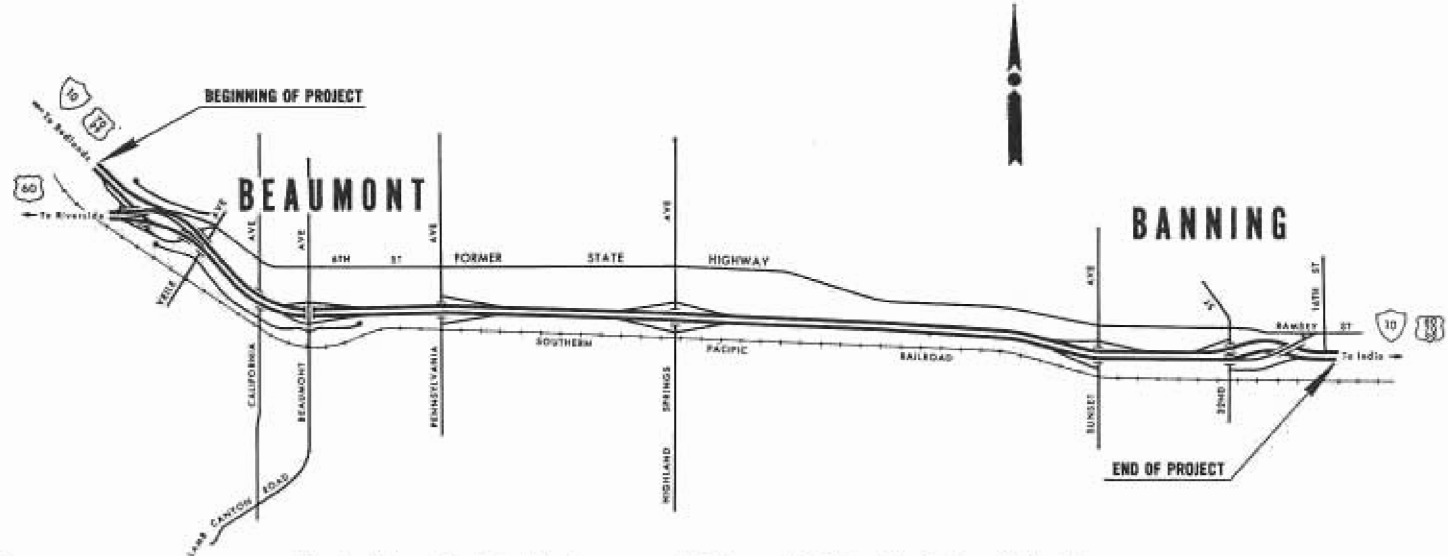
Borrow From One Source

By purchase of property near Sunset Avenue on the south side of the freeway, the contractor was able to obtain about 2,000,000 tons of imported borrow and 198,000 tons of aggregate subbase from one source.

BEFORE—The Sixth and Magnolia Avenue intersection on US 60-70-99 in Beaumont taken in February of last year before the opening of the freeway. The view is eastward.



AFTER—A view of Beaumont following the opening of the freeway, looking west from above Pennsylvania Avenue. Note the lack of congestion on the old highway through the city to the right. Sixth and Magnolia intersection is at white building in upper right.



The location and extent of the freeway project discussed in this article is shown in the above map.

Average daily production of imported borrow from this source was 24,000 tons, utilizing one loader, 10 bottom-dump trucks, six scrapers and two pusher tractors.

The main material source was supplemented by five other sources of imported borrow, aggregating about 800,000 tons, where the contractor was able to grade residential or industrial sites and shorten his haul. Also, by reason of their location in traffic-free areas, the material was hauled to the freeway with a minimum of interference with public traffic.

Unusual features of construction on the project included use of a truck scale with an in-motion weighing device. Photographs show use of this scale in weighing trucks which were moving at about 3½ MPH. A substantial increase in speed of the grading operations was achieved by this device.

Weight Recorded Electronically

The weighing installation is composed of a 70′ x 12′ truck scale of 100 tons gross capacity, with indication in 1/100-ton increments. By means of the electronic attachment, it is possible for DW-20 scrapers or trucks to proceed across the scale deck at reduced speed and, without stopping, register the weight of the load within one graduation, or 1/100 ton. Extensive tests disclose that the scale will hold this accuracy under the most rigorous conditions. As many as 1,090 loads per day have been weighed and recorded.

Traffic control signals mounted at each end of the scale platform are for the guidance of the drivers, alternately showing green or red, thus preventing two trucks from rolling on the deck at the same time. These lights are interlocked with the printer, and operate automatically. The scale provides duplicate paper strip records, the one extruded from the scale housing for the State Division of Highways and the other, wound up inside the printer, for the contractor.

The operator, observing the approaching carrier, punches the number of the rig in the keyboard visible above the paper strip. When the printer is actuated, both the truck number and the weight are recorded.

A new slip-form paver used on the job lays a two-lane width of concrete pavement.

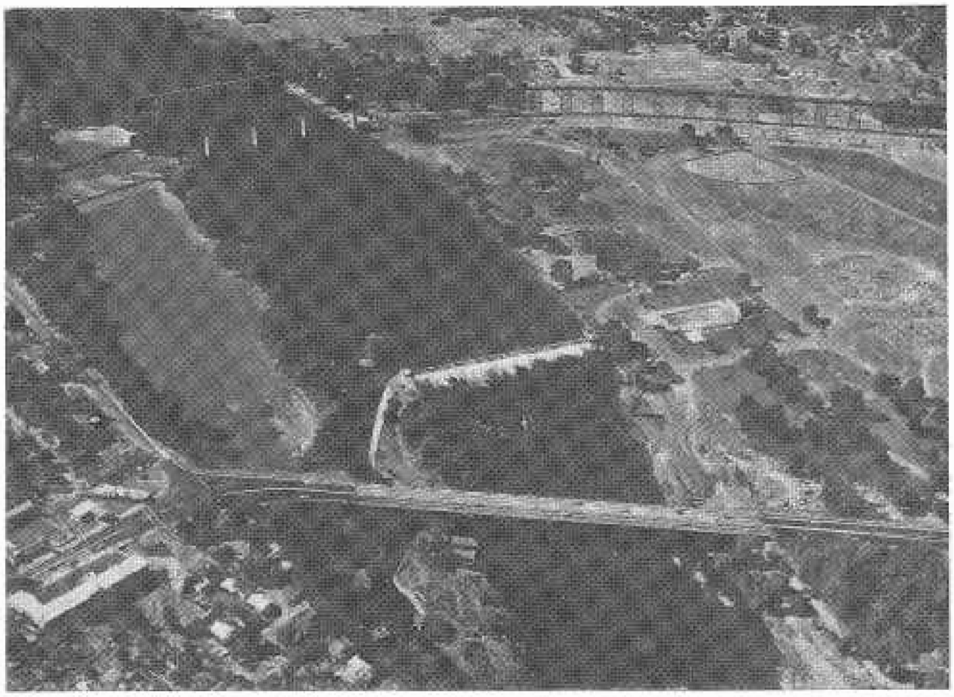
New Slip-form Paver

Another unusual feature of the project included the first use of the Lewis slip-form paver for placing a two-lane width of concrete pavement. The accompanying photograph shows the paver in operation. The 6″ diameter pipe float used immediately behind the paver was found by trial during the early days of paving to improve the smoothness of the finished pavement and became, thereafter, a standard procedure. Smoothness specifications permitted 0.01′ deviation from a 12′ straightedge longitudinally and 0.02′ transversally. High spots were ground off by use of a concrete bump cutter with 18″ or 24″ cutting heads, equipped with diamond impregnated cutting blades set at approximately five blades to the inch of head width. Profilographs were used to locate and mark areas which required grinding. Only one run of the grinder was generally required to reduce high spots, although some bumps required a second cut.

A state weighman operates the new in-motion scale. The print-out tape showing the truck number and weight is visible below the weighman's wrist.

Superintendent for the contractor on this project was Glenn MacAfee. State representatives were W. H. Crawford, District Construction Engineer; Ed Walker, Resident Engineer; and W. B. Garrett, Bridge Department.

SACRAMENTO RIVER BRIDGE IN REDDING WIDENED



The structure in the foreground is the Highway US 99 bridge which spans the Sacramento River at Redding. Immediately upstream is the Anderson-Cottonwood Irrigation District diversion dam. The next upstream structure is the 4,353-foot Southern Pacific Railroad trestle. Farthest upstream is the Diestelhorst Bridge which carried Highway US 99 traffic across the river until replaced in 1935.

The Sacramento River Bridge on Highway US 99 at Redding in District II was recently widened to accommodate four lanes which will more adequately handle the traffic volume of 25,000 vehicles per day.

The widening of the Sacramento River Bridge completes an improvement project that was started with the construction of the present one-way system in downtown Redding.

John C. Gist Construction Company of Sacramento was awarded the contract for this bridge project, including approaches, on their bid of $773,035, and began construction work on June 8, 1960. The completed bridge appears as a single structure; however, a new bridge was constructed upstream immediately adjacent to the original 2-lane bridge, utilizing a portion of the original upstream walkway as a part of the median divider.

The completed structure is 783 feet long and the combined over-all width is now 74 feet, 8 inches, with two 28-foot roadway sections and a 5-foot sidewalk on each side. The new bridge section has seven concrete piers, five of which were constructed in the river bed, requiring temporary diversion of the river channel. A total of 2,980 cubic yards of concrete and 665 tons of steel were placed by the contractor to complete the project.

The original 2-lane structure was dedicated in December, 1935, and as an interesting cost comparison, the original project, including approaches, was constructed at a cost of $277,500.

DEPUTY ADMINISTRATOR NAMED

Secretary of Commerce Luther H. Hodges has appointed D. Grant Mickle, traffic engineering expert and former director of the traffic engineering division of the Automotive Safety Foundation, as Deputy Federal Highway Administrator.

The position was established by the Act of Congress which abolished the post of Commissioner of Public Roads.

Mr. Mickle had been with the Automotive Safety Foundation since 1943. During that time, he served as advisor or director for traffic surveys and studies conducted by the Foundation in a number of states and cities throughout the country.

South Sacramento Freeway

By DONALD M. YOUNG, District Construction Engineer, and
EDWARD F. SILVA, JR., Resident Engineer

The first section of freeway to be built in California's capital city was opened to traffic November 22, 1961, when State Director of Public Works Robert B. Bradford cut the ribbon on the 7½-mile South Sacramento Freeway.

The result of many years of planning and design plus three years of construction, the four- and six-lane facility brings the US 50/99 Freeway from suburban southern Sacramento County into the central city area.

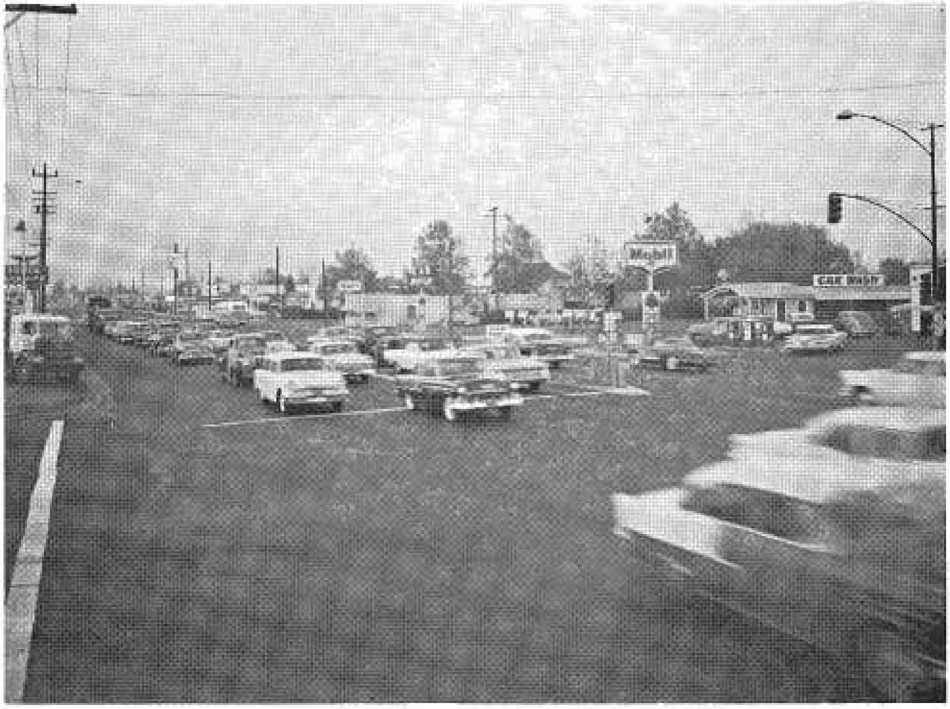
It was built under two contracts. Twenty structures, the approach roadways, ramps, and connections to existing streets were completed in September 1959 at a construction cost of $1,-973,000 by Lew Jones Construction Co. and Brighton Sand & Gravel Co. of Sacramento, a joint venture firm.

Work started June 1, 1960, by Gordon H. Ball, Inc. of Danville on the highway portion of the project which was completed at a cost of approximately $4,720,000. This contract included grading, paving, three additional structures, drainage pump stations, and installation of signs and safety lighting.

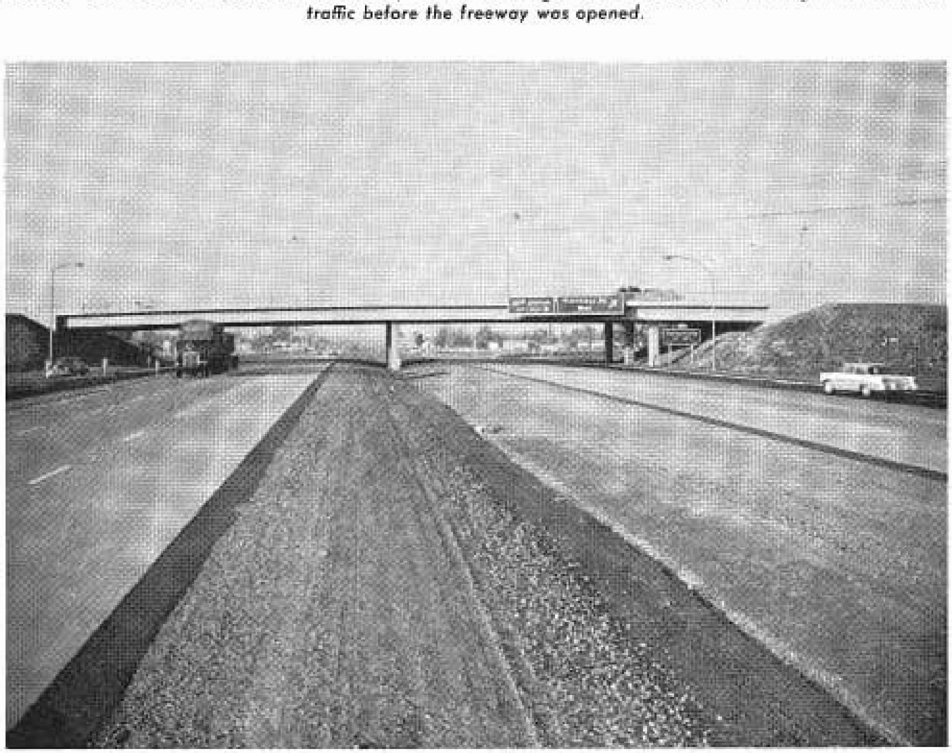
In replacing the former US 50/99 route along congested Stockton Boulevard, the new nonstop alignment provides a minimum radius of curve of 2,000 feet and a maximum grade of 3 percent on the main line, with the exception of the temporary connection to existing city streets at the north end.

Provision for More Lanes

In width, the freeway consists of three miles of four lanes divided from its south end to Florin Road, and 4½ miles of six lanes divided from there to Broadway. Sufficient right-of-way



BEFORE—Old US 50-99 (Stockton Boulevard) at the Fruitridge Road intersection, showing late afternoon traffic before the freeway was opened.



AFTER—The Fruitridge Road West interchange on the new South Sacramento Freeway.

was obtained to accommodate additional lanes when required.

The main line surfacing of portland cement concrete was done by the slipform method which eliminates conventional side forms—the second time this paving technique has been used in District III. On the six-lane portion of the job, it was only the second time that a 36-foot-wide slipform paver had been used on any project in the entire State.

The resulting riding qualities are excellent with an average profilograph reading of 2.9, and an overall range of 0.26 to 4.22 on daily runs.

Some of the major contract items were 1,063,000 cubic yards of roadway excavation, 540,000 tons of imported base materials, and 262,800 square yards of portland cement concrete surfacing. Approximately 112 tons of steel were required for signs and sign bridges.

Travel Time Reduced

Although the lengths of the new freeway and the former street route are almost identical, eight to ten minutes are shaved off travel time when driving the entire distance. Based on preliminary traffic volumes, this results in a total savings of 55 days of time each day the freeway is in use.

The delay on the old route was caused by restricted speed zones, 14 or more signalized intersections (depending on origin and destination), uncontrolled access to the narrow four lanes, and the right-angle left turn from Stockton Boulevard to

The new South Sacramento Freeway looking north toward the downtown area. The Fruitridge Road West interchange is in the foreground.

Broadway near the State Fairgrounds.

Even more important is the safety factor. Based on a comparison of Stockton Boulevard's past rate of 5.18 accidents per million vehicle miles with experience factors on comparable full freeways, the new facility is four times safer than the former route. During the first year of operation, it it estimated that approximately 240 accidents will be eliminated from the statistics on this route. Of these, 132, or 55 percent, would have been injuries or fatal fatalities.

The South Sacramento Freeway during construction showing the connection with Stockton Boulevard (old US 50-99) in the foreground. The view is northward.

Street Traffic Declines

As was expected, when the freeway opened a marked decline in traffic volume occurred on Stockton Boulevard. A few weeks later, preliminary 24-hour counts on a normal weekday were taken at two locations. These were compared with the former counts at the same locations on the previous route, Stockton Boulevard.

One count was taken near the south end of the freeway just north of Mack Road. Readings for a comparable day on Stockton Boulevard before the freeway was activated showed an average daily traffic of 8,000 vehicles northbound and 7,600 southbound. Following the freeway opening, this dropped to 1,700 and 2,300 respectively, with the freeway count 5,500 and 5,300.

Traffic Count Drops

Just north of Fruitridge Road, the old count on Stockton Boulevard was 13,700 northbound and 12,900 southbound. This dropped to 8,500 and 8,400 respectively after the new facility went into use. The initial freeway count here showed 15,750 and 18,300.

This sharp increase of the total traffic on these two routes north of this intersection is accounted for by the fact that the alignment of the new route at this point not only draws traffic from Stockton Boulevard, but also from Franklin and Sacramento Boulevards and other city streets that formerly handled considerable north-south traffic.

Local Motorists Experimenting

Our preliminary studies indicate that local motorists are still in the process of learning how best to exploit the freeway to individual advantage, and it is expected that temporarily the traffic pattern will remain in a state of flux as area residents continue to experiment and learn the advantages of urban freeway service.

Also it appears that many residents from the Fruitridge area are continuing to use their former routes into downtown Sacramento but take the freeway for their trip home.

Wells Being Drilled

Under an $18,620 contract with Arnold Bowline of Bakersfield, eight wells are presently being drilled and developed at various locations along the freeway to provide irrigation for future landscaping.

Included in the 1962-63 construction budget is $442,000 for extensive landscaping of the northern three miles from Sacramento Boulevard to U Street. Another planting project is planned for the remainder of the new freeway in the future.

Freeway Will Be Extended

From the temporary connection at the north end of the project, additional freeway will ultimately extend north through the city between 29th and 30th Streets to join the Elvas Freeway near the north city limit. Right-of-way acquisition on this section is well advanced. This section will become part of Interstate Highway 80.

Other future planning in the vicinity includes a proposed east-west freeway, also a part of Interstate 80, which would run between W and X streets and will connect with the north-south route at a major interchange.

The total number of driving tests given by the Department of Motor Vehicles during November was 92,140. Of these 17,604 resulted in driving test failure.

Junipero Serra

Advance Planning Pays Off On Interstate Route 280

By JACK O. GRASBERGER, Senior Highway Engineer

In the spring of 1784 Father Junipero Serra laboriously made his way along El Camino Real to pay a last visit to the Mission San Francisco de Asis. No doubt, as he traveled northward along the bay front, he would often gaze westerly toward the beautiful hills which separate San Francisco Bay from the Pacific Ocean. Today, these hills serve as the location for a future interstate highway extending from San Francisco to San Jose and appropriately known as the Junipero Serra Freeway.

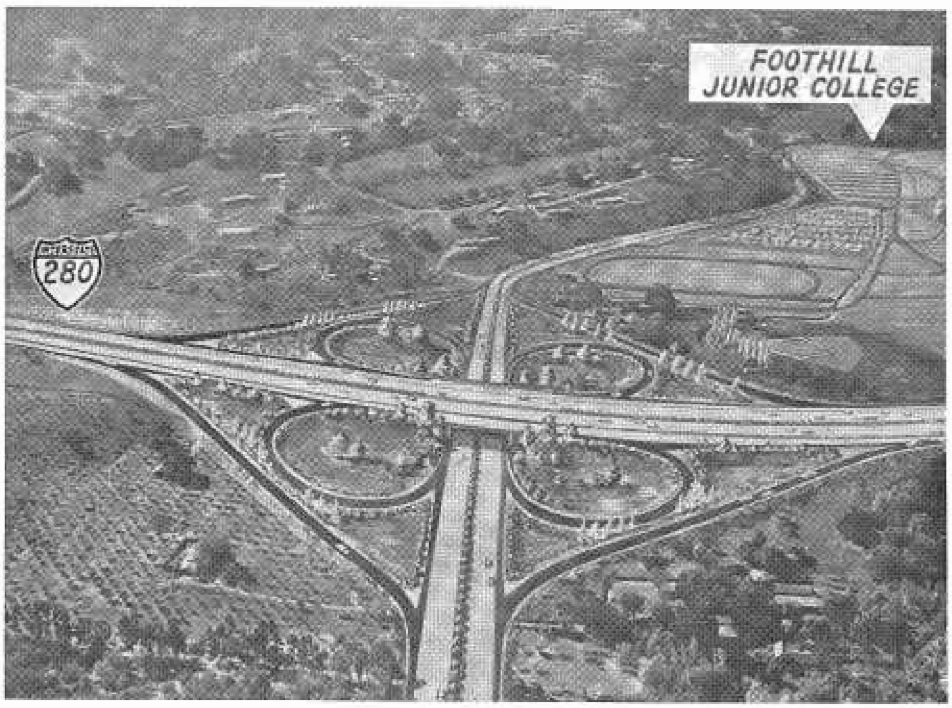
The story of this freeway has its beginning during the years following World War I when the mass production of automobiles and development of the San Francisco Peninsula combined to create a major transportation need.

Joint Highway District 10

As early as 1928, the need for an additional arterial highway extending from San Francisco southerly to the San Jose area was recognized. Joint Highway District 10, comprising San Francisco and San Mateo Counties, was created and by 1939, a location for a four-lane highway, to be known as Junipero Serra Boulevard, was planned as far south as the Santa Clara county line. This routing followed what was then the westerly edge of the developed area, generally along the foothills on the east slope of the coastal ridge. The projected right-of-way was delineated with iron pipes, bringing forth a flood of protests by affected towns from Burlingame to Menlo Park.

A seven-mile portion extending as far south as Crystal Springs Road in San Bruno was constructed by 1952, with rights-of-way largely acquired through Millbrae.

BEFORE—Looking SW along El Monte Avenue in the town of Los Altos Hills (see photo below).



AFTER—Retouched photo indicating artist's conception of proposed interchange with an improved (four-lane) El Monte Avenue. The initial location for the Junipero Serra Freeway was modified to avoid conflict with plans for the Foothill Junior College.

During the ensuing years, financial problems and diverse opinions as to the routing and recognition that the scope of the needed highway improvement was of more than only local concern led to the conclusion that further development of this route should be a state responsibility. In 1956, the Legislature included the constructed portion in the State Highway System as Route 237.

The Division of Highways, in cooperation with the U. S. Bureau of Public Roads, was concurrently proceeding with the study of possible routes for the National System of Interstate and Defense Highways authorized by Congress. This route was included as an Interstate route in 1955, and by 1957, the Legislature had included new Route 239 in the State Highway System, extending from San Francisco to U.S. Route 101 near San Jose. It is now also designated as Interstate Route 280.

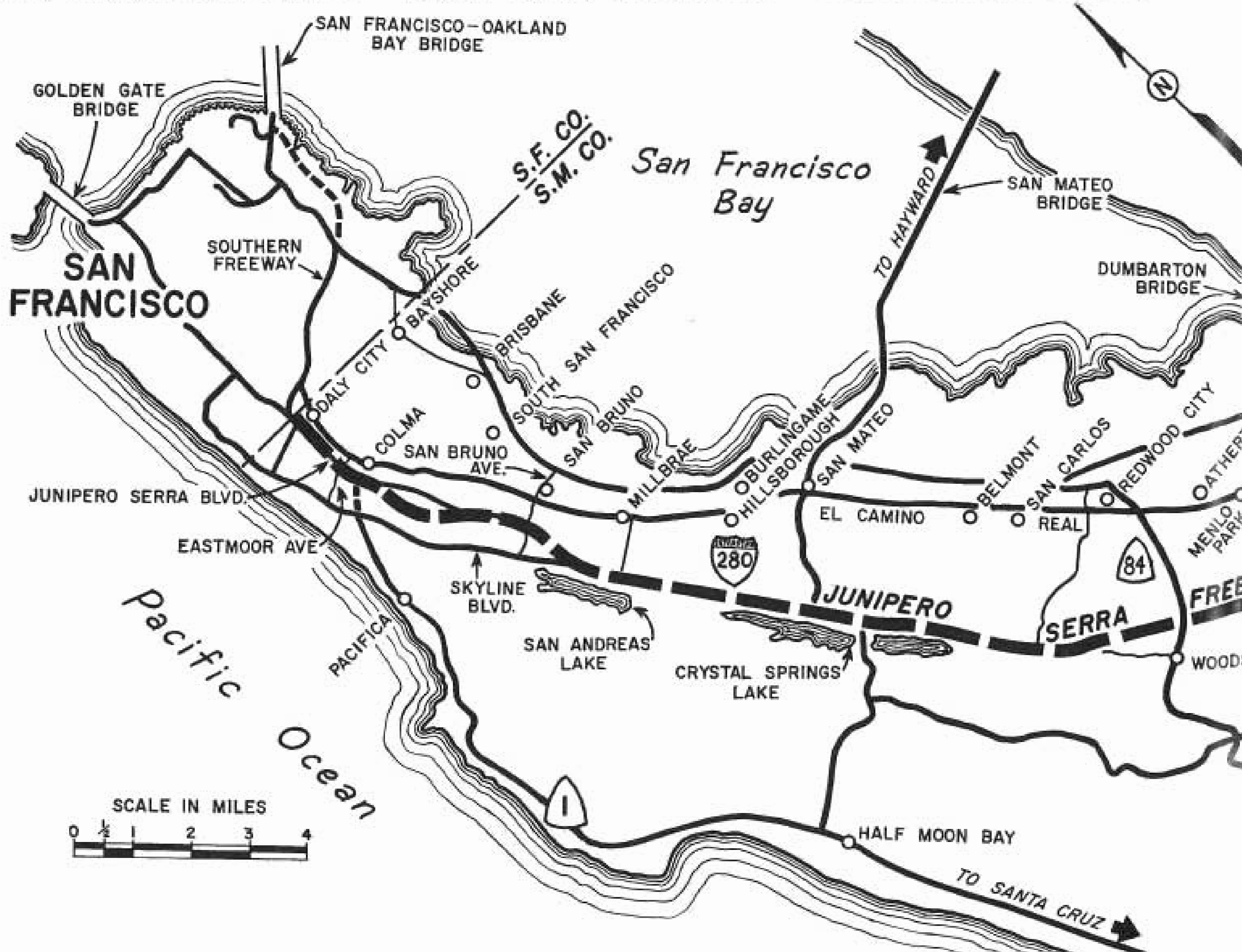
50 Miles of Paper Highway

Preliminary planning studies were well along by early 1957. Aerial mosaics and topographic maps at scale 1″ = 300′ had been ordered covering all possible route locations within both San Mateo and Santa Clara Counties. Contour interval was 1″ = 10′.

Two basic locations were developed and referred to as alternates "A" and "B." The "A" alternate followed generally the original location projected for the Junipero Serra Boulevard by the Joint Highway District and was the most easterly and closest to built-up areas in both San Mateo and Santa Clara Counties. Alternate "B," the more westerly location, followed Skyline Boulevard along the coastal ridge in northern San Mateo County and thence generally along the foothills to the west of alternate "A." Later, additional alternates were developed, mostly to the west and further away from the developed area. These latter studies were made at the request of the cities and counties and certain civic groups.

First Public Meetings

From April through July of 1957, more than 40 public meetings were held with local governmental officials, civic bodies and local community or-



ganizations for the purpose of explaining in detail the studies that had been made. After new studies of additional routings had been suggested and made, district public hearings were scheduled in San Jose and Sunnyvale to discuss alternative locations in Santa Clara County.

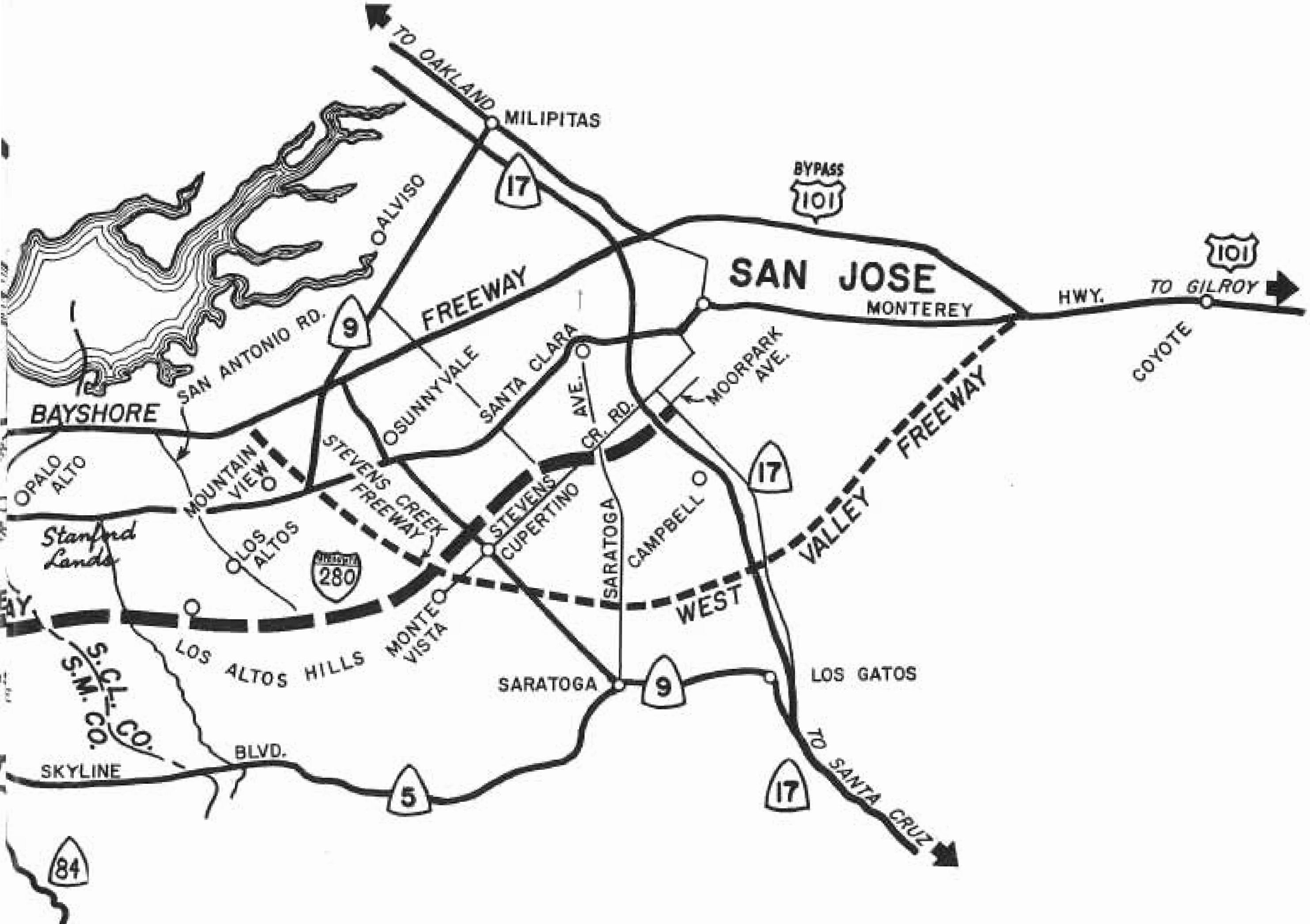
A method of analysis was developed whereby alternative locations were considered as part of a freeway system, including all of the existing or planned major routes in the area. Every effort was made to simplify the analysis for public presentation, but the description of an alternate routing such as the "B-B4-U1-A—" was not unusual for a location within just the northern part of Santa Clara County.

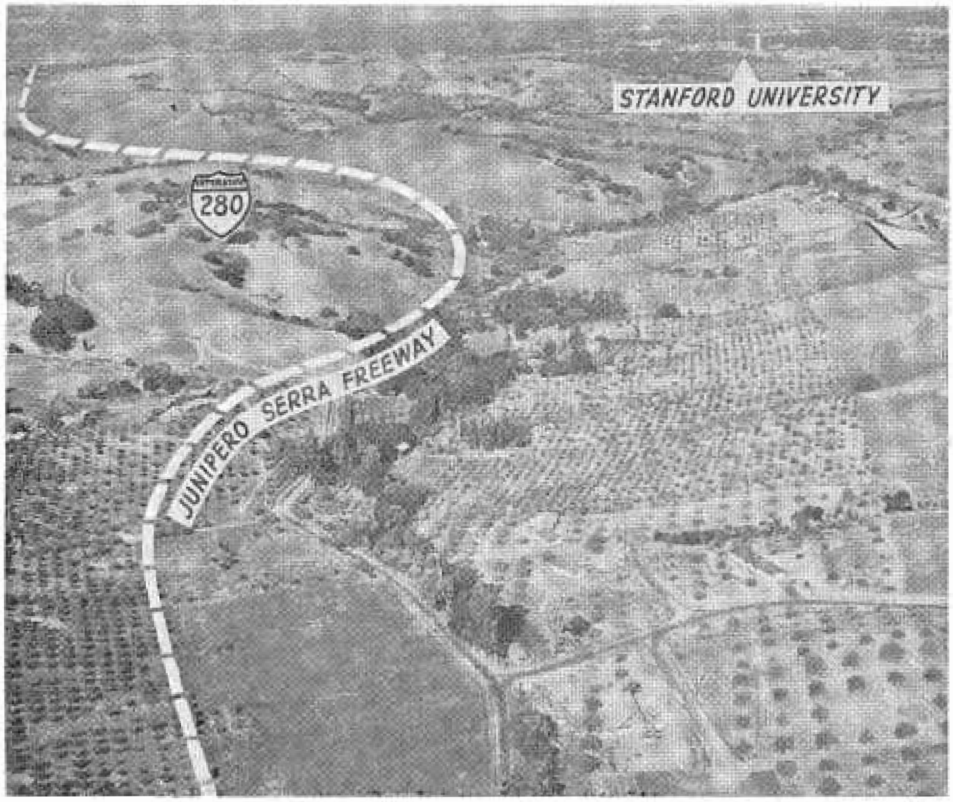
What is now known as the West Valley Freeway bypassing San Jose to the south, and a two-mile length of the Junipero Serra Freeway along Moorpark Avenue in San Jose were adopted by the California Highway Commission on November 25, 1957. At the same time, a southerly extension of the Stevens Creek Freeway was adopted, establishing a continuous location for the West Valley Freeway. A route bypassing San Jose to the south, as intended by the Legislature, had been established. However, only a small portion of the Junipero Serra Freeway routing had been adopted. More than 35 miles of location was still to be determined to the north and through San Mateo County.

Don't Muddy the Waters

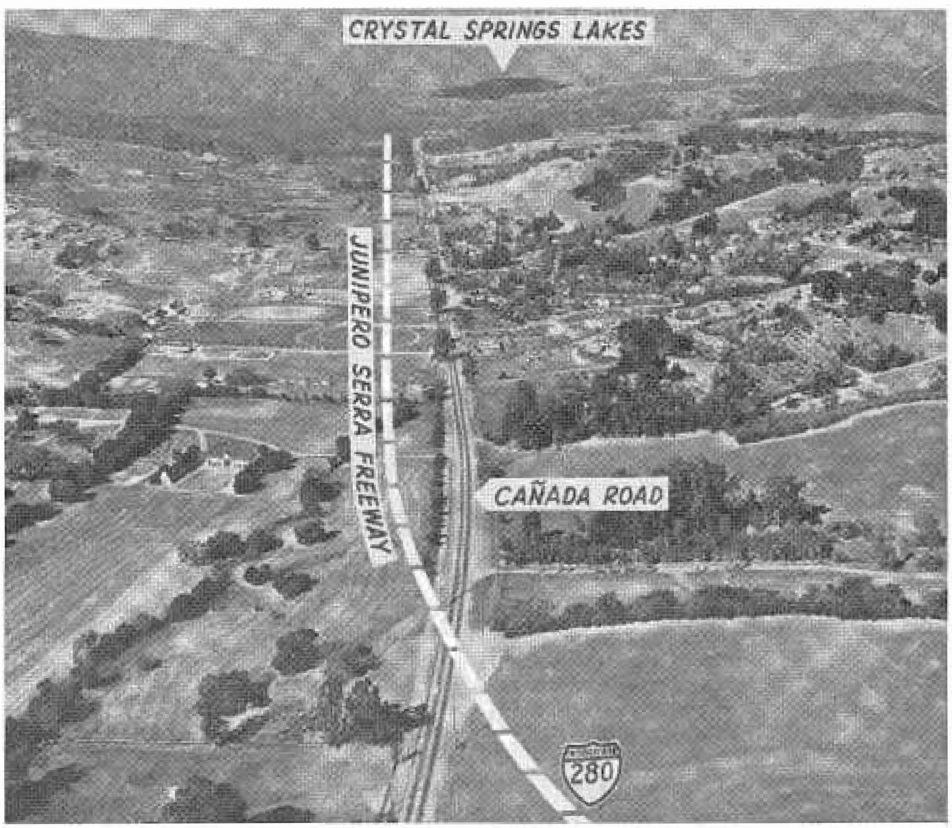
By the summer and fall of 1957, District public hearings had been held in San Mateo and Santa Clara Counties. These hearings covered the portion of the route extending from San Bruno to the previously adopted section in Santa Clara County. The local governmental agencies were virtually unanimous in their opposition to Route A, located through the highly developed portions of the peninsula and to the east of Skyline Boulevard. In San Mateo County, Route B, located along Skyline Boulevard, appeared to be most feasible.

A multitude of considerations are necessary in the study and selection of a major route. To properly locate a freeway route, consideration must be





Looking northwest along Purissima Avenue in the town of Los Altos Hills. Hoover Tower on the Stanford University Campus can be seen in the background. Wherever feasible, separate alignment and grades for each roadway with wide median areas for planting will be used.



A view looking northwest along Canada Road in the town of Woodside. Watershed lands of the City and County of San Francisco in the background. This beautiful valley is only 4 miles west of El Camino Real.

given to both the motorists who will use it and the communities through which it passes. All possible alternate routes are investigated so that the final result will afford the best traffic service at the least possible cost, consistent with minimum disruption to community values.

More than 14 miles of the Skyline route traversed lands of the watershed area owned by the City and County of San Francisco. Domestic water supply for San Francisco and most of the northern peninsula is impounded in San Andreas and Crystal Springs lakes, located just west of Skyline Boulevard.

Originally, water supply was limited to runoff from the watershed lands. As water needs increased, additional water had to be brought in from outside sources as far as the High Sierra, and the reserviors now serve as terminal storage for the Hetch-Hetchy System, provide for seasonal fluctuations in consumption and protect against water shortages resulting from limited local runoff. This water supply is of very high quality and does not require filtration treatment.

Meetings were held with representatives of the Water Department who were concerned about the danger of pollution or increased turbidity of the water by reason of highway construction activity. At the same time, a citizens committee, representing property owners along Skyline Boulevard, proposed that the highway be located farther to the west and closer to the lake. Such a location would preserve existing homes, but would place the freeway westerly and well below the Skyline ridge, causing severe problems in drainage control, particularly during construction when it was feared that storm runoff would carry mud and debris from the construction down into the reservoir.

Studies were made to determine if storm runoff could be controlled during construction so as not to increase turbidity in the lakes. Cost estimates for an extensive drainage control system were included as part of each alternate, including the one suggested by the citizens committee which encroached deep within the watershed area.

Commission Hearings

In the spring of 1958, public hearings were held by the California Highway Commission in both Santa Clara and San Mateo Counties. The State Highway Engineer recommended a route generally following the Skyline location in San Mateo County and a location through the lands of the Leland Stanford University, acceptable to their Board of Trustees. The location through Los Altos Hills in Santa Clara County was recommended as being in the best public interest.

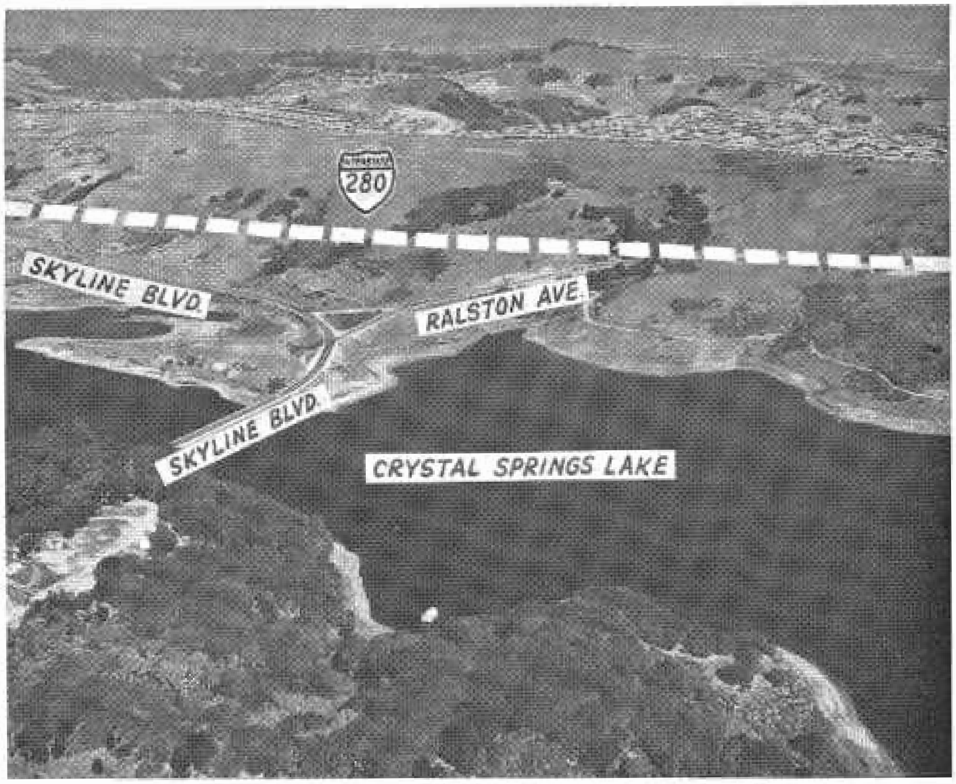
The recommended route represented a modified location over that originally conceived, in terms of better fitting local planning and requiring fewer homes. Actually, an estimated 84 improved properties would be required by this 35 miles of freeway, an amazingly low figure in this rapidly growing suburban area.

After careful consideration of testimony by local governmental agencies, citizens groups and individuals, and subsequent reports by several agencies and groups, the Commission adopted the route recommended by the State Highway Engineer. This location truly represented exhaustive negotiations and considerations with reasonable compromise between the Division of Highways and local representatives and resulted in an unusual degree of concurrence by all concerned.

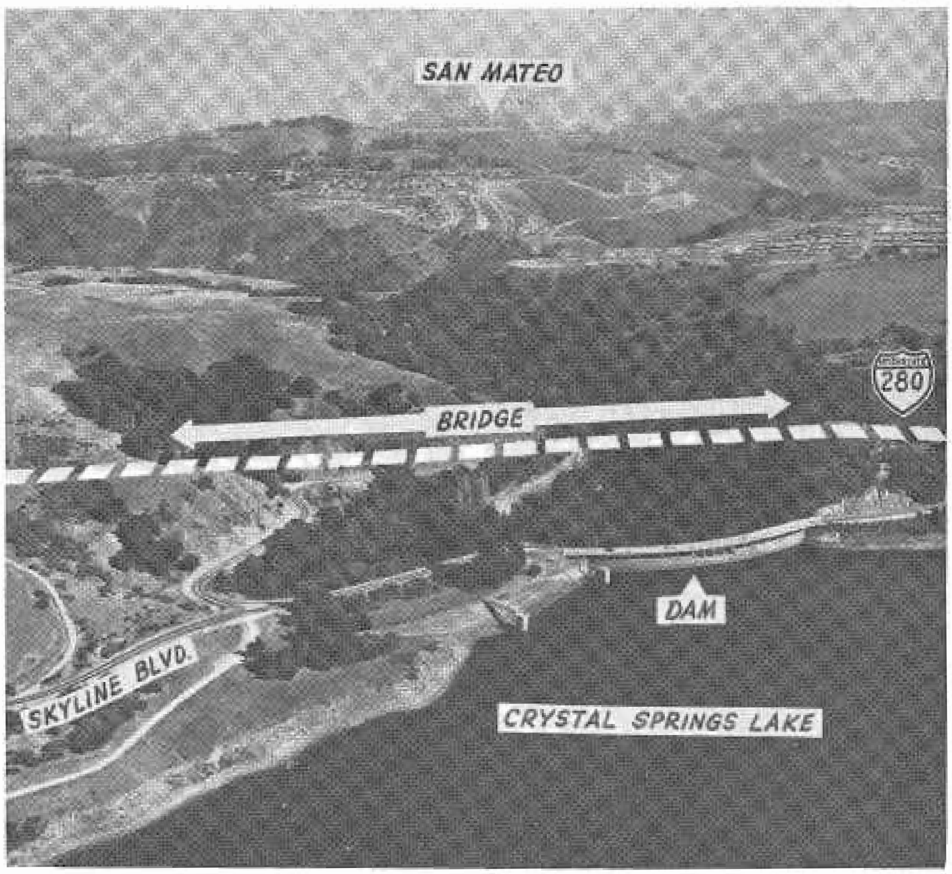
The adoption of the route from San Bruno to San Jose by the California Highway Commission on July 23, 1958, set the stage for the commencement of design study. Location studies were still in progress for 8 miles of the route north of San Bruno to the San Mateo County Line. A route for this portion generally following the existing Junipero Serra Boulevard was adopted in 1960, thus establishing the general route in its entirety. The Junipero Serra Freeway had been located and approved as a basic 8-lane interstate freeway with minimum median width of 22 feet.

Freeway Agreements

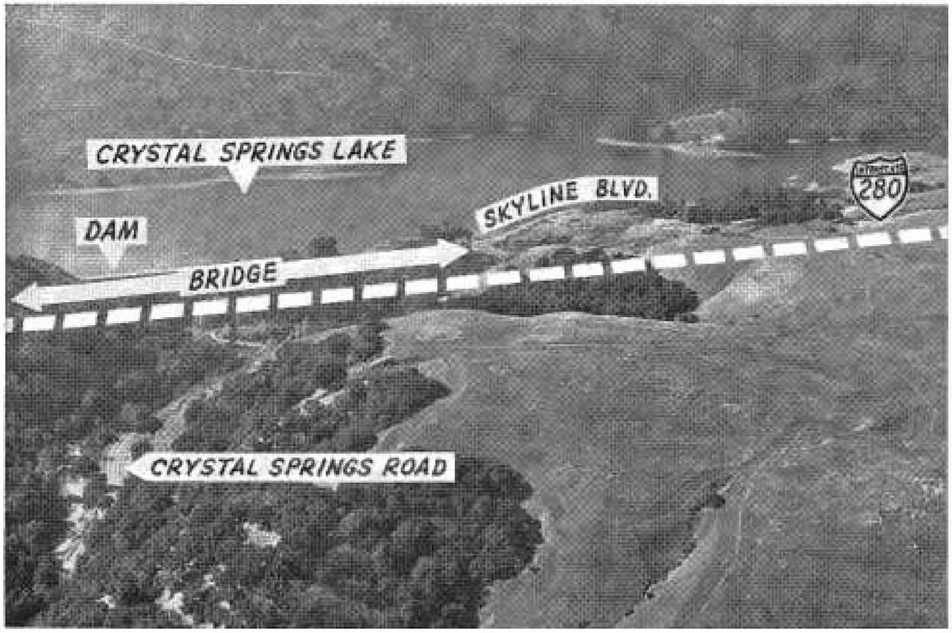
Preliminary to actual design, it is necessary to negotiate agreements with each city and county involved in location of the freeway. The number and location of interchanges which



An easterly view showing the Crystal Springs Lake in the foreground. Residential development has reached the east boundary of the watershed lands in this area.



Looking east along San Mateo Creek Canyon. The Crystal Springs Lake and Dam will be visible from future bridge over the canyon, providing a breathtaking view for future motorists.



A westerly view of the Crystal Springs Lake and Dam showing the coastal hills in the background. The future bridge will be about 1,700 feet long across the canyon and about 100 feet above the dam.

relate directly to the traffic service afforded each community, establishing which local streets would be carried over or under the freeway, and which would be cut off by the construction of the freeway, are all part of what is known as a Freeway Agreement negotiated between the State and local jurisdiction. Since 1958, 18 freeway agreements have been executed with the cities and counties for the Junipero Serra Freeway.

Once the general details of the freeway interchanges and road separations have been worked out with local authorities, the Division of Highways can proceed with detailed design. Numerous special design problems have been encountered in the design of this freeway, including preservation of the pure water impounded in the San Andreas and Crystal Springs reservoir.

Design Problems

One major problem in the design of the freeway in northern San Mateo County has been the increased subdivision activity bordering the adopted location. Every effort is made to cooperate with local agencies and keep to a minimum the number of improved properties required to build the freeway. The early adoption of the route, and the relatively few improvements which need be disturbed, emphasize the advantage of advance planning.

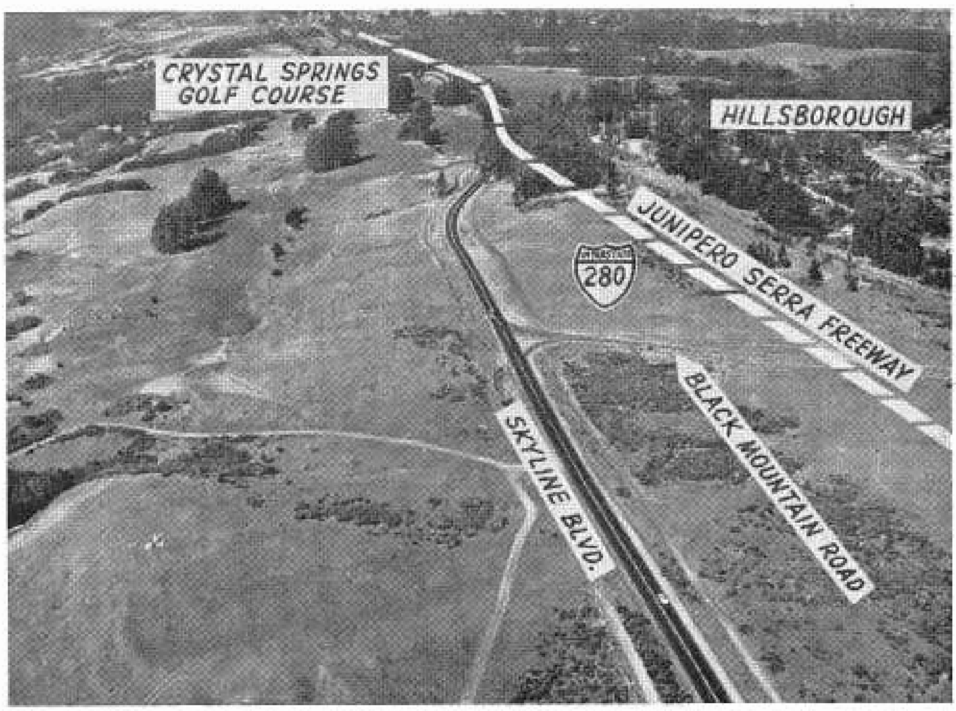
A depressed 12-lane freeway is planned in Daly City where two major traffic corridors coincide. The north-south corridor includes the Junipero Serra Freeway in San Mateo County and Junipero Serra Boulevard in San Francisco. The east-west corridor includes the Sign Route 1 Freeway (from the coast) and the Southern Freeway in San Francisco. These two traffic corridors coincide for over a mile and will carry an estimated 150,000 vehicles each day by 1975. This is in excess of volumes presently carried by any freeway in the Bay area and requires special design study.

The possibilities of using a dual-dual system of lane arrangement, or what amounts to a freeway within a freeway, were studied and rejected because of excessive right-of-way requirements and inherent inflexibility in the event of unforeseen traffic distribution.

In southern San Mateo County, it will be necessary to bridge the proposed two-mile long, underground, linear accelerator planned for Stanford University. The proposed Ladera Dam flood control and water retention project will further complicate design of the freeway through Stanford lands, and consideration of its possible future construction resulted in some modification of both route and design.

A Beautiful Highway

The Division of Highways has been in contact with many public agencies and private organizations interested in

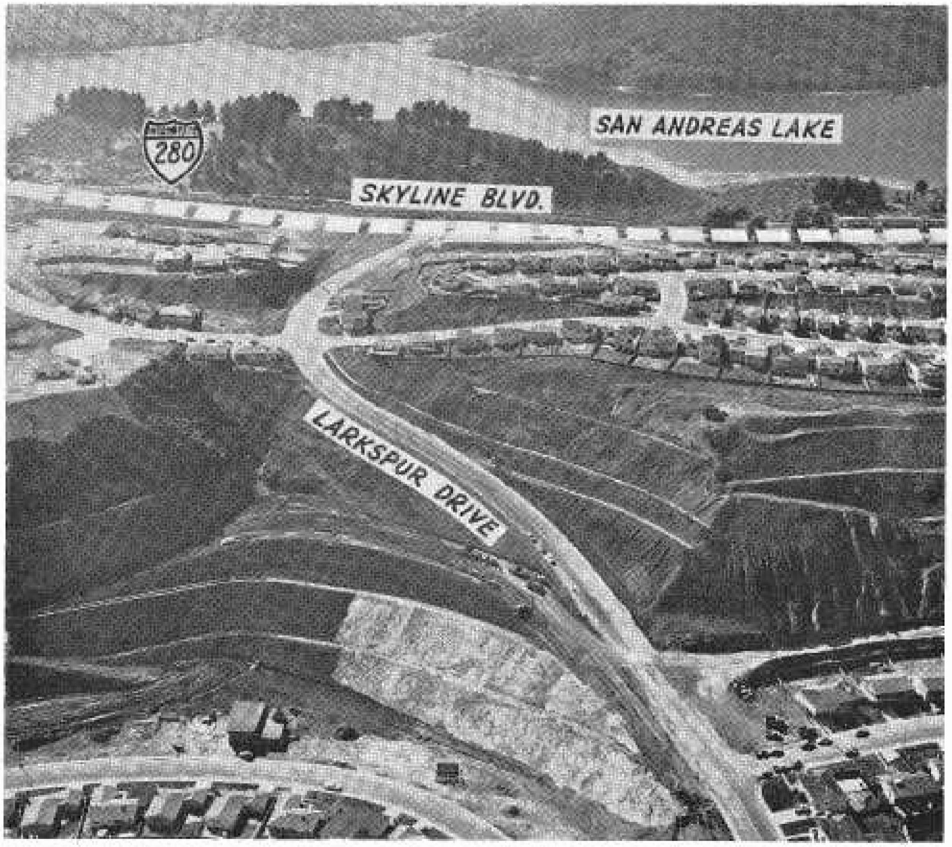


Looking north along Skyline Blvd. on location through the watershed lands of the City and County of San Francisco. Modifications to the Crystal Springs Golf Course are planned.

esthetic treatment for this freeway. The State Division of Beaches and Parks, the San Mateo County Park and Recreation Commission, the San Mateo County Horsemen's Association and the Tri-County Committee for Freeway Beautification, composed of representatives from San Mateo, Santa Clara and San Francisco Counties, have exchanged ideas and information designed to preserve the natural beauty of the areas through which the freeway will pass.

In areas of rugged terrain and wherever feasible, separate alignment and grades for each roadway will be used. This "split level" design will be used extensively in both San Mateo and Santa Clara Counties in order to better fit the country and minimize cuts and fills. In some instances, median planting areas may exceed 100 feet in width.

A new high-level bridge will carry the eight-lane freeway over San Mateo Creek Canyon. The bridge, not yet designed, will be about 1,700 feet long and over 275 feet above the canyon floor. The bridge site will be just east of Crystal Springs Lake Dam and future motorists may anticipate a breathtaking view of the lake.



A westerly view of San Andreas Lake and Skyline Blvd. Development in foreground within the City of Millbrae is typical of other areas adjacent to the freeway location in northern San Mateo County. In spite of heavy development, only an estimated 84 improved properties need be moved in the 35-mile stretch from San Bruno to San Jose—thanks to advance planning.

Construction Units

Present plans call for 16 separate construction projects extending a total distance of almost 50 miles from San Francisco to San Jose. The first of these, scheduled for construction in 1962, starts in San Jose at the San Jose-Los Gatos Freeway and extends northerly for approximately 4.5 miles to Doyle Road. $4,750,000 has been included in the 1962-63 State Highway Budget for construction of this first unit. It is hoped that the entire freeway will be constructed, under construction, or financed within five years. Since this route is part of the Interstate Freeway System, federal financing will amount to about 92 percent.

The total cost is estimated at $145,000,000—about $110,000,000 for construction and $35,000,000 for rights-of-way. Of the latter amount, approximately $7,000,000 has already been expended and another $11,000,000 has been made available in state highway budgets through June 30, 1963.

When completed, this scenic, interstate freeway will provide much needed relief for peninsula traffic, doubling the existing freeway capacity south of San Francisco and will relieve heavy congestion now experienced in Bayshore Freeway. It will doubtless serve to accelerate development of the hills west of peninsula cities and in years to come be as familiar to peninsula travelers as the El Camino Real of old or the Bayshore Freeway today.

L.A. Design Chief Ralph V. Chase Retires

Ralph V. Chase, Assistant District Engineer for District VII in Los Angeles, retired early this year after almost 28 years with the Division of Highways. Since 1956 he had been in charge of design for state highways in Ventura County and the north portion of Los Angeles County.

RALPH V. CHASE

In his career with the division, Chase spent five years in construction and close to 23 years in design. He was Resident Engineer on portions of the Angeles Crest Highway and the Ventura Freeway. As a senior highway engineer he supervised design of the Harbor Freeway and portions of the San Diego and Golden State Freeways.

A native of Deer River, Minnesota, he attended grade school in Idaho, Missouri, and Minnesota, and high school in Minneapolis, Minnesota. He studied engineering at the University of Minnesota and the University of Southern California.

He and his wife, Clare, have one son, Donald.

Experimental Paint

Corrosion Resistance Tested On Leffingwell Creek Bridge

By HERBERT A. ROONEY, Senior Chemical Testing Engineer, and
A. L. WOODS, Bridge Paint Inspector

In accordance with the continuing research program of the Technical Section of the Materials and Research Department concerning the development and application of improved corrosion resistant paints this report describes the experimental paint systems applied to the Leffingwell Creek Bridge in October 1958, and the results observed as of May 1961, after an exposure period of 2½ years.

The Leffingwell Creek Bridge is situated just north of the town of Cambria on Road V-SLO-56-B (State Sign Route 1) in San Luis Obispo County and is close to the shoreline of the ocean as shown in Figure 2. It is a low level structure containing eight steel stringer spans with a concrete deck supported on concrete piers and abutments. The 24-foot wide concrete deck shields the steel girders to a limited extent from rain thereby allowing salt to accumulate in heavier deposits than would occur if the steel were more exposed as in a superstructure. This bridge and several others similarly situated with respect to the ocean present an ideal location where protective coatings may be tested in a very corrosive environment.

Poor Correlation

Although accelerated laboratory corrosion tests to determine the protective quality of paints are often made in salt spray cabinets, there is frequently poor correlation between laboratory tests of this type and actual corrosion observed when the paints are applied in a natural corrosive environment. This is true for many reasons. Panels exposed in a salt spray cabinet are normally painted under ideal atmospheric conditions in the

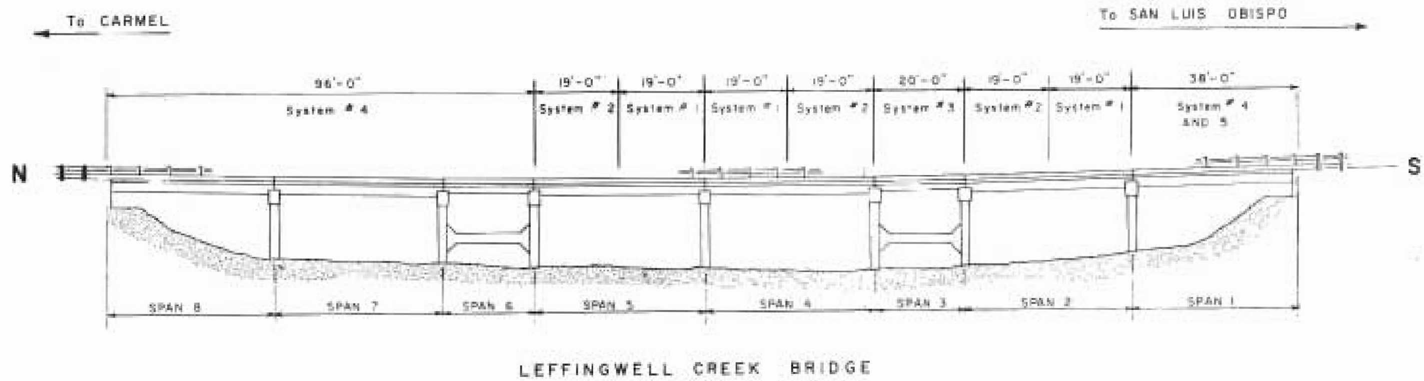


FIGURE 1—A diagram of the Leffingwell Creek Bridge on State Sign Route 1 in San Luis Obispo County showing the location on the structure of the various systems of painting discussed in this article.

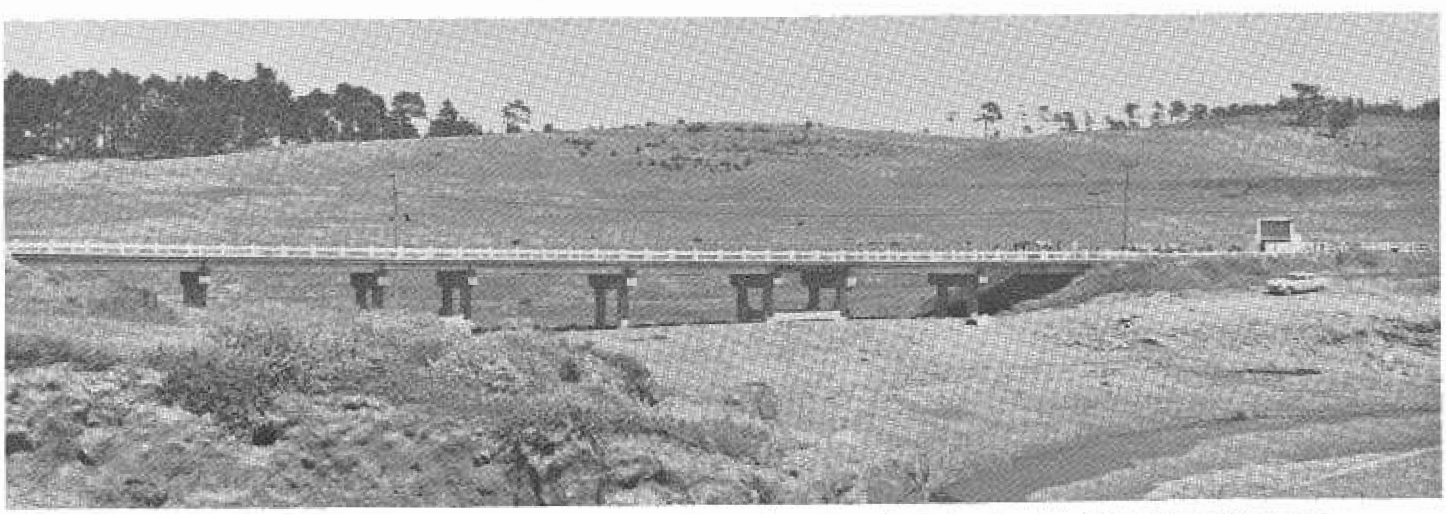


FIGURE 2—A photograph of the actual bridge shown in the diagram above. Note the beach and surf line in the lower right corner.

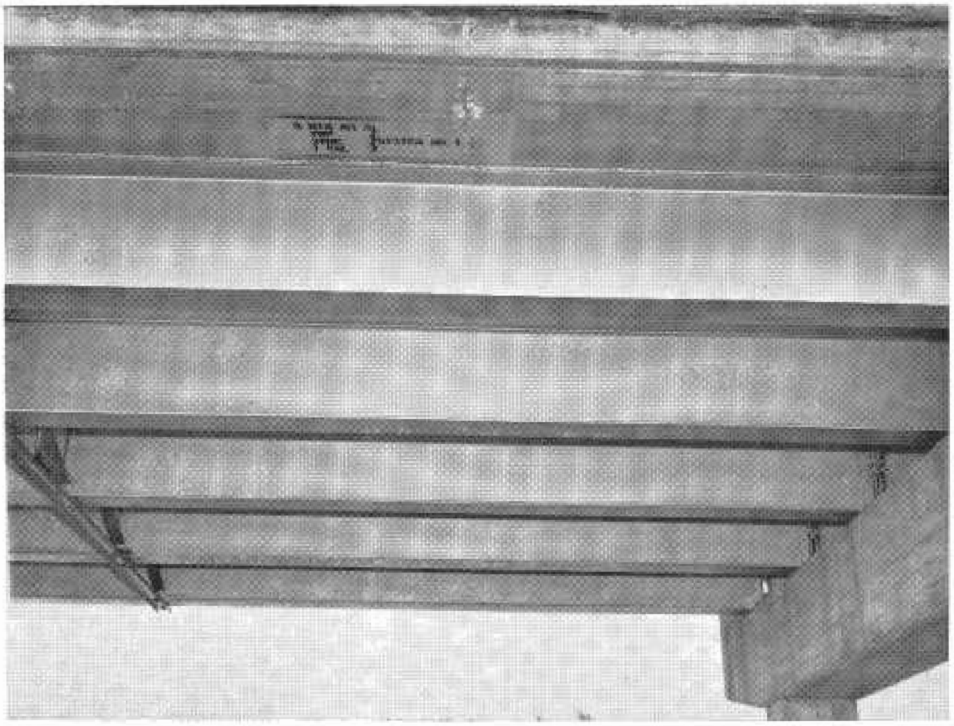


FIGURE 3—Under view of the south portion of Span 2 on which Painting System No. 1 was used.

laboratory before they are placed in the cabinet. Paint is applied to structures like the Leffingwell Creek Bridge and bridges in similar areas along the coast where the humidity is frequently in the range of 70-80% and above and the air temperature seldom greater than 60°F. The solvents in the paint cause moisture from the humid atmosphere to be carried into the paint film during application due to the cooling effect produced by the vaporization of the solvents.

Even if paint could be applied under ideal conditions to structures in this coastal zone, discrepancies between salt spray cabinet tests and field testing would still be evident since weather cycles cannot be duplicated in a salt spray apparatus. Both the composition of the salt and the nature of the exposure do not reproduce conditions occurring in the natural environment. However, salt spray cabinet and weatherometer tests do have some value in their ability to separate the very poor from the better types of corrosion resistant paints.

Description of Coatings

Figure 1 is a drawing of the Leffingwell Creek Bridge showing where each paint system was applied and Table I is a description of the coatings comprising each system. Figures 3 to 6 show the conditions of these various coating systems as of May 10, 1961.

As of the date of May 10, 1961, the best system appeared to be No. 1 (Figure 3), the inorganic chemically cured zinc coating with the complete vinyl System No. 4 (Figure 6) almost equivalent to System No. 1 in durability. The greatest failure occurred in the 100% solids epoxy coating represented by System No. 3 and as shown in Figure No. 5. It may be of significance that the application of System No. 3 was not preceded by a vinyl wash treatment. It has not been customary to use this treatment in advance of epoxy coatings.

Because of the prevailing winds and topography, the southern half of the bridge presents the most severe corrosive conditions. All systems were used in this portion of the bridge to give comparative data under conditions of an equally severe corrosive environment.

No Definite Conclusions

This report is a progress report and no definite conclusions, other than the complete failure of the epoxy coating represented by System No. 3, can be drawn for another two or three years.

The decreasing order of durability of these Systems as of the date of this report is:

System	Order
1	1
4	2
2	3
3	4

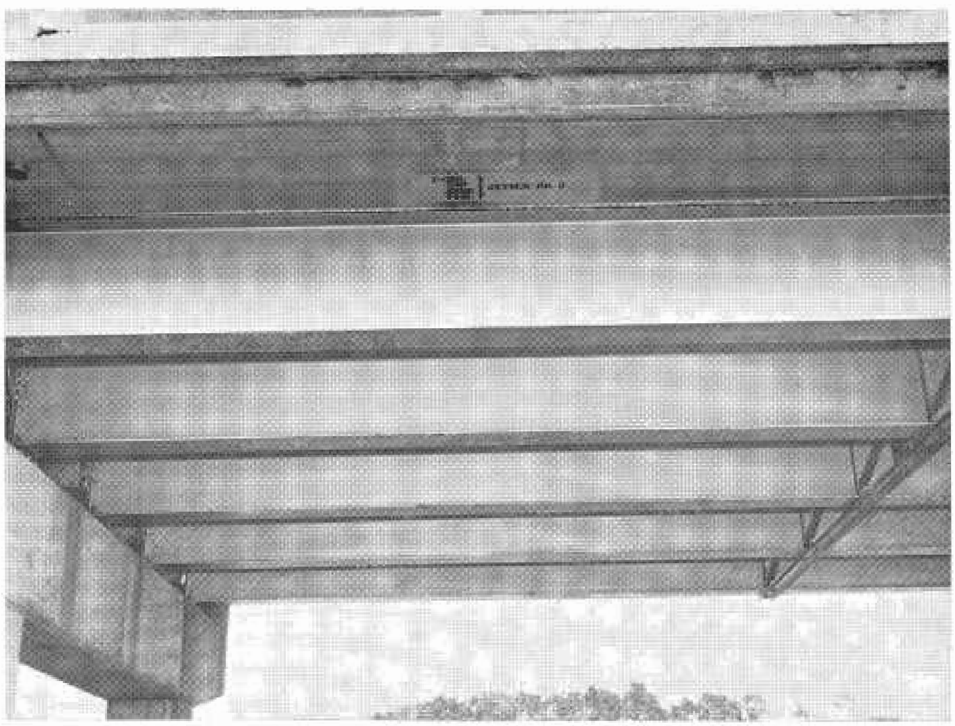


FIGURE 4—Under view of the north portion of Span 2 on which Painting System No. 2 was used.

FIGURE 5—Under view of Span 3 on which Painting System No. 3 was used.

FIGURE 6—Under view of the north portion of Span 1. Painting System No. 4 was used except on the stringer in the foreground on which System No. 5 was used.

A rating of System No. 5 is not justified because of the relatively small area to which this system was applied.

Acknowledgment

Sincere appreciation is due Robert Souza of the Materials and Research Department for the excellent photographs he took for this report and to Mr. F. N. Hveem, Materials and Research Engineer and Head of the Materials and Research Department, for his suggestions and interest in the promotion of research relative to corrosion.

TABLE I

COATINGS

System No. 1

3 mils of inorganic zinc pigment-silicate binder cured with a phosphoric acid solution, Curing Agent scrubbed off with water, Vinyl Wash Primer, State Specification 52-G-52, applied followed by 2 mils of Vinyls, State Specifications T58-G-40 and T58-G-41 in alternating coats and a final coat of 1 mil of State Specification T58-G-49, Vinyl Paint, Aluminum Finish Coat.
Total film thickness, 6 mils.

System No. 2

Vinyl Wash Primer, State Specification 52-G-52; 3 mils of Semi-Quick Drying Red Lead Primer, State Specification 58-G-53; 2 mils of White Traffic Paint, State Specification 55-G-95; 2 mils of Vinyl Paints, State Specification T58-G-40 and T58-G-41 in alternating coats; 1 mil of State Specification T58-G-49, Vinyl Paint, Aluminum Finish Coat.
Total film thickness, 8 mils.

System No. 3

Epoxy Paint, 100 percent solids, made with an epoxy resin of viscosity 40-100 poise at 25°C and an epoxide equivalent of 180-195, 20 percent TiO_2 and 5 percent Cr_2O_3 cured with an epoxy amine adduct and applied by hot spray 15-20 mils thick.

System No. 4

Vinyl Wash Primer, State Specification 52-G-52; 4 mils of Vinyl Paints, State Specifications T58-G-40 and T58-G-41 in alternating coats; 2 mils of Vinyl Paint, Aluminum Finish Coat, State Specification T58-G-49.
Total film thickness, 6 mils.

System No. 5

Vinyl Wash Primer, State Specification 52-G-52; 4 mils of Semi-Quick Drying Red Lead Primer, State Specification 58-G-53; 2 mils of Phenolic Iridescent Green, State Specification 58-G-79.
Total film thickness, 6 mils.

Vallejo-Benicia

First Section Completed On Connecting Freeway

By C. F. RODERICK, Resident Engineer

On June 14, 1961, the first section was completed for the new freeway which will connect US 40 in Vallejo with the new Benicia - Martinez Toll Bridge now under construction across the Carquinez Strait. This portion of freeway has been open for use by public traffic since December 1960 subject to a few restrictions where connecting roads were under construction. The completed portion is 3.23 miles long between Cedar Street in Vallejo and near the west city limit of Benicia.

The connecting link of the freeway between the west city limit of Benicia and the Benicia-Martinez Bridge, including the toll-gate plaza, is now under construction. All contracts are expected to be completed for opening the bridge to traffic in the summer of 1962.

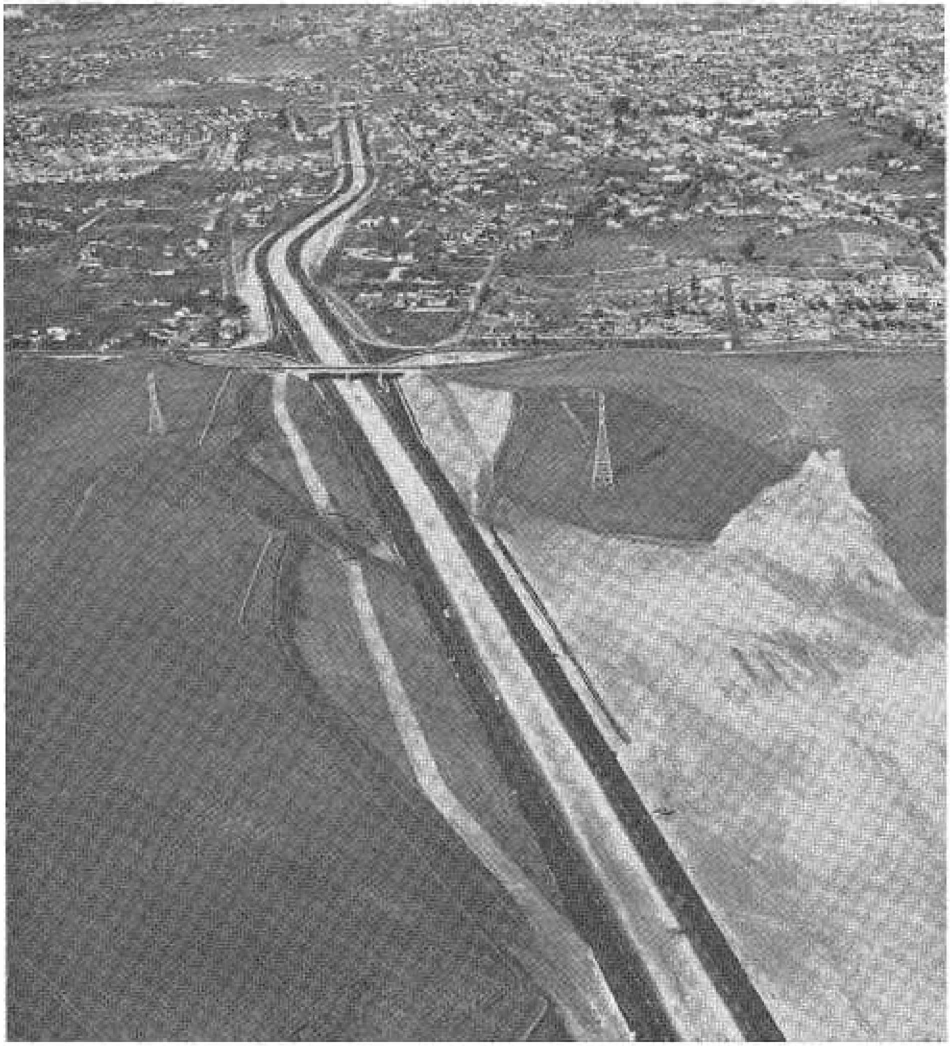
The Vallejo-Benicia Freeway is in the interstate highway system and is a portion of Interstate Route 680. The US 40 freeway construction contract completed in the Vallejo area January 6, 1959, provided a full cloverleaf interchange ending at Cedar Street, which was picked as the beginning of full construction on this project. However, a ¾″ open-graded contact blanket from Cedar Street westerly to Lemon Street was also a portion of this contract.

Interchange Built

Interchanges were constructed at the freeway intersections with Glen Cove Road and Columbus Parkway. Connections were made with Laurel Street on the south and Cedar Street on the north, which, with the Laurel Street Overcrossing constructed on the previous US 40 contract, provided an interchange for this area. A pedestrian overcrossing at Homeacres Avenue was constructed for the use of schoolchildren. A service road to Dillon's Point was also a part of the project.

Since the last mile of the freeway contract followed the existing Benicia Highway a detour was provided in this section by connecting the newly constructed westbound lanes of the Benicia Highway to the nearby Columbus Parkway, a county road. The freeway construction which follows the old road crosses a marshy arm of Southampton Bay. During construction of the original road considerable lateral displacement occurred as well as settlement during construction and continuing thereafter for many years. The Headquarters Laboratory Foundation Section of the Division of Highways made a study of conditions in this area before the contract was let and in the worst section (Station 180-190) a system of sand drains and earth struts were made a part of the construction contract.

Looking east on Interstate Route 680 from above the cloverleaf intersection with US 40. Immediately beyond the cloverleaf is the Laurel Street-Cedar Street interchange. Both interchanges were constructed under a previous contract.



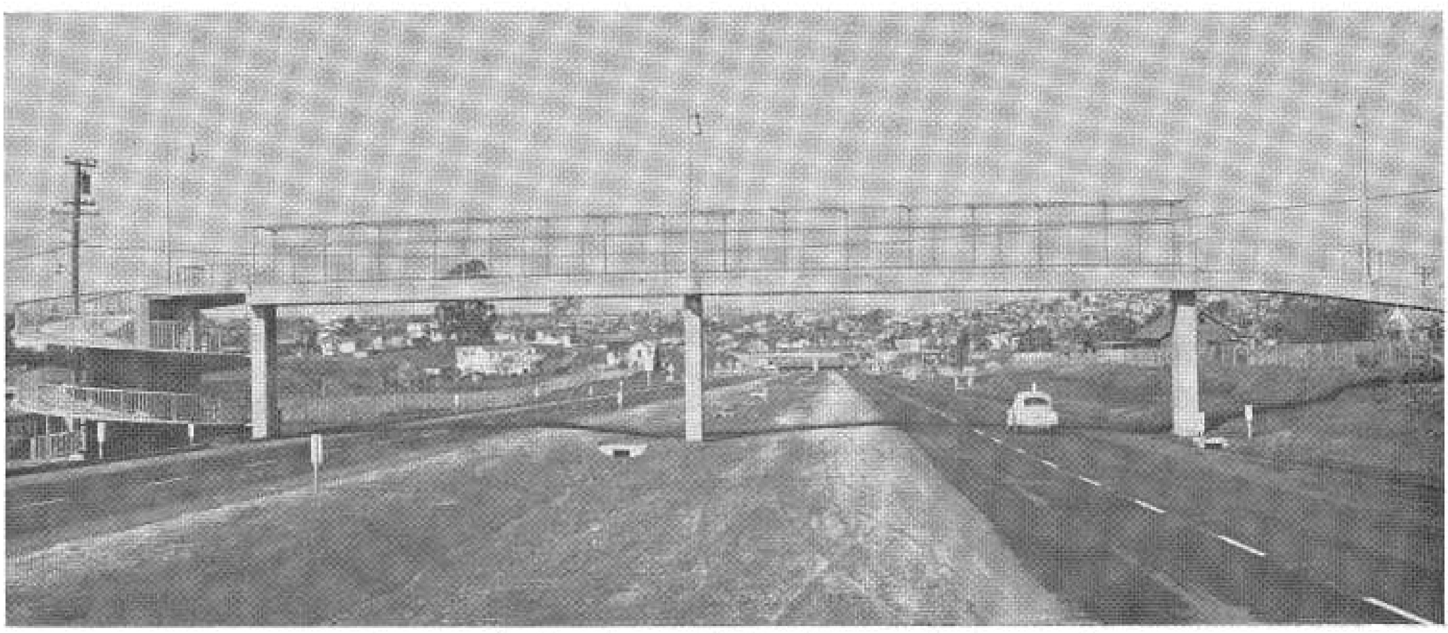
Looking westward from the middle of the project showing the deep sidehill cut in the left foreground and the waste area on the right. The near interchange is Glen Cove Road.

Slow Settlement

The sand drains were spaced at 8 feet and 10 feet centers in both directions with varying depths of 12 to 40 feet and averaging about 25 feet. An overload of 10 feet was placed between Stations 180 and 186 and a 5-foot overload between Stations 187 and 190. The overloads were planned to remain only through the contract time but only the 5 foot section was removed. Settlement occurred so slowly in the 10-foot area it was left in place and a temporary pavement constructed over the top. It is expected the overload may be left in place for several years before it will be removed and the permanent pavement constructed.

Another location where settlement gave trouble was about 300 feet of the service road connection to Dillon Point Road. This crosses a particularly swampy section of the Southampton Bay arm. Although it has been brought to grade after settlement during the contract period, it is expected that further settlement will occur.

Trouble with ground conditions was expected in the large 40-foot to 80-foot cuts east of Glen Cove Road. Slides had occurred previously and were in evidence along the hillsides. Also, underground water had appeared in preliminary drilling operations of the Materials and Research Department of the Division of High-



A view westward on the new freeway of the Shows Homeacres pedestrian overcrossing.

ways. A pervious blanket with perforated metal pipe underdrain system was set up for this section extending east from Glen Cove Road between Stations 143 and 160. Although no free water was encountered during construction, previous experience with conditions in and around the Vallejo area influenced a decision to go ahead with the placing of the planned filter blanket and underdrains. The first hard rains bore out the wisdom of the decision for the water poured from the underdrain outlets even several days after the rains had ceased.

Slide Occurs

A slide occurred during construction in the location (Sta. 151) noted as likely in the Materials Report. The black soggy material was excavated to as much as seven feet below the eastbound lanes and up the side slope to the bench 40 feet above. A dry rock wall was built at the bottom using all of the large boulders from the excavation that could be found. Although sloughing of material above the rock wall can be seen, no movement of the roadbed has been detected to date.

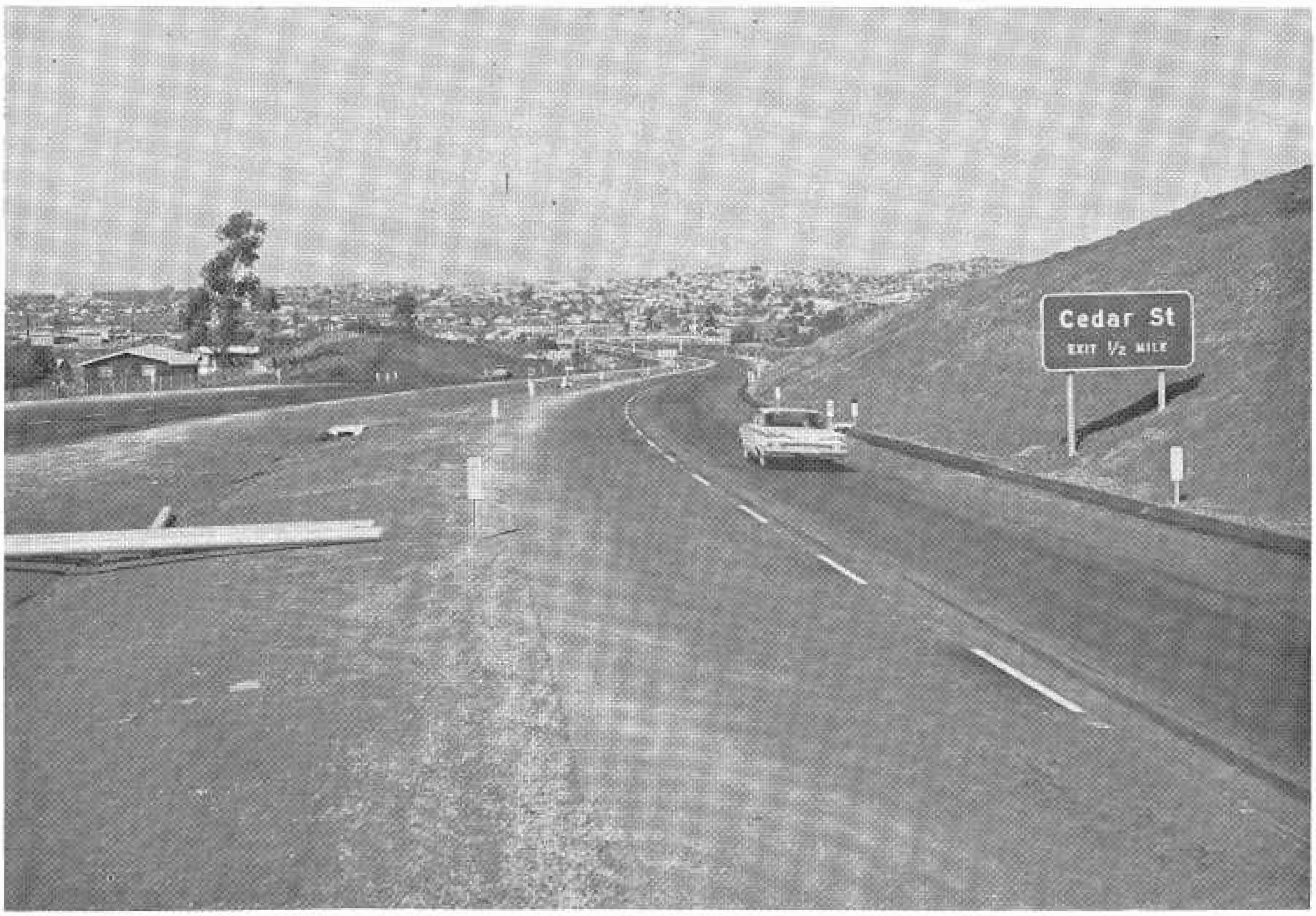
During earthwork operations from the sand drains to the Benicia end of the project under the movements of the heavy grading equipment considerable "pumping" developed along the old highway roadbed. To insure a stable roadbed the black, mucky material was removed to a depth of four feet below grade of the new freeway and backfilled with dry stable material. Over the whole job a total of 28,000 cu. yds. of unsuitable material was removed and replaced with good stable fill in order to insure a firm foundation for the highway.

The grading on this project was not balanced, there being about 400,000 cu. yds. of wasted material out of the 824,000 cu. yds. of roadway excavation. On the plans an optional disposal area was shown north of and adjacent to Stations 150 and 169 which the contractor elected to use.

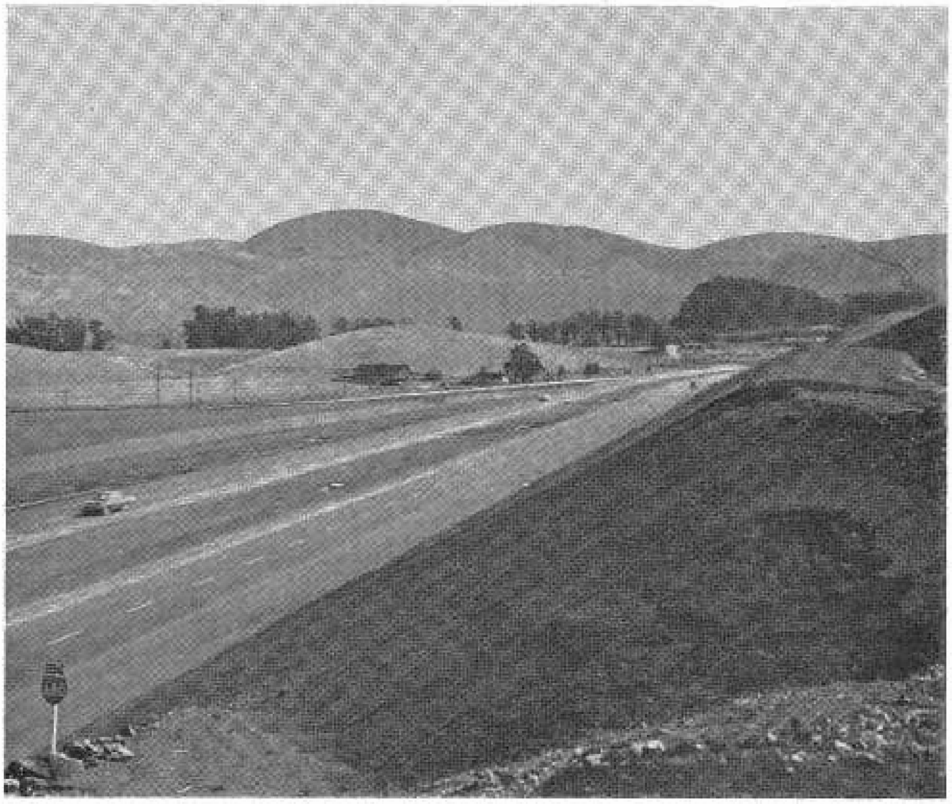
Structural Thickness

The structural thickness of the main freeway was 24″ throughout the job. The subbase material was 12″ in thickness, a sandy material from the sweet site located north of Benicia and about a 9-mile haul to the center of the job for the contractor. The 8″ thickness of cement-treated base was plant mixed and came from the Basalt Plant in Napa. The surfacing was a 4″ thickness of plant-mixed asphalt concrete which also came from Basalt in Napa. On the traffic lanes of the traveled way a ¾″ layer of open-graded asphalt concrete was placed.

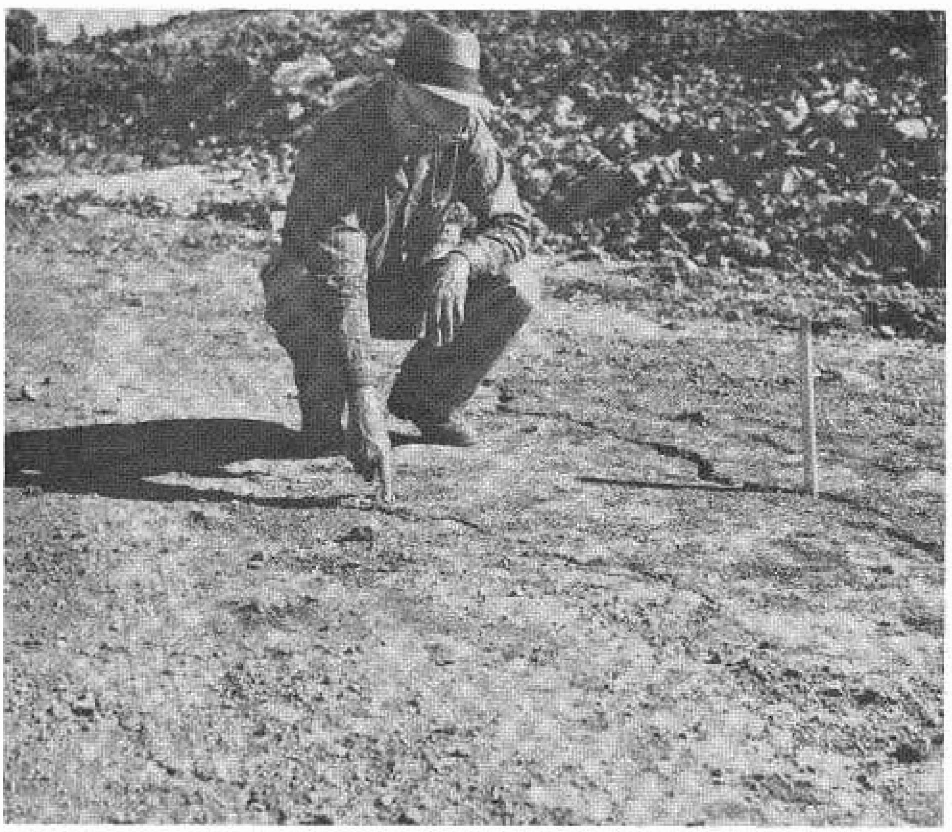
An extensive system of storm drains was constructed throughout the pro-



A westward view of the new freeway taken about halfway between Glen Cove Road and the pedestrian overcrossing (see previous photo).



This photo was taken from the bench of the south cut slope looking west. In the foreground is the slide area at Station 151 with the rock wall at bottom left. Sloughing is in progress but no movement of the roadbed has been detected to date.



Settlement cracks in the earth strut along the north side of the sand drain area caused by the overload which is applied slowly (one foot per week).

ject west of Glen Cove Road. This was a requirement due to the freeway's occupying a good portion of a natural valley in this area.

The bridge construction consisted of the Homeacres Pedestrian Overcrossing, the Glen Cove Road Overcrossing and the Columbus Parkway Overcrossing. The pedestrian overcrossing is made up of one reinforced concrete slab span and three reinforced concrete cored slab spans with a total length of 200 feet and a walkway width of eight feet. At the south end is a reinforced concrete spiral ramp cantilevered out from a central tower. The design of the pedestrian overcrossing is of pleasing appearance in spite of the necessity of enclosing the top portion with a chain link fence to prevent the dropping or throwing of objects on the roadway below.

Prestressed Girders Used

The Glen Cove Road Overcrossing and the Columbus Parkway Overcrossing are both constructed with precast prestressed reinforced concrete girders and reinforced concrete deck. They have a roadway width of a clear 28 feet and Glen Cove Road has a sidewalk on the east side. Columbus Parkway has only the safety curbs on each side. The total length of the Glen Cove Road Overcrossing is 187 feet and Columbus Parkway Overcrossing is 157 feet 7 inches long. Both overcrossings are paved with asphalt concrete surfacing. Columbus Parkway Overcrossing is supported on poured-in-place in drilled holes piling under the piers and abutments.

Frederickson & Watson Construction Company of Oakland were the prime contractors and the cost of construction was $1,725,000. M. D. Engrahm was Resident Engineer during the staking and early part of the contract, C. F. Roderick was Resident Engineer through the main portion and D. C. Willard was Resident Engineer for the final few months of the project. W. F. Fleharty was the District X Construction Engineer. For the Bridge Department George O'Dougherty was in charge for the early part and R. M. McCullough for the major part of the bridge construction. R. T. Orr was the U. S. Bureau of Public Roads representative.

Feather Lake

Highway Project Is Example Of Two Counties' Foresight

By WILLIAM D. McINTOSH, Road Commissioner, Lassen County, and
DONALD D. CHAMBERLIN, Director of Public Works, Shasta County

Among the tall pines and quaking aspen two Northern California mountain counties celebrated the completion of the 46-mile Feather Lake Highway last September.

Commencing five miles west of Susanville, the new highway runs generally in a northwesterly direction and connects State Highway 36 with State Highway 89 one mile north of Old Station.

Of these 46.1 miles of asphaltic concrete, 37.4 miles traverse the western part of Lassen County. The westerly portion drops over the Hat Creek Rim into Shasta County.

Feather Lake Highway can be described as a monument to county government at its finest, having been conceived by foresighted officials who envisioned the importance of this route to the public long before it was generally recognized.

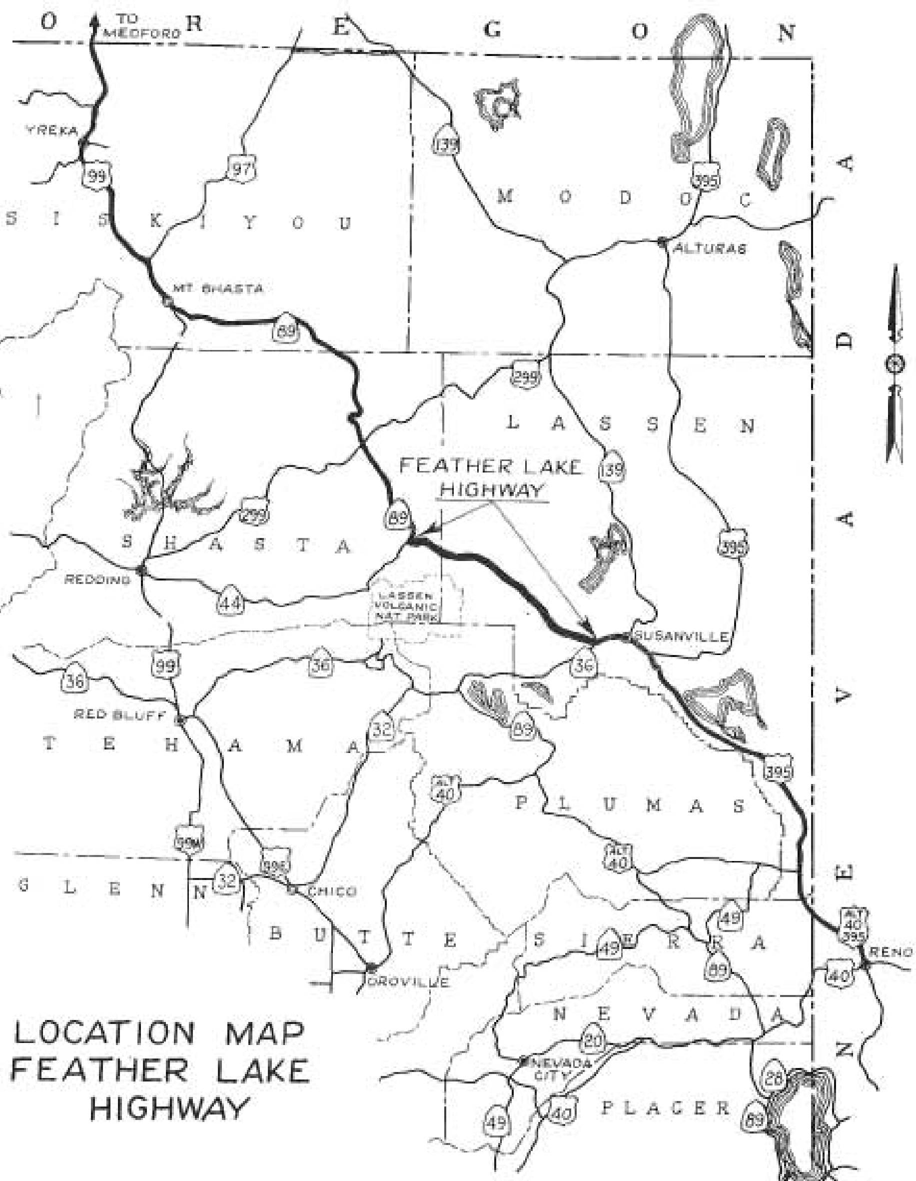
Desired for Interstate Use

The highway is a local road, but designed for and used by interstate travelers as well as California motorists. It is further distinguished by the fact that it is not the dream of the governmental body of one county, but is a result of the co-operative effort of two neighboring counties who worked together to make it a reality.

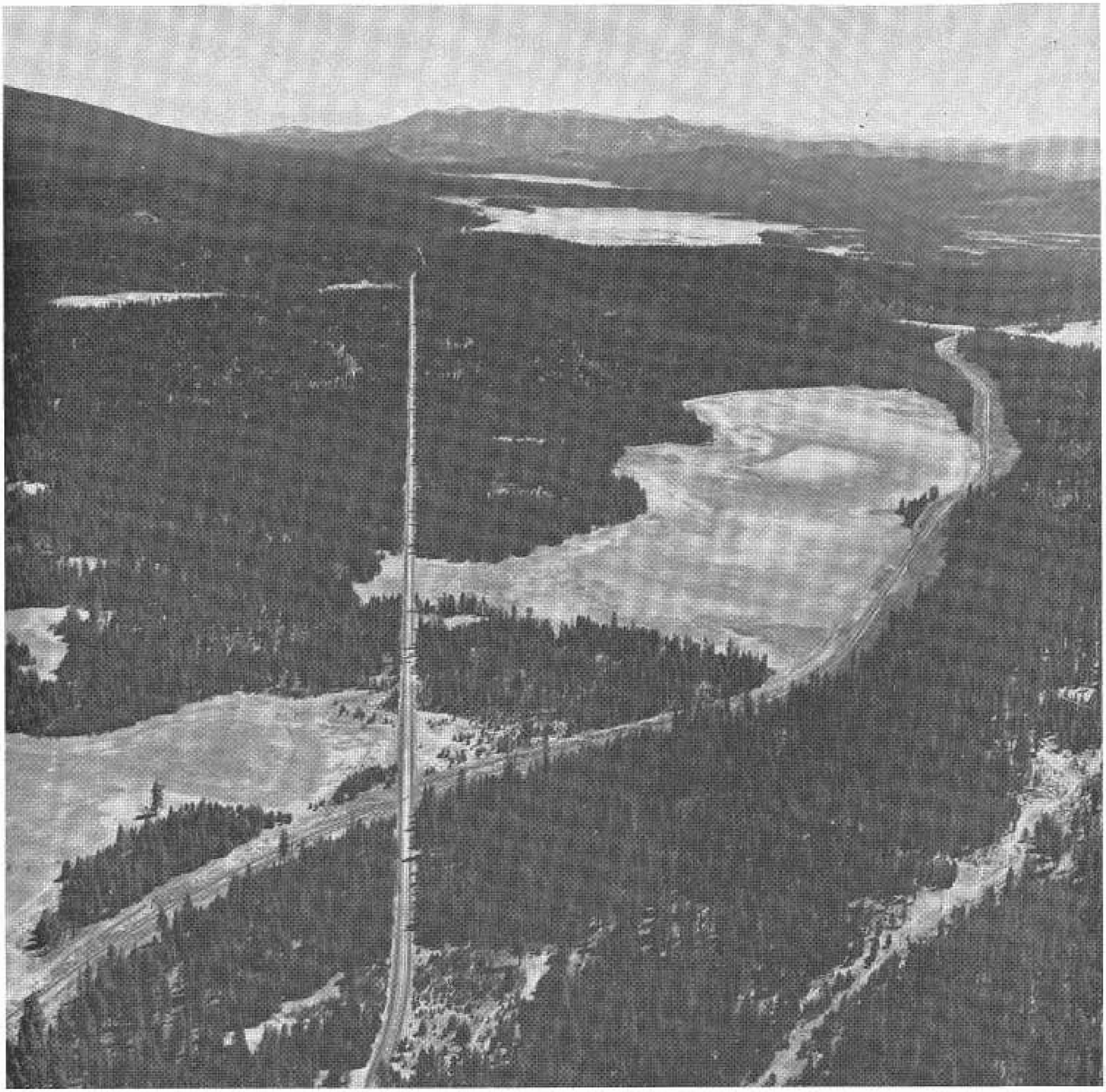
Even before the final contract was finished, travelers going west from Reno to Redding and north to Burney, Yreka, Medford, and points beyond had found the Feather Lake Highway to be a milesaver. It will also serve as an artery for timber management projects of the United States Forest Service and private timber holders; speed fire suppression over a vast area; provide access for ranches and summer pasture; and open large, heretofore untapped recreational areas in the Sierra.

Far-sightedness Borne Out

The far-sightedness of those responsible for the construction of the highway was borne out by the conclusions of the California Freeway and Expressway study ordered by the 1957 Legislature. Among the major routes designated a part of the Freeway and Expressway System was the Feather Lake Highway, which was already under construction by the Counties of Lassen and Shasta. The recommendations of the freeway study were ac-



The above map shows the location of the Feather Lake Highway and its importance as a connecting link of the State Highway System.



The new Feather Lake Highway with the Western Pacific Railroad crossing in the foreground, Anna Lake at right center, McCoy Flat Reservoir in the background and beyond that, in the far distance, Hog Flat Reservoir.

cepted and enacted into law as the California Freeway System by the 1959 Legislature.

The alignment of the Feather Lake Highway follows part of the "Pioneer Freeway System." In 1848 Peter Lassen, an early pioneer responsible for settling portions of Lassen and Shasta Counties, used a portion of the present route to transport new settlers from the East.

First Interest Shown in 30's

The Bureau of Public Roads and the United States Forest Service first showed interest in the route in the 1930's, but it wasn't until Lassen and Shasta Counties took the initiative in 1957 that continued progress was actually accomplished. It was in that year that the two counties placed the route in the Federal-aid Secondary System and programed a schedule of continuous contracts to complete the project. A total of 11 contracts amounting to $2,670,000 were awarded to construct the highway; six by the

. . . Continued on page 35

42-year Veteran Bill Bock Retires

William Bock, Assistant Office Engineer for the State Division of Highways Headquarters in Sacramento, retired in January, ending 42 years with the State.

For many years Bock was in charge of reviewing and co-ordinating plans and contract specifications as the final stage of preparing a highway project for bid advertising.


WILLIAM BOCK

After bids have been opened and contracts awarded, he has been responsible for review of progress payments to the contractor during the course of the job and the final payment upon completion.

Many of the division's procedures in contract administration were developed under Bock's guidance.

Among his other duties were responsibility for the production of the annually revised State Highway Map which is part of the division's annual report, and the supervision of the preparation of title sheets for contract plans and maps showing route adoptions by the California Highway Commission.

Among highway engineers Bock is noted for his excellent memory. He is widely known as a source of ready information concerning hundreds of highway contracts, both past and present.

Bock joined the division as a draftsman in 1919. In March, 1920, he left to become Assistant City Engineer of Tracy, but returned to state service in November of that year.

From 1922 to 1923 he was assistant resident engineer on highway construction projects in Bakersfield and Fresno. He moved to Sacramento to join the Office Engineer's staff in 1923.

Bock was born at Galt, Sacramento County, and attended school at Altamont. He holds an associate of science degree from the Polytechnic College of Engineering in Oakland.

His first professional job was as rodman and timekeeper for the Southern Pacific on railroad relocation and construction in Oregon. In 1916 he became resident engineer for the San Diego and Arizona Railroad. He left to serve with the U.S. Army during World War I.

From July to October of 1919 he was chief of party on topographic surveys for the Pit River Power Company.

Bock and his wife, Lois, have two sons: William K., of Sacramento, and Alton S., of San Jose.

FEATHER LAKE

Continued from page 34 . . .

The U.S. Post Office with its motto of "Neither rain nor snow nor hail nor sleet, etc." has nothing on the above group. Director of Public Works Robert B. Bradford (raincoat over shoulders), flanked by (left to right) District Engineer H. S. Miles, State Senator Stanley Arnold, Lassen County Supervisor "Bill" Tunison (holding oversized shears), Miss Diana Chappius, Queen of Lassen County, and Shasta County Supervisor Norman Wagoner braved a hailstorm to see that the Feather Lake Highway was properly and officially opened.

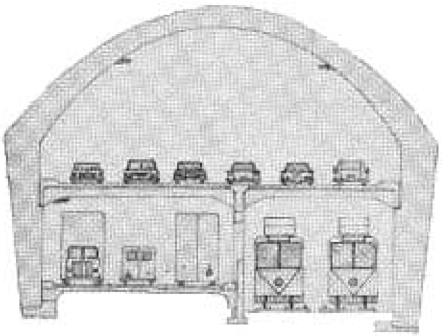
County of Lassen, one by the County of Shasta, and four by the Bureau of Public Roads using national forest highway funds. The final contract was completed in early September 1961, signalling the completion of the overall project.

The Feather Lake Highway, once merely the dream of Supervisor William Tunison of Lassen County (known as the "Father of Feather Lake Highway") and others, is now a high-standard, high-speed route through the Sierra, realizing a saving to motorists of some 29 miles between Susanville and Redding, the two county seats, or 74 miles between Reno, Nevada, and Medford, Oregon.

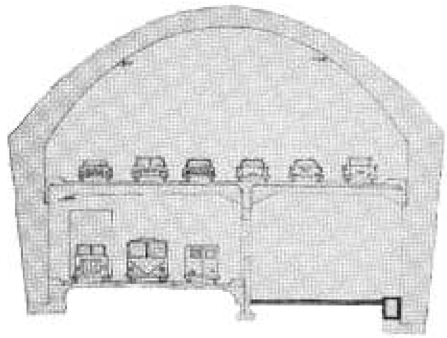
Highway Dedicated

The highway was ceremoniously dedicated at its easterly terminus on September 17, 1961. At that time a joint resolution adopted by the Counties of Lassen and Shasta, offering the route to the State Department of Public Works as a completed section of the California Freeway and Expressway System, was presented.

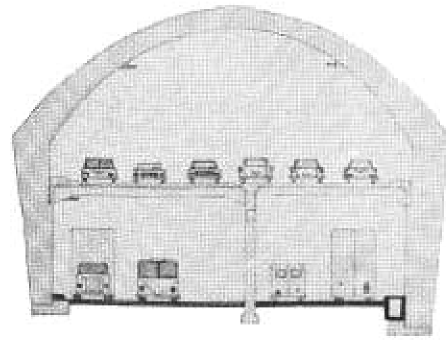
The route was accepted for State maintenance on September 27, 1961, by the California Highway Commission and is now officially designated State Sign Route 44. On January 25, 1962, it was adopted by the Highway Commission as a freeway route. No one could be more justly proud of this accomplishment than the officials of the two small counties who were primarily responsible for the completion of such a monumental and worthwhile project.



Cross section of Yerba Buena Island tunnel, San Francisco-Oakland Bay Bridge, looking east as originally constructed. Lower level right used by electric interurban lines, lower level left for commercial vehicles. Upper level six lanes of passenger car traffic.



When train service discontinued by Public Utilities Commission order; tracks were removed as first step in reconstruction, and area paved. As yet no change in motor vehicle traffic pattern.



Truck lanes lowered to level of of south lanes, and center wall between columns removed. Four lanes of traffic now available for lower level traffic. No change on upper deck at this stage.

Bay Bridge

Second Phase of Reconstruction Nearing Completion

By N. C. RAAB, Chief Projects Engineer,
Division of San Francisco Bay Toll Crossings

In the July-August 1960 issue of *California Highways and Public Works* magazine the first phase of the reconstruction of the San Francisco-Oakland Bay Bridge was described. That article dealt with the San Francisco approaches to the bridge, the conversion of the Transbay Transit Terminal from train to motor coach operation and the paving of the lower deck area over the West Bay crossing, formerly occupied by the bridge railway, for all vehicular use.

This article pertains to the paving of the East Bay crossing; the reconstruction of the roadways through the Yerba Buena Island Tunnel; the viaduct section on the Island; and the strengthening of the West Bay upper deck floor system to accommodate the heavier commercial vehicles.

110,000 Vehicles Daily

The planning for all contracts, in connection with the reconstruction of the bridge, provides for the more than 110,000 vehicles per day crossing the structure without serious delays. Specifications are so worded that construction is carried out on a calendar day basis, which calls for work to be performed outside the normal eight hour day and on weekends.

The present upper deck of the bridge has six 9′-8″ traffic lanes, three in each direction, for automobile traffic only. The lower deck originally had a 31-foot roadway, three 10′-4″ lanes for commercial vehicles. The remaining 27 foot width on the south side was occupied by the railroad.

Upper Deck Strengthening

The plan for strengthening the upper deck to accommodate five 11′-7¼″ one-way vehicular lanes for mixed traffic required the analysis of the present floor system to determine which members were deficient in strength and a practical means of reinforcing those parts not meeting specification requirements.

The completed portion of the lower deck, from San Francisco to Yerba Buena Island, was striped for five lanes. During the construction period it was operated as a four-lane roadway, two in each direction, with the fifth or south lane reserved for contractor's use.

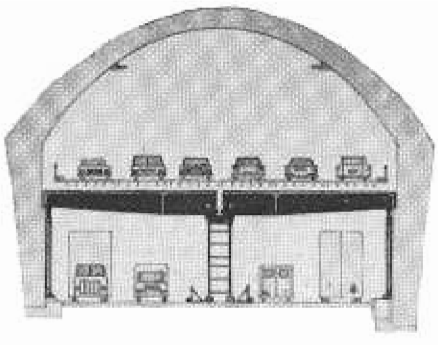
The upper deck floor system consisted of six-inch lightweight concrete slabs, 58 feet in width, supported on 13 longitudinal steel stringers, which in turn are framed into transverse steel floor beams on 30-foot centers.

Reinforce Floor Beams

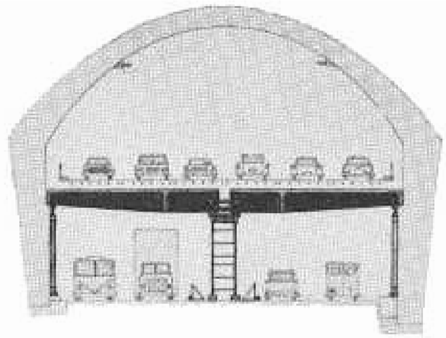
The theoretical analysis of the floor system revealed the adequacy of the concrete slab with its steel reinforcing to support the heavier commercial vehicles, and the same was true of the steel stringers. The floor beams were found to be deficient in strength and required reinforcing.

Due to the many assumptions that are applied in the theoretical analysis of a problem which could materially influence the results, it was decided to verify these findings by field tests using a loaded truck which imposed upon the concrete slab the legal loading concentrations.

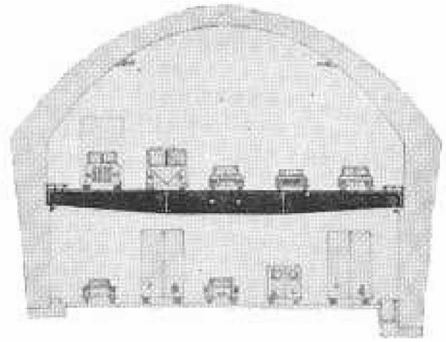
Four floor beams were selected for tests, each with different framing and loading characteristics. Instrument readings were taken of all floor mem-



Next step is lowering of upper deck roadway for better clearance in tunnel, and removal of center supports obstructing repaved lower roadway. Since upper deck must be replaced in sections, traffic moves over portion of upper roadway that is removed by means of a temporary bridge which is moved forward as new precast deck units are replaced in gap at lower elevation.



New deck units are put in position, one side at a time, while truck traffic is transferred to whichever alternate lanes not occupied by construction crews. After positioning, units are tensioned and center gap is filled with concrete.



When all units are in position, columns on lower level have been eliminated. Traffic pattern is now changed to five standard width lanes for mixed traffic; one-way, on each level. Lower level is eastbound, upper level is westbound.

bers before and after test loads were applied.

The results of the tests proved that existing conditions under actual loads were better than the results obtained by the theoretical calculations. It also demonstrated that the method of strengthening the deficient members was practicable and could be achieved under adverse working conditions.

The plan for strengthening the 357 floor beams required a high strength steel plate attached to the lower flange of the member after the plate was stressed to a predetermined amount. By tensioning the new cover plate a compressive stress was induced into the lower flange of the floor beam, resulting in a reduction of the dead load tensile stresses. The tensioning was sufficient to prevent an overstress of the composite flange under legal axle loading.

Traffic Continued

As this construction was done under traffic, the contractor was furnished three of the State's traveling scaffolds which are supported on tracks suspended from the upper deck. These were augmented by lighter platforms which the contractor fabricated and erected. The material was handled from the south lane provided for the contractor's use.

The operation in general consisted of drilling holes through the lower flange of the floor beam, bolting one end of the plate to the flange, stressing the free end of the plate by jacks, locking the stressing device, then drilling bolt holes through the lower flange using the stressed plate as a template, and then bolting.

High strength body bolts were inserted in the holes and the nuts tightened with a wrench to a specified torque. Stitch bolts were placed throughout the length of the plate to hold it in position.

Also included in this contract was the widening on both sides of the upper level roadway between the San Francisco Anchorage and Pier W-1 from 58 feet to 69 feet. This widened portion will eventually be incorporated into deceleration lanes and refuge bays for the "off" ramps on the north and south sides of the deck leading to Fremont Street in San Francisco, when the bridge becomes one way westbound.

On completion of the contract, the West Bay crossing will be completed and ready for five lanes of one-way mixed traffic on each deck when traffic is changed to this operation, starting the early part of 1963.

Yerba Buena Island Construction

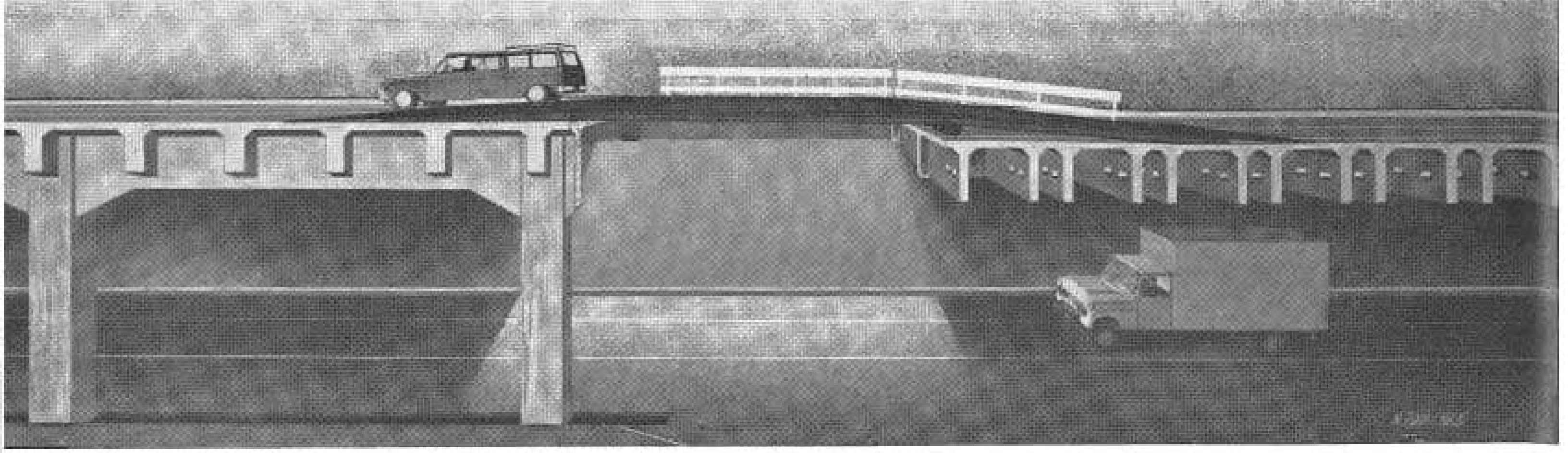
Probably the most exacting and difficult construction operation being completed is the work now in progress across Yerba Buena Island in connection with the San Francisco-Oakland Bay Bridge Reconstruction Project. The contract extends over a length of 1,786 feet which involves 826 feet of tunnel section and the remainder in a double decked concrete viaduct.

The reconstruction in general consisted of the following:

- 1. Remove the two tracks from the south side of the lower deck area.
- 2. Lower the grade and pave the area for two lanes of traffic.
- 3. Remove the present three north truck lanes, lower the grade three feet and repave.
- 4. Restripe the north and south roadways for two lanes in each direction.
- 5. A movable steel bridge with a span of 26 feet and a width of 58 feet which fitted between the curbs of the upper level roadway was placed on the upper deck.
- 6. The columns supporting the upper deck and sections of the deck under the movable bridge, 10 to 12 feet in width, were then removed.
- 7. Precast concrete deck units, 7′-8″ in width, replaced the removed section at a 16-inch lower level.
- 8. The bridge was advanced and the operation repeated.

The upper deck viaduct section to the east of the tunnel was strengthened by the addition of precast, post tensioned, concrete units prior to the removal of the center supporting columns.

Under the south roadway a continuous concrete utility tunnel was constructed to carry the various air, electric power, water, and communication lines across the Island, which



Cutaway section of Yerba Buena Island reconstruction, with movable steel bridge in position. Viewpoint is from south, with San Francisco to left. New deck units capable of accommodating the heavier commercial vehicles at right, old inadequate upper deck floor system before removal at left.

utilities extended to both ends of the bridge.

The 58-foot roadway constructed at ground level was lowered to maintain the 16 foot minimum vertical clearance between the two levels which accommodated both the deeper deck units and the 16 inch lowering of the upper level required for clearance at the tunnel portals.

Remove Concrete At Night

The removal of some of the concrete in the tunnel section was done at night to avoid the heavy traffic on the lower deck. The precast upper deck units were erected during the day by shifting traffic on either the south or north roadways. The new precast deck units rest on shelves of the tunnel which were used to support the original upper deck.

Forty-eight Hour Cycle

The tunnel units arrived at the site in two sections. Each section was raised and placed in position by an elevator hoist mounted on a truck. One end of the section rested on a shelf and the other on falsework struts along the center line of the tunnel. The units were post tensioned after connecting the high strength steel rods at the center and then jacking the two sections apart. The 1′-6″ gap between units is closed by a steel form, filled with concrete and then heat cured. The operation was based on a 48-hour cycle before traffic was allowed on the new roadway. Lightweight concrete was used in the units as well as the key forming the two parts into a single roadway section.

A sprinkler system with fusible metal plugs in the nozzles was suspended from the upper deck in the tunnel section for fire protection. A fire patrol station is automatically notified as soon as water starts flowing through the sprinklers.

Various island roadway connections to the bridge were necessitated to accommodate traffic during the construction period and for the final routing of unidirectional traffic on each level.

Also required by the change are passenger platforms for island personnel using public transportation to the mainland. The platforms are located opposite each other on the east side of the tunnel, one on the north side of the upper deck and the other on the south side of the lower level. The roadway has been widened to six lanes at the platforms which provides for a deceleration and acceleration lane for buses stopping at these stations.

Roadway Lighting

The roadway lighting for the upper and lower decks was a part of this contract and consisted of some rearrangement of the sodium vapor lights on the upper level where new roadway connections and passenger platforms require a change.

The lower level lighting was entirely new throughout the 1,786 foot length of the reconstruction which consisted of continuous lines of fluorescent fixtures on each wall of the tunnel section and separately spaced units on each side of the viaduct.

The lighting circuits are so arranged to have all the tunnel lights on during the daylight hours and half the number during the night. This light arrangement will be synchronized with the viaduct section.

Mechanical ventilation for the two roadway areas in the tunnel was considered during the reconstruction planning stages. The cross section area of 1,500 square feet of the upper level is large compared to vehicular tunnel or tubes where artificial ventilation must be considered for the comfort of the users. There has never been any noticeable or disagreeable effects from motor fumes on the upper level through the tunnel, probably due to the short (540 foot) length and favorable scavenging action of the air currents.

Lower Level Vented

The lower level has a cross sectional area of 1,000 square feet, two-thirds that of the upper area. The lower section does not have a free flow of air, and there could be some ill effects due to this. Provisions for the release of any accumulated fumes was considered in the planning and vents are placed at 7′-8″ centers under the sidewalk. The free flowing air through the upper section should siphon most of the gasses from the lower roadway.

If this does not prove to be an effective means of clearing the vitiated air, after one-way traffic is established, it has been planned to use the utility duct to convey and release fresh air along the lower roadway. Automatically operated electrical blower equipment would be housed in an existing vault at the east end of the tunnel.

Lower Deck Paving—East Bay

The removing of the railroad rails and paving of the area occupied by trains along with other reconstruction work on the East Bay crossing of the San Francisco-Oakland Bay Bridge was performed under another contract.

The decking operation consisted mainly of the following:

- 1. Removing of tracks and appurtenant material.
- 2. Saw cutting the concrete and removing approximately one foot of the truck pavement in the south truck lane to the center of the first highway stringer.
- 3. Remove the center steel barrier to the south truss of the bridge.
- 4. The various utility facilities were hung on the back wall of the barrier.
- 5. The railroad stringer bracing which was no longer required for the highway construction was removed.
- 6. New steel maintenance platforms were hung from the south truss at the lower deck level at specified locations with steel ladders leading to the upper deck.
- 7. Precast roadway deck units were placed, fastened to railroad stringers and joined by a concrete fill.

Tracks Removed

All track material was removed over the existing railroad, segregated and then stored in the proper bins or stacks in the East Bay storage yard. The material was held for disposal through contracted sales.

A one foot width of the lower deck adjacent to the center barrier was notched with a concrete saw. The concrete was broken out to the center of the highway stringer which provided a seat for one of the four lightweight concrete slabs that were placed in each panel.

The longitudinal steel bracing between the railroad stringers was removed to reduce the dead load and the maintenance painting of these parts. The converted railroad stringers are now braced by the continuous concrete deck slab which the stringers support.

The new deck units, approximately six feet in width and with lengths to fit the various panels were trucked to the site, lowered into position on the railroad stringers and then joined together by high early strength concrete.

Before the innermost panel was placed, the steel barrier which is composed of a curb and wall was skidded over the railroad area to its new position along the south truss of the bridge. After adapting and fastening, the salvaged barrier became the new south curb and rail for the 58-foot roadway.

Utility Facilities

The various utility facilities which consisted mainly of a four-inch pipe for compressed air and another for water, primary and secondary electric power cables, and a communication line were hung on the outboard side of the rail.

Salvaged and additional working platforms were suspended from the south truss at about 300-foot intervals which provides the maintenance personnel with a safe working space for the attachment to the outlets of the various utility lines. A steel ladder leads to the upper deck from each platform for easy access to these outlets. These facilities are in turn connected to the traveling painting scaffolds at or near each platform by flexible hoses and conduits. Communication to each end of the bridge can be obtained with a plug-in headset.

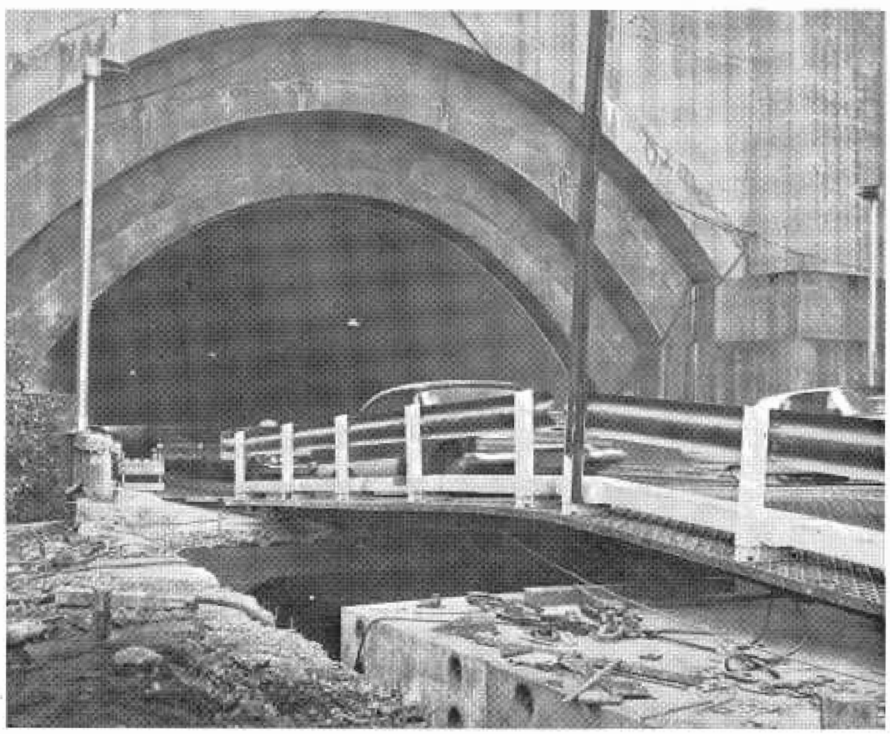
Precast Concrete Units

It was decided to precast the lightweight concrete deck units, transport them to the space vacated by the tracks, then set and join them together at each stringer with a high early strength concrete for the following reasons:

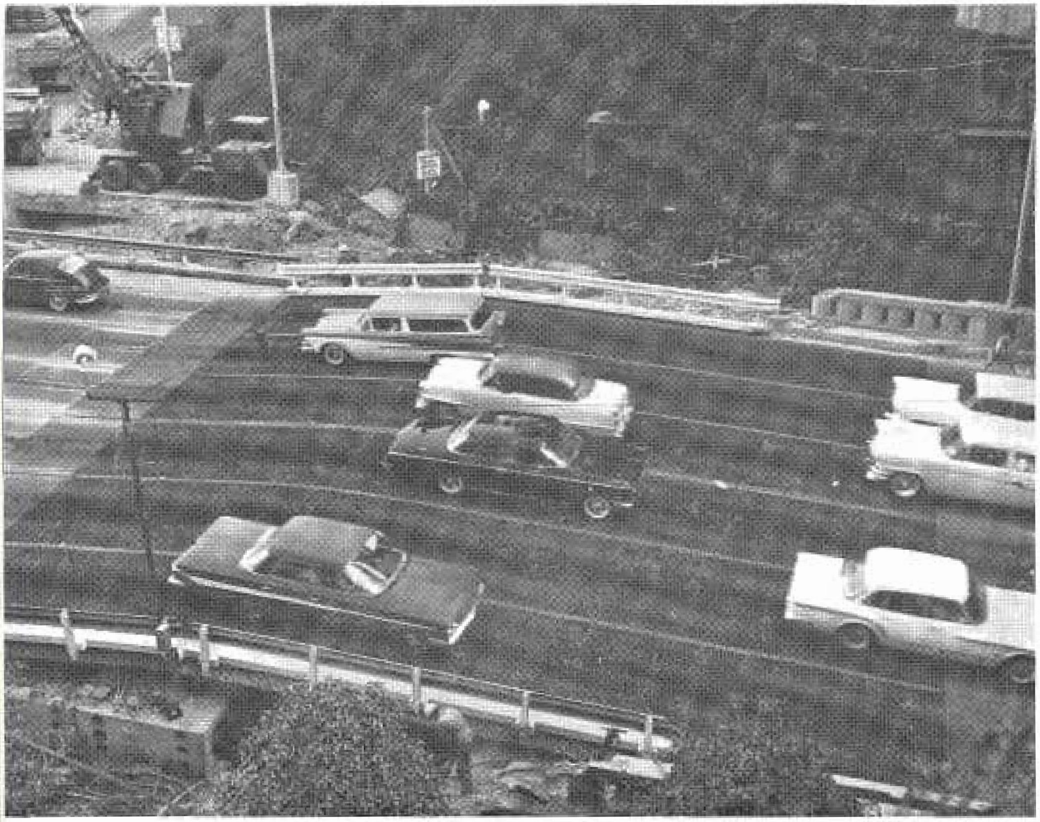
- 1. A poured-in-place slab would have required the inboard truck lane during the pouring and curing stages, thus cutting the lower deck roadway to two lanes.
- 2. There would be some doubt as to the strength of the concrete in certain areas of the bridge due to the excessive vibration of the structure.
- 3. The high early strength concrete used to connect the units together along the stringers does not require the strength that is needed in the slab.

East End of Bridge

The east end of the bridge presented several problems which resulted from the location of the columns supporting the upper floor system, and the separation of the railroad structure from the highway ramp where they



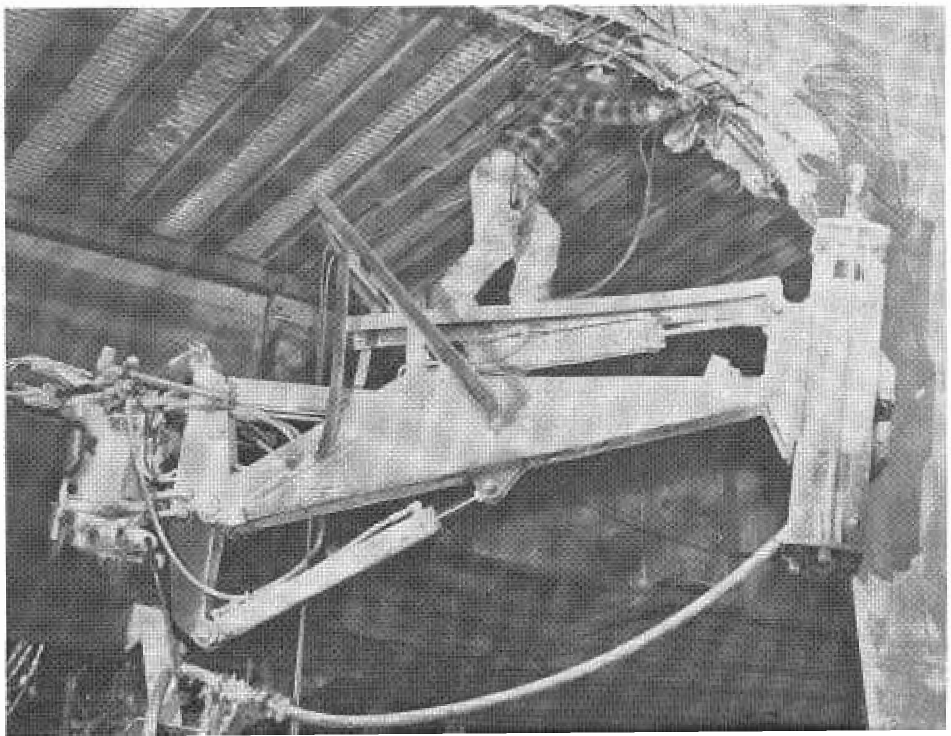
Photograph of movable bridge from viewpoint on same side of bridge as cutaway section of tunnel reconstruction. Outer ends of new deck units are seen in right foreground. The prefabricated, prestressed units fit neatly together, and no additional decking is necessary.



Above: Looking down from slopes at east entrance to tunnel, Yerba Buena Island, showing traffic crossing movable steel bridge. Many caution signals were posted and speed limit across movable bridge was reduced to 15 mph.

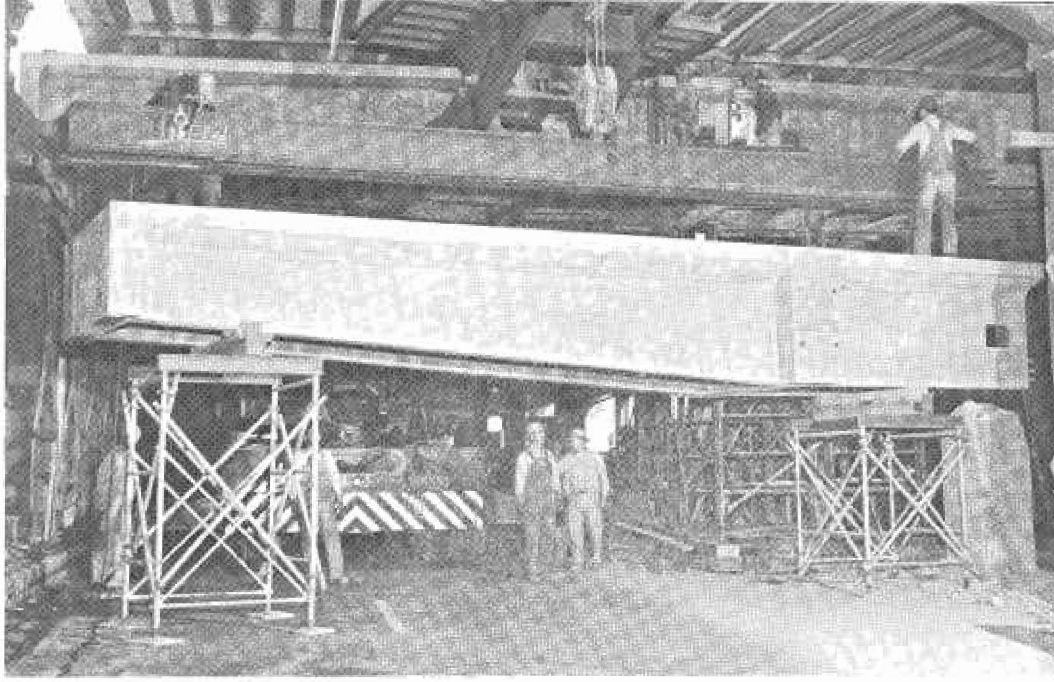
Beneath 90,000 Cars a Day

Left: View through lower level of tunnel, showing center columns to be removed. Construction crews are working in back of camera. Light lines far side of columns are lights of vehicles moving through tunnel over paved area which was once occupied by railroad.

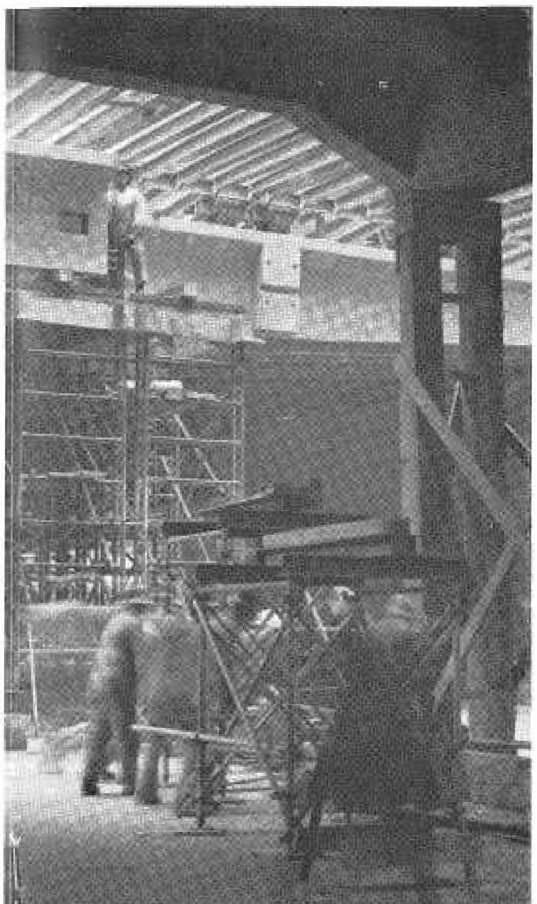


Double mounted air hammers, one vertical and the other horizontal for breaking out upper deck and columns. View shows movable steel bridge left and old reinforcing right. Workman is cutting away reinforcing steel with torch.

Huge precast concrete unit removed from truck and placed on temporary staging before lifting into position. After steel strongback is removed, crane in background places boom with special lifting platform beneath unit and positions unit in place. Men in background, upper right, are joining two previously placed right and left units.

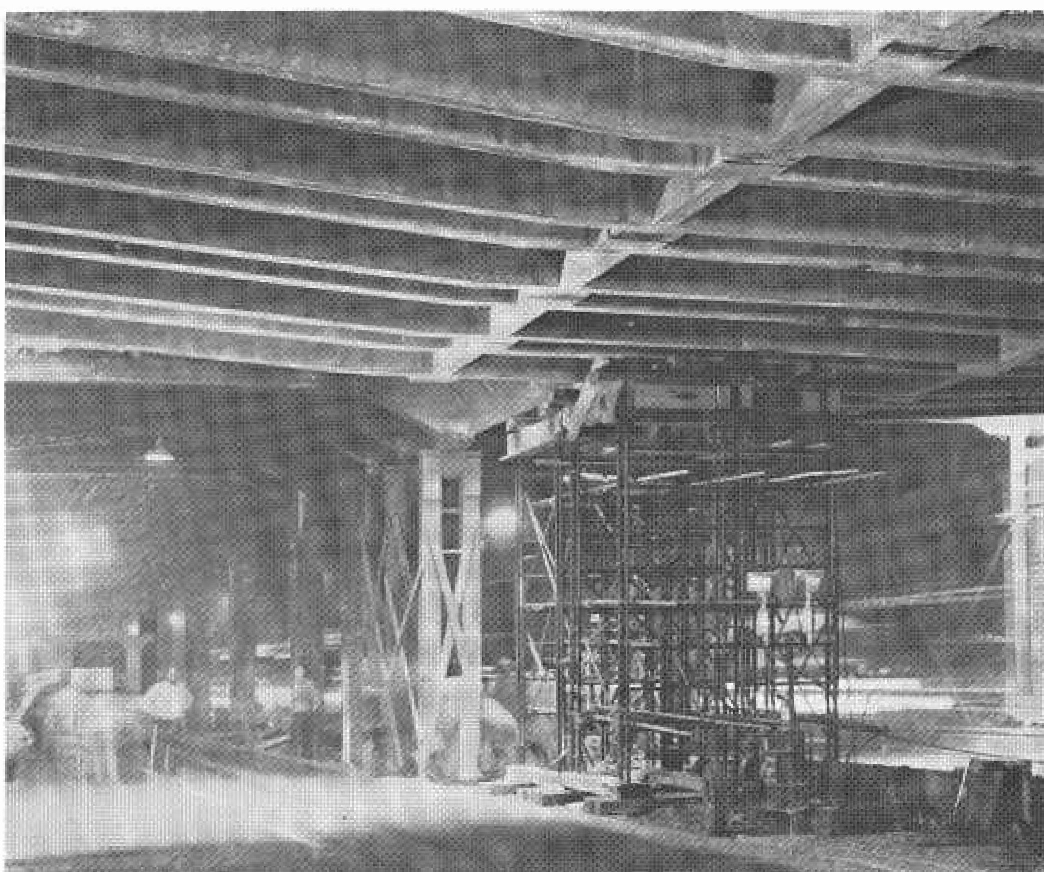


A 48-hour cycle



Above: With unit in position on falsework, workmen rapidly clear lanes of equipment preparatory to shifting traffic. Movable steel bridge is seen above head of workman on falsework. Rectangular hole in legs of unit are for jacking struts. Ends of three high strength steel rods are protruding from end of unit.

Below. Camera facing in other direction, shows truck backing into position with another unit, traffic now moving in other lanes. In upper part of photo is seen a number of units completed, with falsework removed.



both connect to the East Bay mole at the end of the structure. It was thought advisable under this contract to strengthen the upper deck run off spans between E23 and E39, a distance of 645 feet together with the 250 feet of concrete approach, as traffic could be shifted quite readily on the lower deck roadway during this construction period.

The eastbound two-lane highway structure was connected with the railroad ramp by decking between the two roadways. Additional stringers were required to support the slab and when completed formed the five lanes that are required for Oakland-bound traffic on the south side of the mole.

Several columns that were spaced between these two roadways had to be removed which in turn required the lengthening of the upper deck transverse steel floor beams and the strengthening of these members by an additional beam. Other columns had to be constructed on the south side of the piers to support these lengthened members.

Upper Deck Adequate

The present lightweight concrete upper deck with its steel reinforcing together with the stringers supporting the deck proved adequate to accommodate the heavier vehicles.

The reinforcing for the floor beams was accomplished by a unique method of connecting a high strength steel plate girder section to the lower flange of the floor beam. The beams were fabricated with a predetermined camber, as they were of different lengths, and then placed under the floor beams. The two ends were jacked into position, causing the reverse camber of the auxiliary beam to relieve the floor beam of its dead load stress. After the new member was brought into position, the two flanges were bolted together starting from the center.

Settlement Surveys

Settlement surveys have been periodically made of the overwater piers using the permanent bench marks established in the early 1930's during the construction of the bridge. At that time the only settlement occurred during the erection of the steel superstructure, and since then the movement in the piers have been so small that it is difficult to detect with the delicate instruments required for this type of work.

The mole highway on the east end of the bridge was constructed by a hydraulically placed sand fill which was pumped into an excavated area between the bridgehead and the shore. On this fill are located the toll plaza, mole highway approach to the bridge, and a concrete cellular approach structure which has settled with the fill and piles on which it is supported.

This structure was raised by progressively jacking the end of each span a small amount and then blocking. The operation was repeated until the deck was raised to its original grade line. The traveling public was not aware of this operation.

The work under this contract started at Yerba Buena Island and progressed eastward toward the mole; however, some of the subcontracted work such as the structural steel, the electrical and mechanical construction, and other miscellaneous work was carried on in less congested areas.

Curved Sections

There are two curved sections in the east bay crossing having center radii of 1,600 and 2,000 which made the paving operation more difficult than the same work required for the West Bay crossing. There were also two curved runoff spans for the lower deck on the east end of the bridge.

This curved alignment required some specially cast deck slab units and also the addition of extra stringers to support the slab. The steel curbs and rails were replaced as chords and the roadway lanes followed the curve. The space between the south lane stripe and curb is now utilized as refuge bays.

As the deck sections were completed, the 58-foot roadway was striped for five lanes of traffic, with the south lane barricaded for the contractor's use in strengthening the upper deck for the East Bay crossing.

The remaining four lanes were used for two-way traffic during the remainder of the construction.

Electrical and Mechanical Work

A great amount of electrical and mechanical work was required during the lower deck paving contract which consisted in general of the following new construction:

- 1. Change the bridge's main power supply from 5 to 12 KV.
- 2. Provide a four-inch water line across the bridge.
- 3. Install three compressor stations to supply air for bridge maintenance purposes.
- 4. Provide low voltage electrical energy at convenient locations for maintenance forces.
- 5. Communications, control and supervisory system cables installed for more efficient bridge operation.

As the rate for electrical energy is paid on a demand basis at the point of supply, it was thought advisable to provide a service connection in San Francisco at Sterling and Harrison Streets and another in Oakland at the maintenance warehouse on the East Bay mole. A failure in either incoming service will cause the automatic power throwover in the Yerba Buena Island Substation to connect to the energized line.

The bridge's electrical requirements had about reached the capacity of the old 5 KV line and a new and better 12 KV facility distribution was needed.

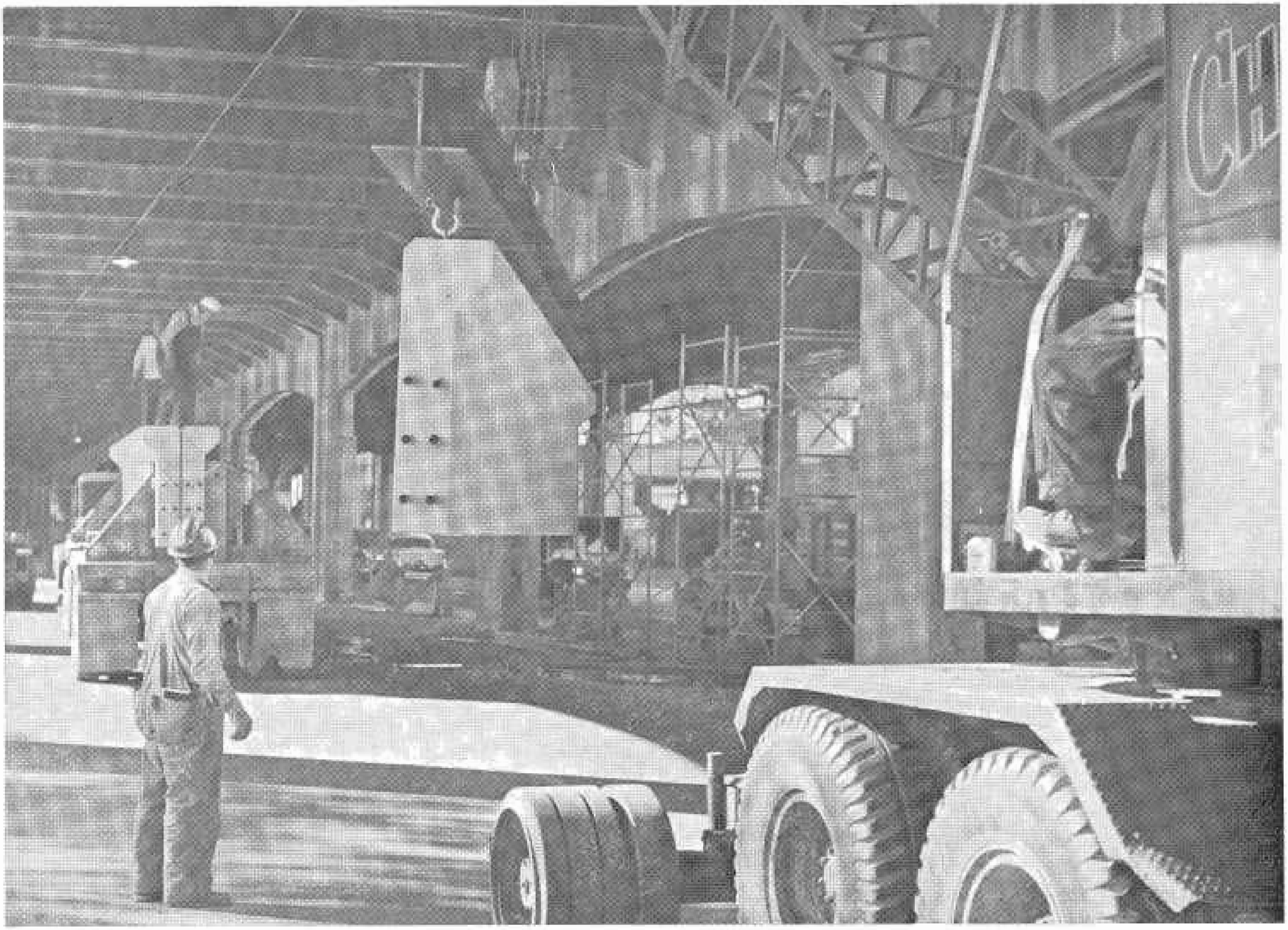
Water Lines Provided

Water is required for various purposes on and at each end of the bridge. Normally the quantity is small; however, the demand could be great in an emergency. To meet the latter requirement, a four-inch water line with a metered source of supply on Yerba Buena Island extends to both ends of the bridge.

A four-inch pipe for the conveyance of compressed air was installed parallel to the water line along the lower deck railing on the south side of the bridge. Valves are provided for hose connections at each of the service platforms suspended at 240- to 300-foot intervals.

Automatic Air Supply

Air is supplied to this continuous line from the Sterling Street Substation in San Francisco, from the substation on Yerba Buena Island, and



Moving precast, prestressed concrete girders into position preparatory to strengthening upper deck supports on section of bridge east of Yerba Buena Island. Units used in tunnel are inverted-U in section, compared to this simple beam section.

the one on the end of the East Bay mole. A drop in air pressure at any of the stations automatically starts one or more of the compressors to renew the supply. The compressors in each substation are so cycled that the last to shut off will be the last in sequence to start again.

There is available at each service platform a terminal box from which 110, 220, and 440 voltages are available for the operation of maintenance and repair equipment.

One large communication cable and one multiconductor control cable run the entire length of the bridge on the south side along with the other maintenance facilities. There is available at each platform, facilities for plugging in portable telephone headset for communication with the person on duty at the administration building.

Communications and Telltales

These cables, with some of the other existing multiconductor cables extending across the bridge and connecting to an indicator board at the toll plaza, will receive the calls from persons in stalled vehicles and signals from five alarm stations. There will also be installed a supervisory system which will indicate by visual, audible and recorded means the malfunctioning of any mehcanical and electrical apparatus. Also a control system whereby various operational functions, such as lighting and signals, are remotely controlled, and a monitoring system indicating their functioning behavior.

Besides the three substations previously mentioned, there are two additional stations on the bridge, one at Center Anchorage Pier W-4 and another on the East Bay spans at Pier E-9 where transformers are installed to reduce the 12 KV voltage to the various voltages needed in the bridge operation and also the necessary switchgear to distribute the electrical energy.

The longitudinal expansion and contraction of the bridge due to temperature changes, the vertical and horizontal movements from wind, and loading conditions are provided for at various pier locations. The continuous runs of pipes have articulated joints to provide for the universal movements at these locations and the electrical and communications cables were so draped to minimize the effect of these movements.

The third and last article on the reconstruction of the San Francisco-Oakland Bay Bridge will be published at the completion of this work.

Cable Moving

New 'Skidding' Technique Saves State $146,000

By RALPH E. DECKER, Senior Highway Engineer, and H. W. MULLER, Associate Highway Engineer

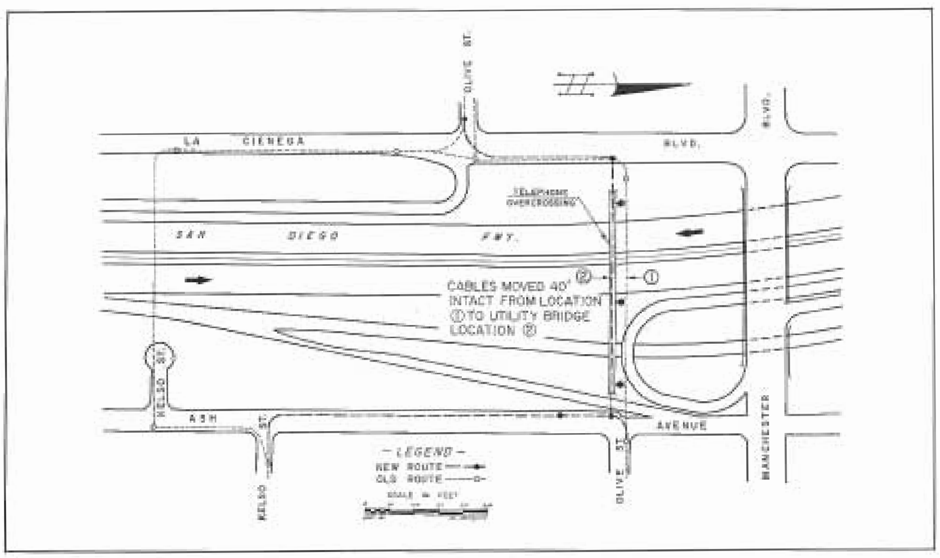
Construction of the San Diego Freeway between 0.1 mile south of 135th Street and 0.2 mile north of La Tijera Boulevard, in the Hawthorne-Inglewood area, is in progress and it is estimated that this section of freeway will be completed about March 1963.

The proposed freeway in the vicinity of Manchester Boulevard in the City of Inglewood will be in cut and necessitated the construction of a bridge over the freeway at Manchester Boulevard between Ash Street and La Cienega Boulevard. This structure is now in service, having been built under an initial contract to expedite the grading and paving of the freeway by eliminating a detour for Manchester Boulevard traffic.

Multiple tile telephone duct installation in the new utility overcrossing bridge.

New Technique Employed

The procedure used to span the proposed depressed freeway with the Pacific Telephone and Telegraph Company cables, located in Kelso and Olive Streets crossing the freeway right-of-way, required the construction of a reinforced concrete utility bridge at Olive Street. This new method permitted the nine communication cables in Olive Street to be skidded intact 40 feet southerly along the ground by use of equipment and manpower and placed in the utility bridge which was constructed as a part of the previously mentioned initial freeway contract. By this new procedure uninterrupted service of the telephone cables in Olive Street was maintained. This new method, which we have called the "Transfer Intact Method," was a pioneer venture which was successfully employed on this project.



Sketch of a portion of the San Diego Freeway in Inglewood showing the former telephone cables crossing the freeway right-of-way in Kelso and Olive Streets, and the cables as relocated in the new telephone overcrossing bridge at Olive Street.

Important Cable Use

Plans for the relocation of the Pacific Telephone and Telegraph Company's underground conduit and cable installations crossing the freeway right-of-way in Olive and Kelso Street, one and three blocks respectively south of Manchester Boulevard, had to be determined during the design of the Manchester Boulevard overcrossing. The Olive Street installation consisted of nine multiple tile ducts and nine communication cables that contained more than 11,000 pairs of wires. The Kelso Street installation consisted of nine multiple tile ducts and three communication cables that

. . . *Continued on page 73*

San Diego Freeway

Half of 90-mile Route Completed or Under Way

By JAMES E. MARTIN, Executive Assistant, District VII

In District VII the San Diego Freeway extends from the San Diego County line near San Clemente to the Golden State Freeway near the San Fernando Reservoir, a total length of 94.5 miles. Portions of this interstate route are constructed, under construction or advertised for construction and on other sections of the route right of way is being acquired and freeway design is in progress.

The San Diego Freeway is completed or under construction in a continuous line from California Avenue in Long Beach to junction with the Golden State Freeway near San Fernando Reservoir in the San Fernando Valley, a distance of 42.7 miles.

The completion of the San Diego Freeway, from its junction with the Golden State Freeway in the San Fernando Valley to the Westminster area, a distance of approximately 60 miles, will open new travel vistas to users of the Interstate Highway System.

Substantial time and distance savings will accrue to north-south traffic through the district, as this freeway will create an effective by-pass, relieving traffic from congested city streets and conventional highways in the area through which it will pass.

1965 Completion

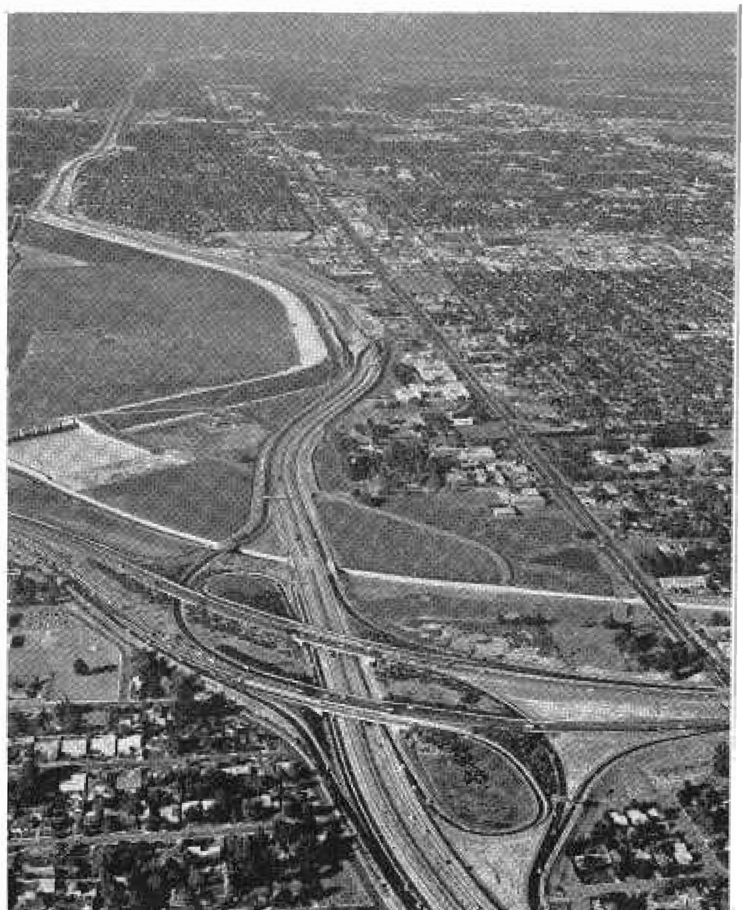
Preliminary estimates call for opening the entire freeway as far as Westminster by 1965; the temporary end to be at Beach Boulevard. The Pacific Coast Highway, Garden Grove Boulevard, Sepulveda Boulevard and other heavily traveled arteries, will divert large traffic volumes to the new facility. Also, newly generated traffic—that is, new trips not previously made on the freeway by any mode of travel, and area trips previously made to different destinations—will contribute to the San Diego Freeway volumes.

An estimate of traffic flow for 1965 on the San Diego Freeway indicates an average of 60,000 vehicles daily, between the Ventura and Golden State Freeways; peaking to 110,000 average daily traffic at Olympic Boulevard in Los Angeles, dropping off to 50,000 average daily traffic at the Harbor Freeway; peaking again to 75,000 per day just west of Westminster on the common roadway of the Garden Grove and San Diego Freeways, which will be a 2.1 mile, 10-lane section between Los Alamitos Boulevard and Bolsa Chica Road, where it reverts to an 8-lane facility. The 1965 estimate of San Diego Freeway traffic at the temporary end at Beach Boulevard is 35,000 vehicles.

By 1980, the target year for the completion of the freeway network in District VII, traffic volumes along the long stretch of San Diego Free-

PHOTO BELOW LEFT—Construction at Mulholland Summit, looking north. Note the relocated Mulholland Drive and Mulholland Bridge, under which the freeway will pass (bottom of photo).

BELOW RIGHT—The completed San Diego-Ventura Freeway Interchange (foreground). At the center is the temporary terminus of the freeway at Burbank and Sepulveda Boulevards.



way will have doubled, coinciding with the Southern California population and industrial expansion.

As of November 11, 1961, a total of 4,365 parcels had been acquired along the entire 90-mile route, representing an outlay of $83,754,855. Only 298 more parcels, estimated to cost $16,065,478, remain to be acquired to complete the right of way program for the San Diego Freeway. A complete right of way cost and construction breakdown is given in the accompanying chart.

RIGHT-OF-WAY COST

	TOTAL		TO DATE 11-30-61		TO GO	
SAN DIEGO FREEWAY	Parcels	$Cost	Parcels	$Cost	Parcels	$Cost
Los Angeles County						
174th Street (Artesia to Golden State Freeway)	3,505	60,748,769	3,443	55,941,158	62	4,807,610
Main to 174th	213	4,770,763	211	4,490,489	2	280,274
Alameda to Main	73	1,866,327	69	1,668,923	4	197,403
Studebaker to Alameda	564	18,057,624	471	15,306,372	93	2,751,252
Orange County Line to Studebaker	52	823,765	47	735,413	5	88,352
Orange County						
Santa Ana Freeway to Los Angeles County Line	256	13,553,087	124	5,612,500	132	7,940,587
Total	4,663	99,820,335	4,365	83,754,855	298	16,065,478

(These figures do not include overhead costs since July 1, 1961)

CONSTRUCTION COST

ROUTE 158 Expended to date 12/13/61	$199,420,000 (R/W & Constr.)		
	Completion Date	Construction Cost	Miles
60-61 Fiscal Year			
Route 4 to Burbank Boulevard	(gr)	$3,345,000	8.9
62-63 Fiscal Year			
Route 4 to Burbank Boulevard	1-64 (pav.)	8,300,000	—
Burbank Blvd. to Valley Vista	7-3-58	2,800,000	1.3
Mulholland Bridge and relocating of Mulholland Drive	4-1-60	1,824,000	—
Valley Vista to Casiano Road	10-26-62	19,650,000	5.6
Casiano to Ohio	6-23-57	4,641,000	2.0
Ohio to Venice	2-19-57	6,440,000	3.5
Venice to Jefferson	7-14-60	5,371,000	1.8
(Manchester to Vesta) (Br.)	4-19-62	1,633,000	—
(Manchester) (3 Br.)	2-1-61	421,000	—
Jefferson to La Tijera	3-27-63	4,730,000	1.5
La Tijera to 135th	2-21-63	11,637,000	4.7
135th to Hawthorne	1-28-63	4,533,000	2.0
Hawthorne Boulevard to 174th Street	6-4-62	3,313,000	1.1
174th Street to 190th Street	8-8-62	7,048,000	3.4
190th Street to Carson Street	4-25-62	7,070,000	2.7
Carson Street to Alameda	6-22-62	4,322,000	1.9
Alameda to Long Beach Freeway	1-23-62	5,134,000	1.1
61-62 Fiscal Year			
Long Beach Freeway to California	10-11-63	7,820,000	1.6
62-63 Fiscal Year			
Atlantic to Orange County Line	9-64	14,000,000	5.9
(Lakewood to Cherry)	2-5-62	1,437,000	—
(Studebaker to Cherry)	2-25-63	3,423,000	—
(Clark to Lakewood)	1-9-63	1,299,000	—
(Willow to Lakewood)	3-14-60	154,000	—
ORANGE COUNTY			
0.6 mi. E. Bolsa Chica to Los Angeles County Line	9-64	9,000,000	4.8

Completed Projects

Sections of the San Diego Freeway have been constructed in Orange County since early 1958, when the first unit of 1.6 miles was completed at a cost of $665,000 from junction with the Santa Ana Freeway near El Toro Marine Corps Air Station to Niguel Road.

On September 22, 1959, a 7.5-mile section, costing $4,218,000, was completed from Niguel Road to Trabuco Creek, where it joins another 3.7-mile section through San Juan Capistrano completed on December 24, 1958, under $4,081,000 contract. Another San Diego Freeway project through San Clemente to the San Diego county line, 1.8 miles, was completed on October 20, 1958, at a cost of $2,413,000. On December 1, 1960, a connecting link was completed between San Juan Capistrano and San Clemente, adding 5.8 miles of freeway at a construction cost of $6,358,000.

Previously completed major contracts on the San Diego Freeway in Los Angeles County, in south to north order, are as follows: Jefferson Boulevard to Venice Boulevard, 1.8 miles, $5,371,000, July 14, 1960; Venice Boulevard to Ohio Avenue, 3.5 miles, $6,440,000, February 19, 1959; Ohio Avenue to Casiano Road, two miles, $4,641,000, under two contracts in 1957; Mulholland Drive Bridge and Relocation, $1,824,000, April 1, 1960; and Valley Vista Boulevard to Burbank Boulevard, 1.2 miles, $2,800,000, July 3, 1958.

Minor contracts financed in the 1961-62 Highway Budget include median barriers and signs from Jefferson Boulevard to Casiano Road north of Sunset Boulevard, 7.2 miles, $190,000; landscaping, between Venice Boulevard and Charnock Avenue, 0.2-mile, under $18,640 contract scheduled for completion in July, 1962; functional planting, Avenida Allesandro to connection with Pacific Coast Highway in San Clemente, 7.1 miles, $152,000; and storm drain channel, Westminster Avenue to Springdale Street, 0.4-mile, under $166,750 contract scheduled for completion in March, 1962.

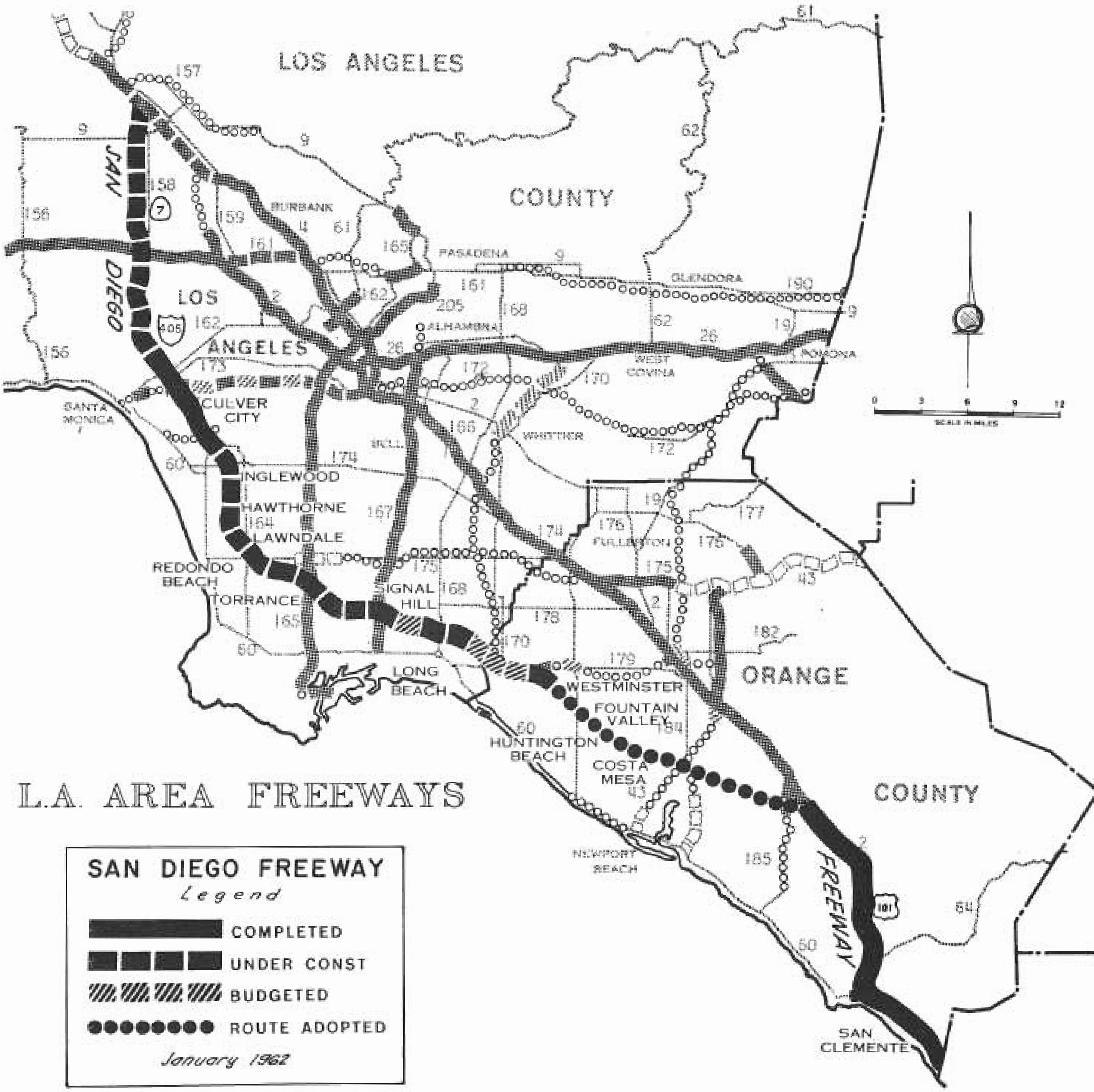
Some of the minor San Diego Freeway projects recently completed are as follows: landscaping, Burbank Boulevard to Ventura Boulevard, April 26, 1960, $95,000; landscaping, Wilshire Boulevard to Matteson Avenue, April 28, 1960, $164,000; landscaping, Slauson Avenue to Venice Boulevard, December 15, 1961; and bridge and approaches, Willow Street to Lakewood Boulevard, March 14, 1960, $154,000.

Oil Well Abandonment

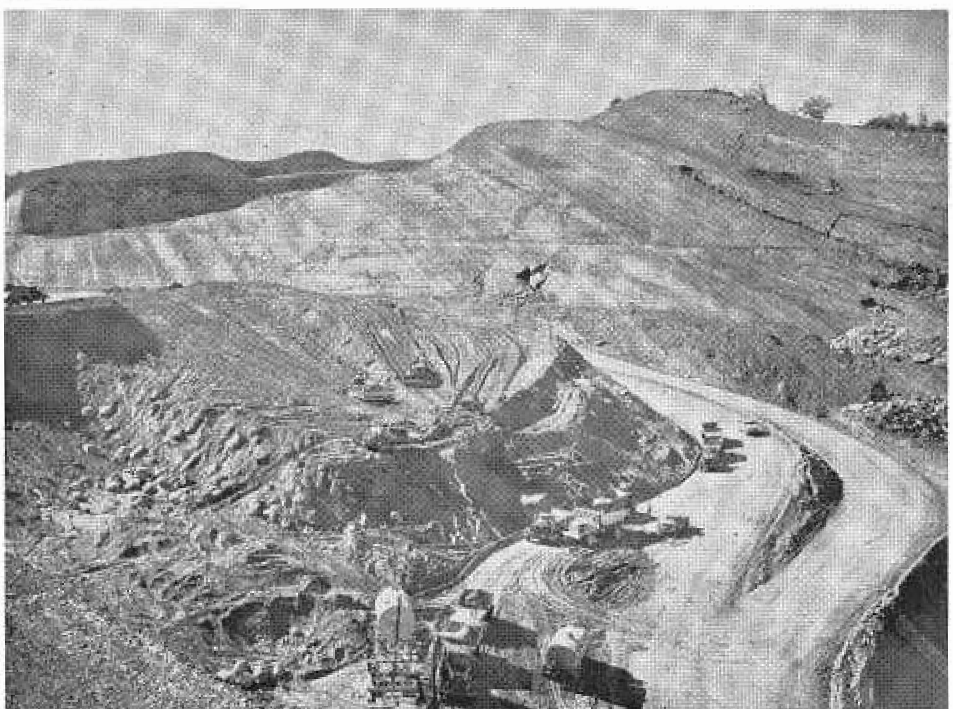
Before construction could be undertaken on the San Diego Freeway in the Long Beach area between the Los Angeles River and Walnut Avenue (overlaps construction now in progress between California Avenue and the Long Beach Freeway), about 95 abandoned oil wells in the Long Beach (Signal Hill) Field had to be capped and reabandoned under five right of way clearance contracts, the last of which was awarded on July 26, 1961. Combined cost of the projects: $451,191.

Long Beach Oil Field

From information supplied by John B. Sansone, Senior Exploitation Engineer, Shell Oil Company, the Long



Embankment construction on the San Diego Freeway in the San Fernando Valley. The view is northward from Hart Street with the Sherman Way interchange at the center.



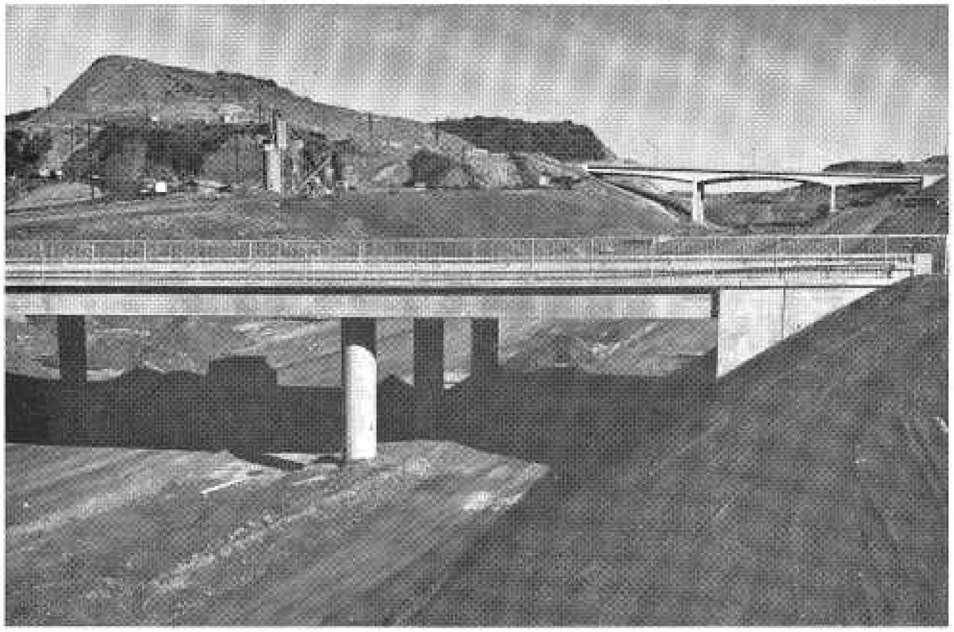
Closeup of hauling operations within the Mulholland Cut. Note the developing slide area at top right.

Beach oil field is described as an area about five miles long by one-half mile wide. It is a faulted anticline, elongated to the northwest. The dominant faults are the Cherry Hill and Northeast Flank. The sediments include Recent to Miocene resting on Jurassic-Triassic (Franciscan) schist basement. The field was discovered by Shell Oil Company with the completion of Alamitos No. 1 on June 25, 1921, with an initial flow of 590 B/D, 21.3° gravity oil, 0.4% cut, producing from the interval 2,729-3,114 feet. It took 90 days to drill with cable tools. This well is still pumping 2 B/D oil and 1 B/D water. To date the well has produced approximately 700,000 barrels of oil. As of January 1, 1960, only two fields in the entire State of California had produced more oil than the Long Beach Field (817,954,000 barrels). The Long Beach Field, with an estimated recovery of 525,000 barrels per acre, has the distinction of having produced to date more oil per surface acre of any field in the United States and probably the world. This is due to the fact that the field is actually a series of fields superimposed upon each other, and because of the density of wells drilled on a relatively small surface with multitudinous ownerships (town lots). The field, with the exception of the Airport Area Pool, represents a view of the past in development. It is now what is commonly referred to as a "stripper" field. Derricks and much of the pumping equipment are obsolete.

First Contract

The first contract for re-entering and reabandoning oil wells within the San Diego Freeway right of way was accepted as completed by the State Highway Engineer on August 1, 1960, and the construction cost was $123,017. Since this was the prototype project, it will be discussed in some detail.

The work consisted essentially of locating the wells, preparing the sites, rigging up and drilling out the well to below the shoe of the surface casing, underreaming a 36-inch by 25-foot section below the shoe of the surface casing, pressure cementing cement slurry plugs, cutting and pulling the surface casing from a point



Completed bridge structures on the San Diego Freeway at Mulholland Summit. Upper structure is Mulholland Drive Bridge. Top left is reconstructed Sepulveda Boulevard.

below the proposed roadway subgrade elevations, and general cleanup.

The wells were located using a ¾-cubic-yard truck crane equipped with a clamshell bucket. Although the old locations secured from available records were incomplete and at times misleading, one could, by observing the ground strata and buried debris, locate the wells even though some of them were found to be as much as 50 feet from the reported locations and 25 feet below the ground surface. A tractor was used to backfill the spoil banks and prepare the site for the drilling equipment.

After the well casings had been found the contractor welded on 12-inch risers equipped with flanges to which the blowout prevention equipment was bolted. Metal cellars were provided to retain any overflow of rotary mud.

The drilling equipment consisted of a highly portable rig with a 70-foot mast and a T-25 draw-works and rotary table, a positive displacement rotary mud pump, a 100-barrel mud tank with shaker screen, a caterpillar electric power unit, and various lesser equipment, tools and paraphernalia.

Junk Removed

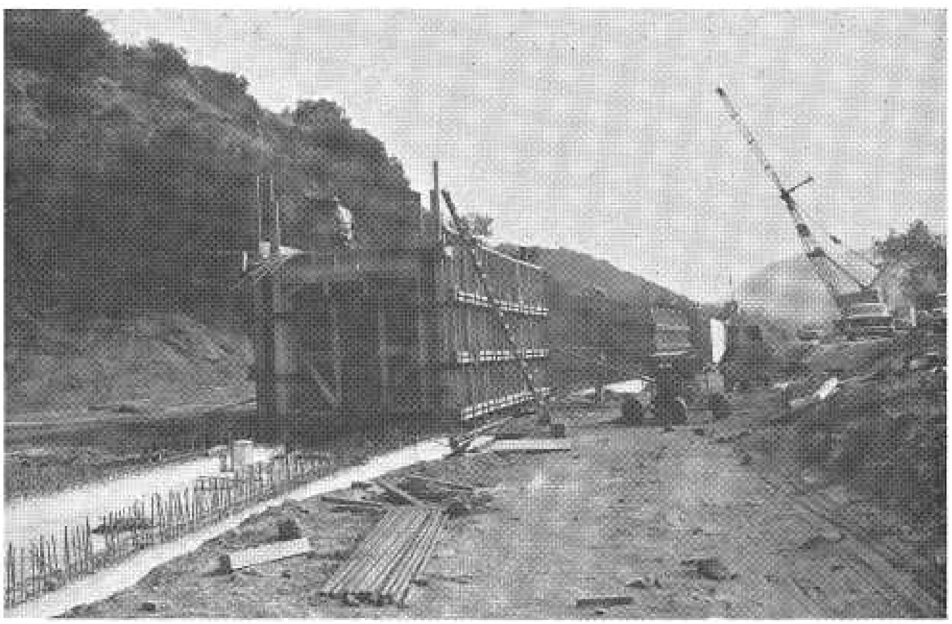
The wells abandoned on this project were, in general, wells that had been abandoned in past years before present-day standards of abandonment were enforced. They were filled with anything and everything, including wire line, short lengths of casing and pipe, wood, rock, gravel, stones, chunks of concrete and miscellaneous trash. Removal of the junk from the wells required a lot of ingenuity. However, the contractor combined know-how with various fishing tools, including wash-over shoes, grabs, spears, magnets, jars, and milling heads to perform the programs as specified.

Probably the most difficult type of junk to remove was the wire line. The line wound around the bits and balled up so that it was necessary to cut a window in the surface casing, cut the wire with a cutting torch and remove it in small pieces. Sublin bits were used to drill the wood and debris. Tri-cone rock bits were used to drill out consolidated material.

Removal of the debris created circulation problems which were corrected by treating the rotary mud with clay to increase the specific gravity, bentonite to act as a lubricant and retain the clay in colloidal suspension, and hexameta phosphate to decrease the viscosity. The treatment provided a heavier mud than could be circulated rapidly and resulted in a successful clean-out operation.

Underreaming the 36-inch by 25-foot section below the shoe of the surface casing was accomplished using a scraper. Cement plugs were placed using a truck-mounted pumping unit capable of pumping cement slurry to any desired depth, under as much as 5,000 pounds per square inch pressure. The contractor cut and pulled the stub of the surface casing using the clamshell and cutting torch.

The contractor worked 24 hours a day, seven days a week and completed the work in less than 60 calendar days.



Construction of a huge drainage facility south of Mulholland Drive. The reinforced concrete box passes under the freeway.

PROJECTS UNDER CONSTRUCTION

Studebaker Road to Cherry Avenue

A contract started on July 18, 1961, on a project for bridge and frontage road work between Studebaker Road and Cherry Avenue. The 2.2-mile, $3,422,700 project is scheduled for completion in February 1963. The bridges are described as follows: Studebaker Road Undercrossing, Los Cerritos Channel Bridge, Stearns Street Undercrossing, Palos Verde Avenue Undercrossing, Woodruff Avenue Undercrossing, Albury Avenue Pedestrian Undercrossing, Bellflower Boulevard Undercrossing and Los Cerritos Diagonal Undercrossing.

Clark Avenue to Lakewood Boulevard

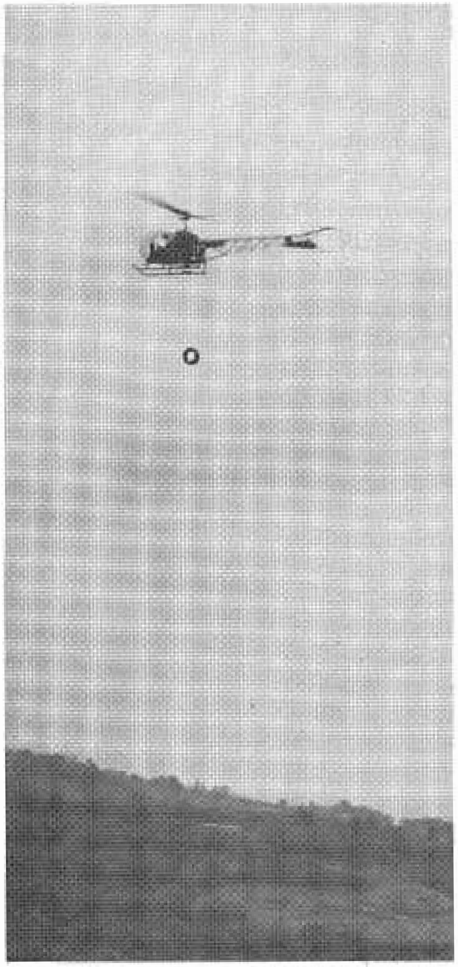
On July 10, 1961, construction began on 0.6-mile, $1,299,300 contract for bridges between Clark Avenue and Lakewood Boulevard. Completion of this project is anticipated by January 1963. The bridges are Willow Street Undercrossing (314 feet long) and Clark Avenue Undercrossing. Also, a 10-foot-wide by 5½-foot-deep reinforced concrete drainage facility, Bouton Creek Channel, in open and closed channel, extending approximately ½ mile, is being built concurrently and crosses under the freeway at Willow Street and at Clark Avenue.

Lakewood Boulevard to Cherry Avenue

Work began on the Lakewood Boulevard to Cherry Avenue section of the San Diego Freeway on December 14, 1960, and completion of this 0.7-mile project is anticipated by March 1962. The $1,436,595 contract is mainly for the Spring Street Overcrossing with some incidental street work. The 340-foot diagonal box girder bridge, which has eight-foot-high cells to house a 54-inch welded drainage pipe, will span the future freeway.

California Avenue to Long Beach Freeway

Construction began on December 6, 1961, on the California Avenue to Long Beach Freeway portion of the San Diego Freeway under $7,300,000 contract covering a distance of 1.6 miles. The estimated completion date is December 1963. Bridges are of the box girder and structural steel type and are designated as follows: Atlantic Avenue Overcrossing, Long Beach Boulevard Undercrossing, Wardlow Road Undercrossing, Pacific Avenue Undercrossing, Bixby Overhead, Appian Way Ramps, Los Angeles River bridges (three structural steel structures, two 696 feet long and one 811 feet long). The first order of work will be the clearing out of four oil sumps adjacent to the Los Angeles River, containing an estimated 180,000 cubic yards of rotary mud, oil, water and sand. A special feature of this job will be two utility structures, a box girder pipeline overcrossing on the east end and a box culvert pipeline undercrossing on the west end.


A helicopter in flight carrying a roll of wire.

Dominguez Channel

Since Los Angeles County Flood Control District and United States Corps of Engineers programs for control and conservation of floodwaters lie within the area traversed by the San Diego Freeway and since flood control construction has frequently been a part of freeway construction under joint or co-operative agreement with the Division of Highways, it is pertinent to discuss in some detail one flood control project in particular, the Dominguez Channel, which more or less parallels the route of the San Diego Freeway from Hawthorne to the Long Beach Freeway.

Improvement of Dominguez Channel in southwest Los Angeles County is a major Los Angeles County Flood Control District project which will involve expenditure of over $21,000,000 for construction of 18 miles of flood control channel, reconstruction of 25 highway bridges and relocation of four major railroad lines as well as many other utilities.

To date, the Flood Control District has spent over $9,000,000 for permanent improvement of Dominguez Channel. Reaches have been completed between International Airport and 120th Street and Vermont Avenue and Compton Boulevard. A stretch of about one-half mile between Compton Boulevard and Rosecrans Avenue is under construction at the present time.

Bridge footings for the Anaheim Street viaduct have been underpinned to accommodate the channel improvement, and new bridges have been built at Henry Ford Avenue, Sepulveda Boulevard, Alameda Street, Carson Street, and 213th Street. New bridges at Avalon Boulevard, Main Street, and 223d Street-Wilmington Avenue are presently under construction. In addition, design of additional bridges at Figueroa Street, 182d Street, and 190th Street is under way and construction is slated to start within the next two years.

During October the board of supervisors approved plans and specifications for another reach of the channel from Henry Ford Avenue to 223d Street. Bids were opened by the Flood Control District on December 8, 1961. In order to handle construction of this four-mile section, it was necessary to relocate a network of mainline tracks of the Union Pacific Railroad, the Santa Fe Railroad, the Pacific Electric

Railway and the Harbor Belt Line Railroad plus a complex of utility pipelines and facilities.

Timetable for improvement of the remainder of the project from 223d Street to Vermont Avenue calls for its completion in about three years.

Long Beach Freeway to Alameda Street

Next in line constructionwise on the San Diego Freeway is a 1.3-mile construction project between existing Long Beach Freeway and Alameda Street. This project is nearing completion at a contract cost of $5,134,400 and was opened to traffic in mid-January 1962. Work began with the usual clearing and grubbing operations on May 23, 1960.

Two million tons of fill material was removed from a state-owned borrow site at Alameda Street and Del Amo Boulevard; another 300,000 tons was obtained from the Los Angeles County Flood Control District Settling Basin adjacent to the Los Angeles River at Carson Street. Bridges, 10 in number, are of the box girder, reinforced concrete T-beam type and precast, prestressed concrete girder type, with the Union Pacific Railroad spur being of precast, prestressed cored slab. The bridges include: the San Diego-Long Beach Freeway Interchange, Santa Fe Avenue Undercrossing, 223d Street Overhead, Terminal Island Freeway Overcrossing, and Carson Street and McHelen Avenue Undercrossings. Bridge lengths vary from 10 feet to 605 feet. Ramps are provided at the interchange, Santa Fe Avenue and Alameda Street. The contractor hauled the bulk of his fill two miles, using a 60-inch belt loader and a fleet of bottom-dump trucks (as many as 23 and 24 at a time) working two 7½-hour shifts. For compaction a special type self-propelled segmented roller was used, being equally maneuverable forwards or backwards and thus precluding turning movements.

Alameda Street to Carson Street

The Alameda Street to Carson Street section of the San Diego Freeway, 1.9 miles, has been under $4,321,900 contract since start of work on December 27, 1960.

After clearing and grubbing, 1,378,000 tons of borrow was hauled two miles from Del Amo Pit using belt loaders and bottom dump trucks. Up to 18,000 tons was hauled per one 10-hour shift at the peak of operation.

Bridges include the Dolores Yard Overhead, a concrete deck on welded steel girders 818 feet in length; Wilmington Avenue Undercrossing, a concrete box girder type 200 feet long; Dominguez Channel Bridge, a concrete T-beam bridge 438 feet in length, supported on 24-inch precast, prestressed concrete pile bents. Ramp connections are provided at 223rd Street, Alameda Street, Wilmington Avenue (full interchange), and Carson Street.

Twelve existing high pressure pipe lines, three to nine inches in diameter, had to be relocated from a suspension bridge over Dominguez Channel and housed in a new supporting structure. Structure work was by the Division of Highways and relocation by Shell Oil Company. The relocated lines pass under the freeway and over Dominguez Channel.

This contract, as well as others on the San Diego Freeway, provides nine-inch thickness truck lanes and chain link cable-reinforced median barrier. Contract completion date is anticipated by June, 1962.

Carson Street to 190th Street

The Carson Street to 190th Street section of the San Diego Freeway, a $8,120,400 contract which started on July 17, 1960, and will be completed in mid-May, 1962, has been more complicated than the adjoining jobs because of detour construction and city street revisions. There are 17 bridges, the major ones being Carson Street, 213th Street, Avalon Boulevard, Torrance Lateral (flood control), Main Street, Figueroa Street, East Connector Undercrossing (tunnel), Harbor Freeway (five bridges) and the West Connector Undercrossing (tunnel).

Under the same contract 3,000 feet of the Harbor Freeway was built as far south as Francisco Street; also built was a realigned extension of Figueroa Street frontage road on the east side of the freeway, extending one mile south of the interchange to 208th Street. Knox Street between Vermont Avenue and Figueroa Street was reconstructed along with Avalon Boulevard, which was placed on new alignment for a distance of 3,500 feet.

The general order of work required building of the Harbor Freeway section first for traffic detouring and accommodation of construction in

A helicopter hovers over the stand preparatory to picking up hose used to pump concrete for fence construction.

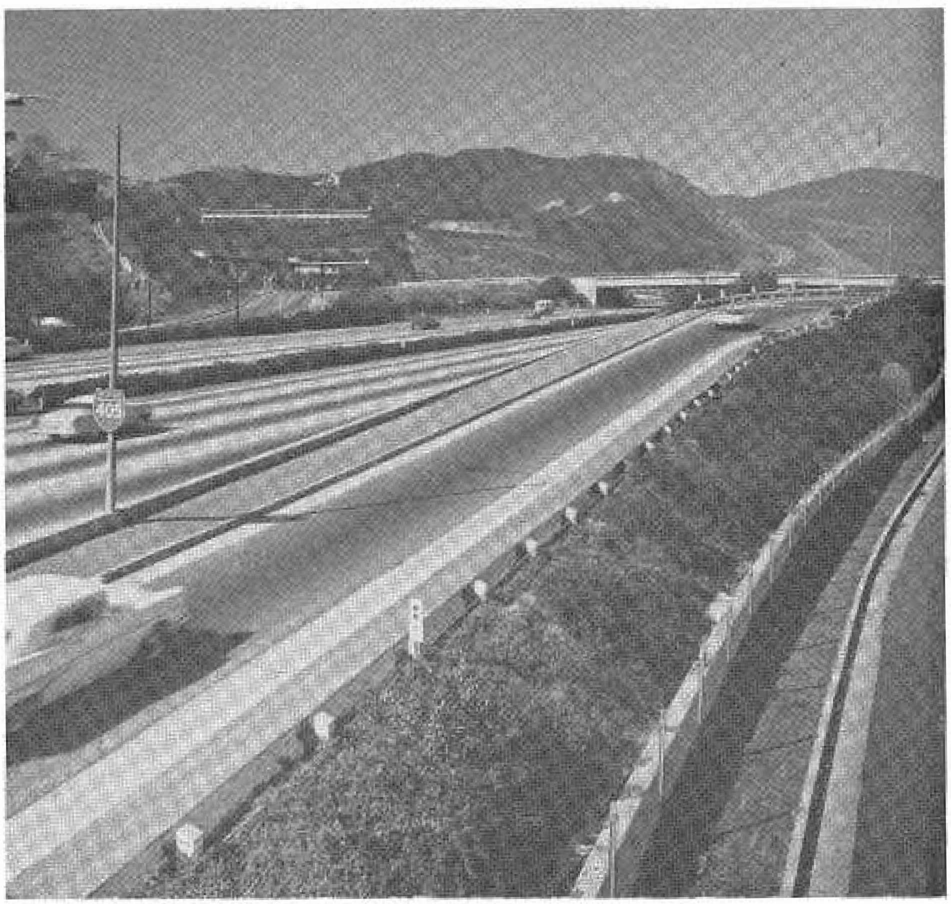
progress on a separate Harbor Freeway contract; after which detours were constructed for Avalon Boulevard, Moneta Avenue, Main Street, and Broadway. An eight-foot by nine-foot box was constructed at Knox Street to drain into Dominguez Channel; another 12-foot by 12-foot triple box was constructed under the Harbor Freeway, replacing a 90-inch pipe, and is an extension of the Torrance Lateral emptying into Dominguez Channel.

To further complicate matters, two dump sites were uncovered between Main Street and Avalon Boulevard, yielding 270,000 cubic yards of unsuitable material, which was distributed in selected areas over the job and covered with dirt to a depth of two to four feet. Refuse—often of a spontaneously combustible nature—was removed with scrapers, rake-attached loaders and clam bucket with fork teeth. Operations were hampered by discarded rubber tires and lengths of cable.

Imported borrow, 3,300,000 tons, was obtained from a State-owned source at Del Amo Boulevard and Wilmington Avenue. The contractor built a 40-foot wide high-speed haul road, using 60,000 cubic yards of fill, two miles long, across Del Amo Estate property. On this road he placed his scraper-hauled bottom dump truck trailers, each unit capable of carrying 60 tons at 30-mile per hour speeds. In an experimental run, he used 90-ton capacity triple scraper rigs reaching speeds of 45 miles per hour. During hauling operations, uniformed and deputized security officers worked hand-operated stop and go signals at grade crossings.

These safety precautions resulted in 3,000,000 cubic yards of material hauled without major accident or personal injury. At this writing, almost all of the bridges are completed and preparations are being made for paving.

The contractor plans to use a system of concrete haul called central mix. The concrete will be mixed wet in seven cubic yard batches and hauled by special non-agitated trucks to the construction site, where the concrete will be spread between the headers through spreader boxes. This system is expected to eliminate mixing on the job, mixers and water trucks on the grade, and the line of batch trucks waiting in front of the mixer.



Looking north along a completed section of the San Diego Freeway toward the Sunset Boulevard overcrossing (top). Note the Interstate 405 sign at the left.

190th Street to 174th Street

A connecting contract is in progress between 190th Street at the Harbor Freeway to 174th Street (Artesia Boulevard) in Torrance, 3.5 miles, at a construction cost of $7,054,200. The estimated completion date is early August, 1962. Imported borrow—from a private source at Crenshaw Boulevard and Pacific Coast Highway, a haul distance of approximately 7 miles—amounted to 3,000,000 tons and was placed in freeway fill utilizing bottom dump trucks averaging 15,000 tons per daily 10-hour shift. Other major quantities include 5,210,000 pounds reinforcing steel and 184,000 square yards concrete paving.

On this section of the San Diego Freeway the District Right of Way Department expended Chapter 20 funds in advance of the regular acquisition program in order to prevent costly development within the proposed right of way area due to rapidly increasing land values. Accordingly, between the year 1953 and 1955, 58 parcels were purchased at a cost of $1,155,465, resulting in an estimated savings to the State of $6,967,595.

Actual construction began on January 10, 1961. The job has eight bridges: 190th Street-Vermont Avenue Undercrossing, Normandie Avenue Overhead, undercrossings at Western Avenue, Arlington Avenue, Crenshaw Boulevard, 182d Street, and Yukon Avenue, and Artesia Boulevard-San Diego Freeway Separation.

Yukon Avenue and 182d Street were realigned, and at the latter location a 60-inch storm drain was constructed passing under the freeway for a distance of 700 feet and eventually emptying into Dominguez Channel. The contract provides for construction of median barrier fence of the chain link, cable-reinforced variety. Construction operations are currently centered around placement of subbase materials and bridge work. This contract and the one north of it will be opened to traffic simultaneously when completed.

Artesia Boulevard to Hawthorne Boulevard

This $3,312,500, 1.1-mile section of the San Diego Freeway was begun on April 1, 1961 and will be completed by mid-June, 1962.

There are four bridges: Prairie Avenue Undercrossing, Redondo Beach Boulevard Undercrossing, 166th Street Undercrossing and Hawthorne Boulevard Undercrossing (350 feet long, built on a skew).

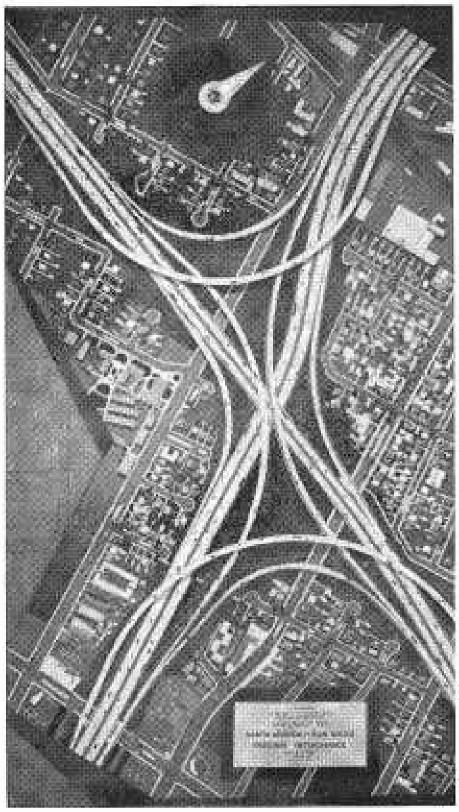
The borrow was obtained from a commercial source in the Palos Verdes Hills and hauled seven miles over city streets, utilizing bottom dump trucks averaging 15,000 tons per day. The Palos Verdes materials were considered as high quality for fill embankment, being of a coarse sandy nature. This, like other projects in the chain of contracts under way on the San Diego Freeway, has nine-inch truck lanes and median barrier fencing of the chain link, cable-reinforced variety.

135th Street to Hawthorne Boulevard

Work on this 2-mile section of freeway, between Hawthorne Boulevard and 135th Street, was started on July 19, 1961 under $4,532,350 contract.

There are five bridges: Manhattan Beach Boulevard Undercrossing, Inglewood Avenue Undercrossing, Compton Boulevard Undercrossing, Lawndale Overhead and Rosecrans Avenue Undercrossing. The 1,800,000 tons of imported borrow were obtained from Walteria Lake, located at 236th Street and Hawthorne Boulevard, a haul distance of six miles, which under agreement between the Los Angeles County Flood Control District, is being converted into a water retention sump.

A part of Los Angeles County Flood Control District Project 584 (Walteria Lake Storm Drain), the 25-acre sump has not yet been advertised for bids; but plans call for a pump station at 236th Street and the east side of the sump area which will pump water from the basin through a storm



A model of the Santa Monica-San Diego Freeway Interchange in West Los Angeles built by District VII modelmakers, Mr. and Mrs. John Unruh. The vertical roadway is the San Diego Freeway.

drain system and an eventual outlet at Dominguez Channel. The project is part of the $225,000,000 storm drain bond issue approved by voters in 1958.

The contractor used conveyor belt with bulldozers in the pit and raised the material to ground level by elevator belt, where it was loaded into bottom dump trucks. The material was again transferred to carry-all scrapers and distributed over the job. At the height of operations, the contractor anticipates moving fill materials at the rate of 18,000 tons per shift.

Freeway construction also included building a flood control box structure 10 feet by 6 feet for a distance of 1,000 feet along Inglewood Boulevard and under the freeway.

This portion of the San Diego Freeway, scheduled for December, 1962 completion.

Manchester Boulevard to Vesta Street

A $1,633,000 job is in progress on the San Diego Freeway between Manchester Boulevard and Vesta Street, 0.5 mile. The estimated completion date is April 1962.

The job involves the construction of five bridges and realignment of La Cienega Boulevard. The bridges are Freeman Boulevard Overcrossing, Florence Avenue Overcrossing, the ATSF and UP double track railroad, the central outfall sewer, a six-foot diameter conduit crossing the freeway, and removal of a temporary timber railroad trestle.

Construction involved bypassing the outfall sewer line to permit overcrossing construction; it was also necessary to construct Los Angeles County Sanitation District trunk lines connecting to Vesta Street pumping plant. Construction of these lines, one paralleling the freeway on the easterly side and the other, a siphon under the freeway on the west side, necessitated trenching under the existing tracks prior to shofly construction. This work was performed during the wee hours, with stop notices to all through train traffic.

The project also included construction and extension of a Los Angeles County Flood Control District triple reinforced concrete box drainage facility leading ultimately to the Centinela Creek Channel. Sewer lines were encased. The central outfall sewer entailed underpinning the existing brick and concrete conduit prior to construction of bypass chambers. From the chambers, an 84-inch bituminous lined corrugated metal pipe was placed as a bypass line between adjacent glory hole construction. Multiple staged detour construction was required throughout. Road work involved modification of existing Pacific Electric Railway grade crossing.

The intent of this construction was to provide for routing of Florence Avenue and Freeman Boulevard traffic over the freeway path prior to construction on the big 135th Street to La Tijera Boulevard contract within whose limits this project falls.

Exceedingly complicated utility relocations were necessary on this relatively small contract. Some of the utilities concerned were Southern California Edison Company, Inglewood Water Company, Southern California Gas Company, Pacific Telephone and Telegraph Company,

A completed section of the San Diego Freeway looking north from the Santa Monica Boulevard Interchange (center).

Atchison, Topeka and Santa Fe Railroad (overhead signal lines), and Union and Mobil Oil Companies. In addition, highway and bridge lighting and signal installations were installed to conform to ultimate freeway needs.

135th Street to La Tijera Boulevard

Work started on the 135th Street to La Tijera Boulevard portion of the San Diego Freeway on July 17, 1961, under $11,601,800 contract covering a distance of 4.8 miles. The job provides for 23 bridges and two pumping plants. The bridges include: 135th Street Undercrossing; 129th Street Overhead (two structures); El Segundo Boulevard Undercrossing (two structures); 120th Street Undercrossing; Dominguez Channel Protector; Imperial Highway Undercrossing (two structures); Anza Avenue Undercrossing; Lennox Boulevard Undercrossing; 104th Street Pedestrian Undercrossing; Century Boulevard Undercrossing; Arbor Vitae Street Overcrossing; Spruce Avenue Pedestrian Overcrossing; Hillcrest Boulevard Overcrossing; Telephone Overcrossing (cable crossing); Freeman Boulevard Undercrossing; La Tijera Boulevard Overcrossing; and La Tijera Boulevard Overhead (widening existing bridge).

A dump containing some 75,000 to 80,000 cubic yards of trash was uncovered in the vicinity of La Tijera Boulevard and incorporated into other selected fill area on the job. It should be noted here that some of the fills had already been placed under a stockpiling program under which the State accepts suitable materials from other sources in advance of construction, cost free.

The main city street realignment has been La Cienega Boulevard at El Segundo Boulevard, which was reconstructed for 1,300 feet.

A part of this project is construction of the Centinela Creek Channel, in rectangular and trapezoidal sections, extending in open and closed channel from Freeman Boulevard to the northerly limits of the job. It is 25 feet wide by 12 feet deep at its maximum in the rectangular section; in trapezoidal section it measures 12 feet wide by 11 feet deep.

An unusual feature of the job is that drainage facilities have been constructed through the Spruce Avenue Pedestrian Overcrossing. A 30-inch and 24-inch storm drain, carrying surface water, passes through the structure.

The estimated completion date of this contract is March 1963.

La Tijera Boulevard to Jefferson Boulevard

Work began on October 27, 1961, on the La Tijera Boulevard to Jefferson Boulevard portion of the San Diego Freeway, 1.5 miles, at a construction cost of $5,004,400 and the estimated completion date is mid-April 1963.

The project calls for construction of three bridges, two T-girder type and one box girder, at Jefferson Boulevard, Sepulveda Boulevard, and Centinela Boulevard, the latter being the longest at 533 feet. This section of freeway will also have two nine-inch truck lanes and will be equipped with the chain link cable-reinforced median barrier.

The special feature of this job is the Centinella Creek Channel—a $1,800,000 item—which more or less parallels the freeway in open and closed channel from La Tijera Boulevard to Jefferson Boulevard, a distance of about 1.5 miles. It measures 78 feet at its widest and 33 feet at its narrowest and varies in depth from 10 to 13½ feet. Construction of the channel is by the Division of Highways based on design by the U.S. Army Corps of Engineers, who is financing the project, and under agreement with the Los Angeles County Flood Control District. This unit of the channel empties into Ballona Creek.

Complicated sewer work has also been a feature of this freeway unit. Three 78-inch sewer lines passing under the freeway at Sawtelle and Sepulveda Boulevards, a length of some 400 feet, had to be encased with 1,500 cubic yards of concrete to offset the fill load. The lines will be approximately 28 feet below the freeway grade. In addition, a north central outfall sewer, a 102-inch pipe with a 48-inch ventilation line, had to be reinforced or spanned by a concrete structure leaving air space between the pipe and the structure.

This was accomplished through the use of seven 2½-inch, 500-pound test fire hoses each 100 feet long. Utilizing 10-gauge steel plate form, the pour was made over the hoses which were then deflated and removed, leaving the huge pipe free from load.

The job also provides for realigning of 1,000 feet of Sepulveda Boulevard and widening of Jefferson Boulevard (700 feet) and Centinela Boulevard (700 feet), including provision (stubbing off ramps and installation of extra footings) for the future Marina Freeway at Jefferson and Sepulveda Boulevards.

Casiano Road to Nordhoff Street

The largest single freeway project in the district is the San Diego Freeway job between Casiano Road in West Los Angeles and Nordhoff Street in the San Fernando Valley, measuring 5.7 miles through the Santa Monica Mountains, and 6.2 miles in the valley. The portion linking West Los Angeles with the valley at Valley Vista Boulevard entails full freeway construction, grading, structures and paving; the second portion of the job entails grading only, with pedestrian undercrossings and relocation of underground utilities and storm drain system, and lies between Burbank Boulevard and Nordhoff Street.

(This section will be completed under separate contract concurrently with the job in progress, and the 1962-63 fiscal year has financial provision in the amount of $8,220,000 to finish the 8.7-mile section between Burbank Boulevard and the Golden State Freeway in the vicinity of the City of San Fernando.)

The first half of this project, which will complete the freeway between Burbank Boulevard and Nordhoff Street, has been advertised for bid opening on February 8, 1962 (budget allocation $5,000,000). The following structures will be built: Burbank Boulevard Overcrossing; West Van Nuys Ovearhead; Victory Boulevard Undercrossing; Haskell Avenue Undercrossing; Van Owen Street Undercrossing; Sherman Way Undercrossing; Saticoy Street Undercrossing; Raymer Street Overhead; Roscoe Boulevard Undercrossing; Parthenia Street Undercrossing; Nordhoff Street Undercrossing; Plummer Street Undercrossing; Lassen Street Undercrossing; San Diego Freeway-Devonshire Street Separation; Chatsworth Street Undercrossing; San Fernando-Mission Boulevard Undercrossing, and Rinaldo Street Undercrossing.

Work started on the big contract—now estimated to cost in excess of $20,000,000—on August 12, 1960, and the estimated completion date is late 1962. The major quantities used are as follows: roadway excavation 13,000,000 cubic yards; concrete paving 350,000 square yards, bar reinforcing steel 7,000,000 pounds; six-foot chain link right-of-way fence 115,000 lineal feet; concrete in drainage structures 35,000 cubic yards; bridge concrete 14,000 cubic yards.

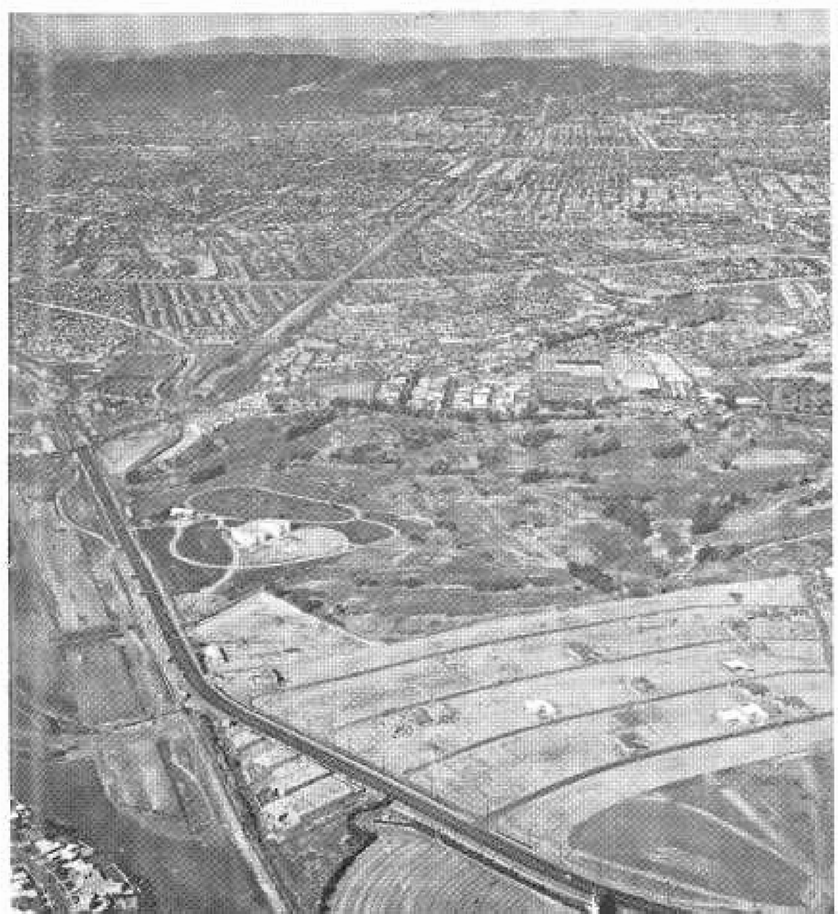
Four bridges and seven pedestrian subways are provided: Chalon Road Undercrossing; Sepulveda Boulevard Undercrossing (S-curve); Brownfield Drive Undercrossing; Rimerton Road Overcrossing; Sepulveda Boulevard Undercrossing (Sherman Oaks); Lemay Street, Hart Street, Valerio Street, Stagg Street, Chase Street and Rayen Street Pedestrian Undercrossings.

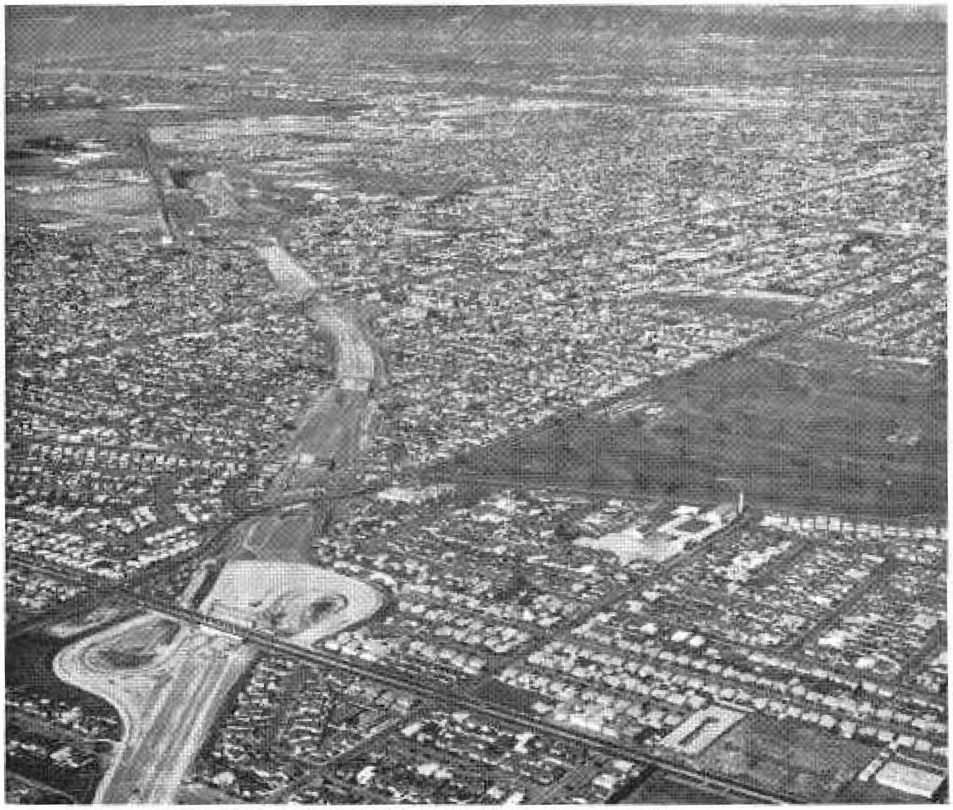
A $300,000 U. S. Army Corps of Engineers' reinforced concrete box drainage facility three miles long was constructed between Moraga Drive and Mission Canyon, ranging in dimension from eight feet in width and 10 feet in depth, to 11 feet in width and 11 feet in depth. It is part of the Sawtelle-Westwood Flood Control Channel, extending 9.2 miles from Casiano Road to Ballona Creek, built in seven sections during the period 1950-1961.

Six-mile Haul Road

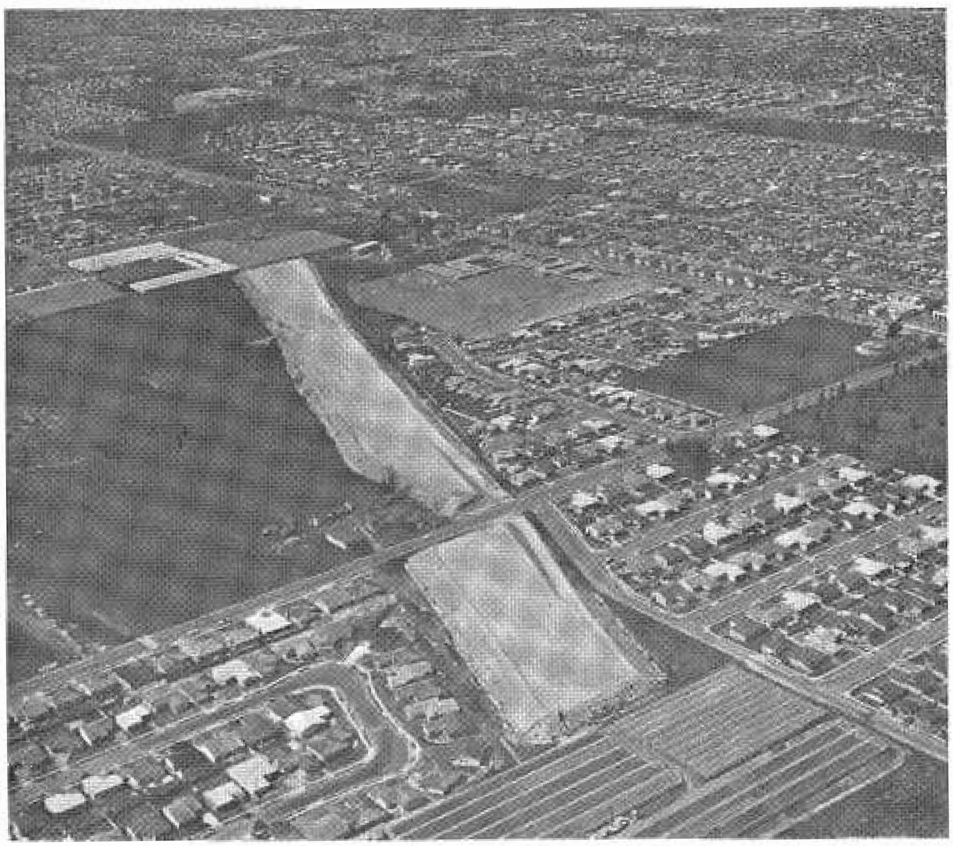
On the north side of Mulholland Drive a 48-inch drainage pipe was constructed in the median area to drain to existing facilities at Sepulveda Boulevard. Northerly of S-curve a 1,000-foot retaining wall was erected to separate the freeway proper from existing Sepulveda Boulevard.

PHOTO BELOW LEFT—The temporary end of the San Diego Freeway (center) at Jefferson Boulevard. BELOW RIGHT—San Diego Freeway construction north from Rosecrans Avenue.





San Diego Freeway construction north from 174th Street.



Freeway fill stockpiled within the right-of-way before actual construction of the San Diego Freeway at Arlington Avenue.

As many as 55 bottom dump trucks fed by two belt loaders hauled a maximum of 15,000 cubic yards per day over a specially constructed six-mile haul road. Hauling operations took a year's time and were completed in mid-December, 1961 when all 3,000,000 cubic yards of embankment fill for the freeway between Burbank Boulevard and Nordhoff Street had been placed.

The contractor used a haul road built under previous contracts but added to it using 11 portable, assembled-in-place Bailey bridges. He also built a temporary haul bridge over S-curve and a bridge at Bromfield Canyon disposal area, and two bridges across railroads. A total of 1,750,000 cubic yards of excess excavation was distributed over the job after satisfying specified embankment needs. About 50,000 cubic yards of material was blasted, with the balance coming out under standard excavation methods.

Approximately midway through the job an instability developed in the Mulholland Summit area within the roadway prism, requiring a change in construction plans. It was necessary to flatten and buttress the slopes and increase the existing 4½ percent grade to 5½ percent by raising the roadbed 80 feet. (A financial allocation by the California Highway Commission, made on December 13, 1961, in the amount of $2,100,000, meets this contingency.) Stabilization of the slopes will also require emergency acquisition of additional right of way on the east and west sides of the Mulholland Cut, and negotiations are currently in progress for the purchase of the needed properties. Construction is in progress beneath existing Mulholland Drive Bridge carrying relocated Mulholland Drive over the freeway. The earth fill falsework, placed there under earlier contract in building the columns, which are 90 feet from the foundations to the bridge soffit, is being removed. This operation, interestingly, gives the appearance of uncovering a finished bridge buried in the ground.

It should be noted that existing Sepulveda Boulevard south of the tunnel was relocated and reconstructed throughout, in connection with freeway work, and that normal traffic flow (approximately 40,000 motor vehicles per day) was maintained during the course of construction.

Operation Sky-hook

Erecting the 72-inch chain link right of way fence along the slopes of Sepulveda Canyon posed a host of problems for the subcontractor who bid the job. The slopes are rugged and high, and accessibility difficult. The first order of work was to clear the scrub and trees from the fence line and this was accomplished.

However, there was the task of transporting the concrete for the fence post bases, which proved to be impractical, and at some locations impossible, by hand. A solution was reached in the form of a transit mix truck and a concreting pump powered by an air-cooled 18-horsepower motor. It was then possible, by means of 2-inch 50-foot lengths of hose, to pump ½-inch maximum, seven-sack mix up to distances of 600 feet.

San Diego Freeway construction at Vermont Avenue (bottom). 190th Street parallels the freeway at the left.

The next problem was that of transporting the fence material. For a considerable distance along the east side of the right of way, beginning just south of Mulholland Drive, it was possible, by using an existing fire road along the ridge top, to truck the material to certain forward points from where it could be carried down to the fence line.

The fence fabric was cut into 25-foot rolls light enough for one man to shoulder. This, too, was a ticklish job because of precarious footing and the presence of rattlesnakes, four of which were killed during the first two days. It was then that the idea of flying in the material was born.

A helicoper was called into service. The first flight took place on March 31, 1961, but due to high winds and trouble with an improvised release mechanism, only a few bundles of fabric were dropped. A bomb release shackle was devised for releasing the loads, along with a raised landing platform composed of two tables and 3-inch pipe legs with space between them to hold the cargo, enabling more efficient hooking of shackle to cargo.

The San Diego-Harbor Freeway Interchange.

On the next flight a graded area near the drop sites was used and 78 rolls of fabric (4,000 feet) and tension wire were flown to the various flagged work areas. On a subsequent flight, drops were made on a mountain top. This time, in addition to the material, it was necessary to drop a roll of ½-inch 600-foot manila line and 12 steel stakes with rings welded on them, so that the fence crew could let themselves down the steep cliff by means of the rope. The crew then drove the stakes into the ground at the site of the fence posts, attached their lifelines

San Diego Freeway construction at Carson Street (center).

through the rings and dug the bases. Approximately 800 feet of 2-inch hose was airlifted at this time since it was easier to link the hoses from the top and let them down the slope to the concrete pump at the bottom.

Operation "Sky Hook" was performed with notable success and attests to the ingenuity and resourcefulness of contractor's crews and state engineers engaged in building California's freeway system.

Nordhoff Street to Golden State Freeway

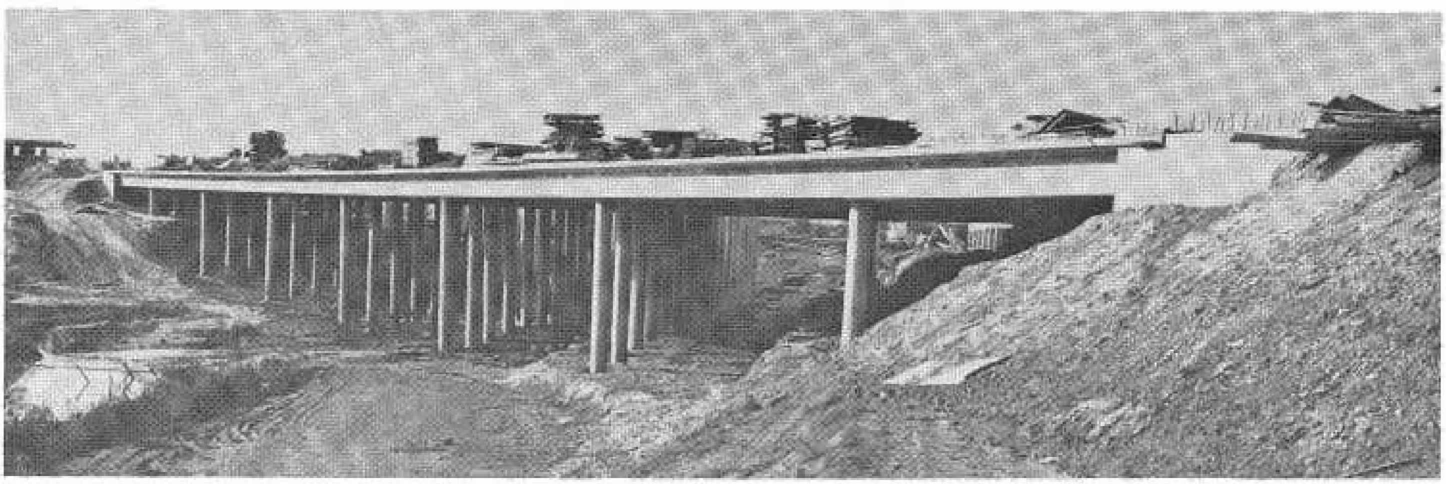
Northernmost construction on the San Diego Freeway is between Nordhoff Street and the Golden State Freeway (US 6-99) in the vicinity of the City of San Fernando. It is part of a $13,383,600 contract on the Golden State Freeway, and work began on February 27, 1961. The San Diego Freeway portion represents $3,299,275 of the construction cost.

Like the freeway portion to the south, this is a "grading only" contract including a drainage system and six pedestrian undercrossings. Fill materials are being hauled for the 3.3-mile link from a state-owned source in the interchange area, amounting to 3,225,000 cubic yards. Belt loaders, bottom dump trucks and compaction equipment with a 50-ton roller are being used in the placement of the fill. The contractor has averaged 15,000 to 25,000 cubic yards per day hauling over his own constructed temporary bridges. This phase of construction on the San Diego Freeway is expected to be completed in mid-1962 at which time it will be possible to advertise for construction bids for structures and paving.

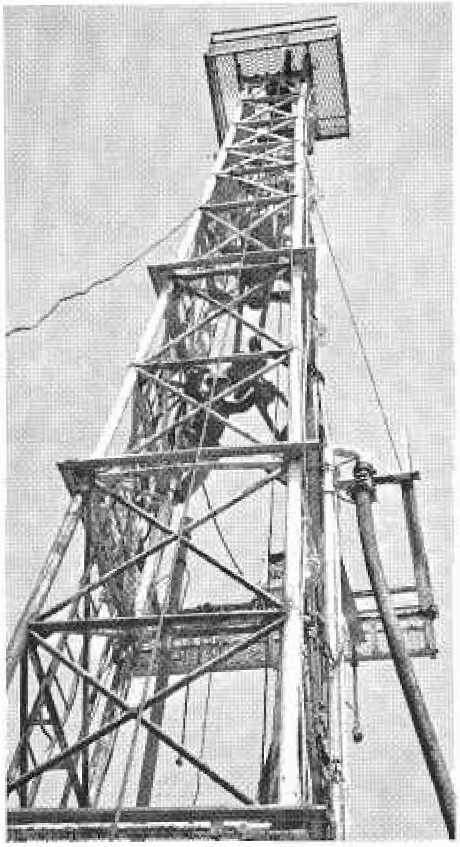
Fill Stockpiling

Prior to 1955 District VII initiated a procedure whereby a free fill is obtained for freeway embankment. However, in July 1959 a program was started to place this operation under encroachment permit and bond, issued by the Right of Way Clearance Section with inspection by the Construction Department.

The San Diego Freeway is one of several routes where fill for freeway embankments has been placed under this arrangement. Between 1958 and 1961, approximately 650,000 cubic yards of free fill was placed on the San Diego Freeway in freeway embankment, representing a savings to the State of $500,000. Fill was stockpiled at such locations as the Santa Monica-San Diego Freeway Inter-



The San Diego Freeway Dominguez Channel crossing at Wilmington Avenue.



Lowering drill pipe to cut away a section of corroded casing. The pump line (right) is used for placing cement and drilling mud.

San Diego Freeway construction in the vicinity of the Long Beach Freeway (foreground). The Los Angeles River is at the bottom.

change, and between Jefferson and La Tijera Boulevards, and between 135th Street and El Segundo Boulevard.

Material Sources Listed

The sources of the material placed by private contractors, were U.C.L.A. building excavations, Barrington Plaza Building (a 22-story apartment), and numerous major commercial buildings constructed along Wilshire Boulevard in Beverly Hills and Los Angeles. The Los Angeles County Flood Control District was also a major contributor to freeway embankment from its Ballona Creek, Centinela Creek, and Sepulveda Flood Control Channel projects.

In addition to fills placed under the free fill program, there were embankments placed on the San Diego Freeway from excess excavation available from construction in progress on the Harbor Freeway. (See *California Highways and Public Works*, May-June 1960.)

Freeway Agreements

Freeway agreements between the State and the various cities have been negotiated for 48.5 miles of the San Diego Freeway in Los Angeles County. Freeway agreements have also been entered into for the 14.6-mile portion from the Los Angeles county line to Bristol Avenue in Orange County. No agreement has yet been reached for a 9.7-mile section southerly from Bristol Avenue to the Santa Ana Freeway at El Toro; however, design is in progress and early resolution of problems on this route is anticipated. The San Diego Freeway is completed, of course, from junction with the Santa Ana Freeway at El Toro, to the San Diego county line, a distance of 20.5 miles.

Additional Moneys Voted

The California Highway Commission announced the state highway budget for 1962-63 at their October meeting in Santa Monica, voting additional moneys for this important interstate route to speed its early completion throughout. An $8,300,000 allocation will finance jobs on the north end of the freeway between Burbank Boulevard and the Golden State Freeway, 8.7 miles, which would complete construction of the San Diego Freeway in the San Fernando Valley; financing of other links in the amount of $14,000,000 will extend the freeway from Atlantic Avenue in Long Beach to the Orange county line, six miles.

Freeway Financed

Another $9,000,000 allocation finances the freeway to Bolsa Chica Road, 4.8 miles.

Other incidental financing includes allocations for tree planting, median barriers, and landscaping, on completed segments of the San Diego Freeway.

Personnel Changes

Trask Retires; Legarra, Baxter, Tinney Promoted

The retirement of J. W. Trask as Deputy State Highway Engineer—Planning, and the promotion of John A. Legarra, Assistant State Highway, to succeed him, has been announced by State Highway Engineer J. C. Womack.

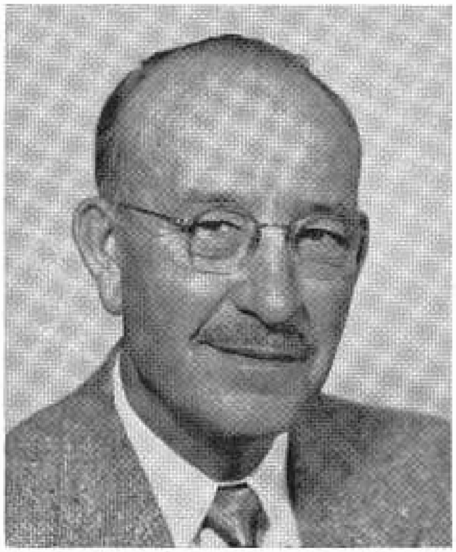
Womack also announced the promotion of Frank E. Baxter, Division Maintenance Engineer, to succeed Legarra and promotion of Edward L. Tinney, Assistant District Engineer in charge of operations for District V in Stockton, to succeed Baxter.

For the past 16 months Trask has been Womack's deputy in charge of all activities involved in highway planning.

His area of responsibility has included advance planning, traffic, design, planning survey, programs and budgets and also the division's large right-of-way program.

His career with the Division of Highways began in 1928 as a junior bridge engineer and has covered nearly every phase of highway work. Previous to his appointment as Deputy State Highway Engineer in September 1960, Trask had been Assistant State Highway Engineer—Operations, with responsibility over the headquarters departments of construction, maintenance, equipment and materials and research.

JOHN A. LEGARRA



J. W. TRASK

A native of Lincoln, Kansas, Trask was raised in Denver and graduated from Utah State University in 1922. He did engineering work for federal government agencies in the Rocky Mountain area before coming to California in 1928.

Most of his early career in this State involved bridge and tunnel construction in the central and northern areas, and then administrative assignments in division headquarters in Sacramento. One of his early assignments was as assistant resident engineer in charge of construction of the Yerba Buena Island Tunnel of the San Francisco-Oakland Bay Bridge.

Moved to District

In 1943 Trask transferred to District II, with offices in Redding, and was promoted to district engineer there in 1950. He moved to District III (Marysville) in the same capacity in 1956, and to Sacramento the following year when he was promoted to Assistant State Highway Engineer—Operations.

Trask served with the U.S. Army Engineers in World War I. He is a member of the American Society of Civil Engineers, the American Society of Photogrammetry and the American Concrete Institute. He has served on the Committees on Construction and Highway Finance of the American Association of State Highway Officials. His civic activities include membership in the California State Chamber of Commerce.

Legarra is being promoted from the position of Assistant State Highway Engineer—Planning which he has held since October 1959.

The new deputy state highway engineer was born in Marysville November 1, 1912, and attended grade and high school in Stockton. He was graduated from the University of California in 1934, with a B.S. in civil engineering, and then engaged in private engineering practice in Stockton.

He joined the Division of Highways in 1941 in the Fresno district. In 1942 he entered World War II service with the Navy Civil Engineer Corps. When he returned to the division in 1946 he worked in the Stockton district in various capacities.

FRANK E. BAXTER

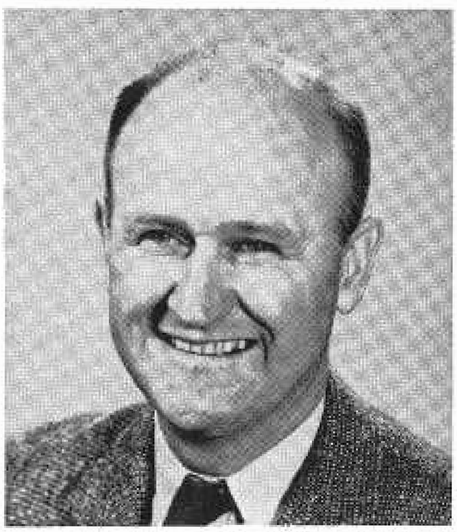
In 1951 Legarra was transferred to Division Headquarters office in Sacramento as assistant traffic engineer. He also worked in the Planning and Design Departments, and was promoted to planning engineer in 1955. He continued in that capacity, except for a period in 1957 as engineer of design, until his promotion to Assistant State Highway Engineer—Planning in October 1959.

Had Active Role

In that position he has had supervision over the Planning, Design, Traffic, Planning Survey, and Programs and Budgets Departments of the Division of Highways. He has had an active role in the development of long-range planning for the State's 12,000-mile Freeway and Expressway System as designated by the Legislature in 1959, and in planning California's 2,200-mile segment of the National System of Interstate and Defense Highways under the accelerated Federal-Aid program.

Legarra is a member of three committees of the American Association of State Highway Officials: Factual Surveys, Roadside Development, and Urban Transportation Planning. He is a member of the American Society of Photogrammetry.

Baxter is being promoted from the position of maintenance engineer

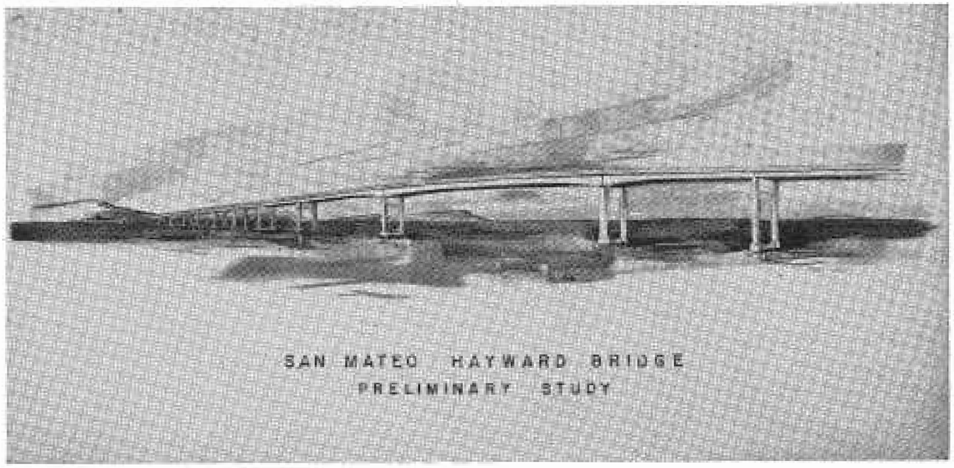


EDWARD L. TINNEY

which he has filled for the past 5½ years.

Born in Los Angeles in 1907, Baxter was educated in that city and at the University of California.

SAN MATEO-HAYWARD BRIDGE DESIGN IS APPROVED



Design work is under way by the Division of San Francisco Bay Toll Crossings for a single-deck orthotropic plate girder structure for the high-level portion of the San Mateo-Hayward Bridge as part of the over-all project to increase the capacity of that crossing of San Francisco Bay.

The California Toll Bridge Authority authorized the single-deck design at a meeting in Sacramento on January 25, 1962.

Last September the Authority had approved a double-deck truss structure for the high-level portion of the bridge where it crosses navigational waters, replacing the existing two-lane lift span. At that time the estimate of toll bridge revenue funds available for the over-all project was $65,000,000. Later figures indicated that $70,000,000 will be available, and the single-deck structure is estimated to be feasible within this latter cost range.

In the meantime, pursuant to extensive discussions of bridge designs at a meeting in San Francisco on December 6, 1961, the Authority decided to retain a special consultant. Governor Edmund G. Brown, chairman of the Authority, appointed William Stephen Allen, San Francisco architect, to this post. The Authority's action in January came after hearing a report by Allen approving the orthotropic plate girder design from the esthetic standpoint.

Allen will continue to be available for architectural consultation on all aspects of design for the structure, according to State Director of Public Works Robert B. Bradford.

Meanwhile, Chief Projects Engineer Norman C. Raab of the Division of San Francisco Bay Toll Crossings said that work is continuing on schedule on the four-lane concrete trestle section which will replace the present easterly portion of the bridge. This phase of the work is being done under a $13,278,590 contract awarded last July.

The entire project, including the new high-level structure, is scheduled for completion in 1965. Portions of the trestle will be opened to four-lane traffic earlier, however, as the work progresses westward.

Total length of the San Mateo-Hayward Bridge is about seven miles.

In 1930, a year after his graduation, he joined the Division of Highways as an engineering aid in the Fresno district. During the ensuing 21 years he advanced to positions of increasing responsibility in that district, including district materials engineer, office engineer, and maintenance engineer.

Moves to Sacramento

In 1951 he was advanced to Assistant District Engineer—Operations for the Redding district, and in 1954 was appointed district engineer at Bishop. He moved to Sacramento headquarters in July 1956 as maintenance engineer for the division.

Baxter is a member of the American Society of Civil Engineers, and has been active on various committees of the American Association of State Highway Officials and the Highway Research Board in the maintenance field.

Tinney, the new maintenance engineer, was born in Omaha, Nebraska, in 1915 and has been a resident of California since 1926. He attended Sacramento Junior College and the University of California, and joined the Division of Highways upon his graduation in 1936. After a brief assignment in the Marysville district he was transferred to the Stockton district. He has been in that district since then, except for World War II service in the Navy Civil Engineer Corps.

His latest promotion was to assistant district engineer in July 1956, first in charge of administration and later of operations.

Tinney is a member of the American Society of Civil Engineers.

GOVERNOR APPROVES DRIVER HABIT STUDY

Governor Edmund G. Brown has approved a $100,000 research program to seek the causes and cures of dangerous driving habits.

The newly established Highway Transportation Agency will administer the research financed by an appropriation of the 1961 Legislature.

Governor Brown said that while "we are spending hundreds of millions of dollars building the finest, safest freeways and highways in the world, our traffic toll continues to climb year after year."

"We know a great deal about how to move volumes of traffic on our streets and highways but little about driver behavior, accident-prone locations and the effectiveness of law enforcement in preventing accidents," the Governor said.

Robert B. Bradford, Administrator of the Highway Transportation Agency and State Director of Public Works, said the research program will cover six general areas.

Series of Conferences

Details of the program were worked out at a series of conferences by officials of the California Highway Patrol, Department of Motor Vehicles, Division of Highways, the Institute of Transportation and Traffic Engineering of the University of California, and the National Safety Council.

"Some of these research studies," Bradford said, "are aimed at producing early and tangible results by which we hope to save lives right now. Others are long-range; there is no magic wand we can wave to stop the tragic loss of life and limb in our mounting traffic. The causes of this disease are deep and complex, and so are the remedies."

Program Approved

Senator Randolph Collier of Yreka, author of the legislation appropriating funds for the program (S.B. 1217) also approved the program as outlined in San Francisco at a meeting of the Senate Fact-finding Committee on Transportation and Public Utilities, of which he is chairman. He said that the appropriation will enable all agencies now doing traffic research to speed up selected important research jobs on a co-ordinated basis and thus obtain quicker life-saving results.

Six-point Program

As submitted by Bradford and approved by Governor Brown, the six-point research program and the amounts earmarked for each study are as follows:

1. $35,000 for a two-part study of "driving environment," involving a comparison of highway locations which appear similar but which have markedly different accident records and, secondly, a study of single-car accidents which in 1960 accounted for more than half of the fatal accidents on California freeways.

2. $20,000 for a study of the effectiveness of traffic law enforcement on the attitudes and behavior of drivers.

3. $15,000 for a detailed study of the behavior of identified "negligent drivers," based on the records of the Department of Motor Vehicles. Procedures for this study will be worked out by that department in co-operation with the traffic institute staff at U.C.L.A.

4. $10,000 for a study on highway system operations, with emphasis on guiding the motorist through signing and other engineering measures. The object is to prevent wrong-way operation on freeway lanes and entering a freeway on an exit ramp.

5. $5,000 for a study aimed at improving the effectiveness of acquiring and processing accident data, beginning with a conference to develop a workable research program.

6. $5,000 for developing an effective means of translating the results of safety research into safer public driving behavior.

Funds in Reserve

The remaining $10,000 of the appropriation is being held in reserve to allow for possible adjustments in the research program, Governor Brown said. Some of the planned studies may need additional funds, or one or more of several alternate studies considered by the conferees may be substituted.

Governor Brown said that Bradford will report periodically to him on the progress of the individual studies and the overall research program.

Lee Redden Retires, With State 40 Years

L. R. (Lee) Redden, District Design Engineer for the Division of Highways in District I, Eureka, retired on December 31, ending a career in state service which began 40 years ago.

Redden was born in Selma, California, and attended schools in Fresno, and the University of California at Berkeley where he obtained a B.S. degree in mining engineering.

L. R. REDDEN

Redden started as a draftsman in 1922 with the Division of Highways in Dunsmuir. Subsequently, he served in District VI, Fresno, and District V, San Luis Obispo, and came to District I in Eureka at Senior Highway Engineer in 1941.

Redden started as a draftsman in 1922 with the Division of Highways in Dunsmuir. Subsequently, he served in District VI, Fresno, and District V, San Luis Obispo, and came to District I in Eureka as Senior Highway Engineer in 1941.

During his period with District I he has been in charge of highway design work.

He and his wife, Ethel, have one daughter and two sons, and eight grandchildren. Redden's two sons are both highway engineers with the California Division of Highways, one in San Luis Obispo and the other in San Bernardino.

He plans to travel after retirement and also spend time on his hobby of stamp collecting. He is active in church work and is also a director of the Humboldt Community Services District.

Flood Problems—3

Cooperative Drainage Job Features Earth Fill Dam

By JAMES W. ROSS, Associate Highway Engineer and WAH G. CHAN, Assistant Highway Engineer

THE State Division of Highways, the Alameda County Flood Control & Water Conservation District and the City of Hayward have pooled their ingenuity and engineering ability to bring to fulfillment a co-operative drainage project that is unusual in the annals of highway drainage.

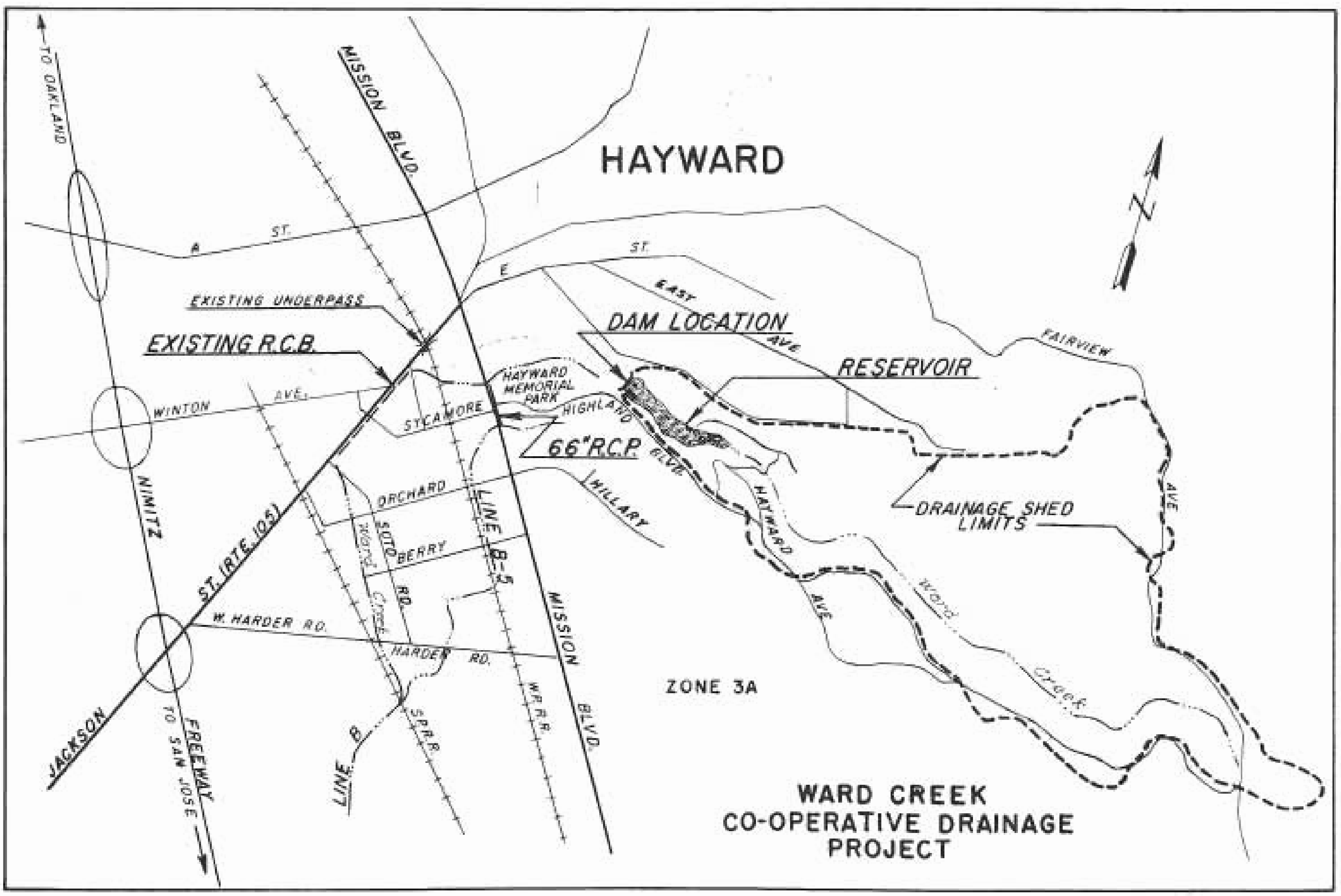
For decades the residential and industrial areas in the Ward Creek Basin in the City of Hayward have been harassed by periodic flooding. For the same length of time, City and County authorities have been besieged with pleas to "do something about it."

> This is a follow-up article to two previous ones concerning District IV drainage problems which appeared in the March-April and May-June, 1961, issues of the magazine.

The State Division of Highways inherited a share of this problem when Jackson Street in Hayward was taken over as a portion of State Highway Route 105 and since then has suffered with periodic road closures due to flooding of the Western Pacific Underpass.

Temporary Methods Tried

Various transitory measures have been taken to alleviate the flooding, but mostly they have simply been "suffered with." The aggregate amount of public and private flood damage would be a staggering sum if complete records were available.



A map showing the location of the Ward Creek Dam and reservoir area in the Hayward area. The location of the reinforced concrete box culvert referred to in the article is indicated by "Existing R.C.B." on the map; the recently completed reinforced concrete pipe by "66" R.C.P."

The Ward Creek dam site is indicated by the white circle at the center of this topographic aerial photo of the Hayward area.

In 1956 the Division of Highways commenced design studies on the widening of Jackson Street (State Highway Route 105) between Mission Boulevard and the Nimitz Freeway in the City of Hayward. The proposed plans called for widening the existing highway from a two-lane city street to a four-lane arterial with a 16-foot median strip. The plans also required the construction of two railroad undercrossings on Jackson Street.

During the preliminary drainage studies the local agencies mentioned above were contacted and they expressed interest in co-ordinating drainage studies. The Division of Highways then started drainage studies to determine the most economical means to protect the highway against flooding.

Historical Data

Prior to the development of this area, Ward Creek emerged from the range of hills east of Hayward onto the flat lands and thence to San Francisco Bay. During the development of this area, flood waters were confined to progressively smaller waterways and eventually to a defined channel. A large amount of storage area for flood waters was no longer available. The creek frequently overflowed its banks both in Hayward Memorial Park and along Jackson Street, causing serious flooding damage to public agencies as well as to private property owners.

Ward Creek is now routed along Jackson Street in about 2,300 feet of reinforced concrete box culvert in State right of way from Silva Avenue to Soto Road.

Deficient in Capacity

Among the principal causes of flooding, insofar as concerns Mission Boulevard and Jackson Street, is an inadequate storm drain beginning in Hayward Memorial Park which lies northeasterly of Mission Boulevard. This problem is compounded by poor entrance characteristics and existence of debris rails in the culvert inlet which plug up even with minor debris conditions. The resulting overflow goes overland to Mission Boulevard and along Mission Boulevard to its intersection with Jackson Street. It then flows along Jackson Street drowning out the existing underpass pumping plant at Western Pacific Railroad. Even with a larger pumping plant, there would be no place to discharge the effluent under present conditions. The underpass could also be flooded by excess flow from the double-box culvert at Silva Avenue and Jackson Street.

Initial Studies

Our initial studies were concerned with enlarging the existing waterway on Jackson Street and providing facilities that would insure collection of flood waters. These facilities would be contained within the present right of way. The estimated cost was staggering and it pointed out that the State could not by itself build a system that would completely eliminate flooding of Jackson Street. This led to exploration of other solutions.

The Flood Control District had once studied a plan to divert the entire flow of Ward Creek from Mission Boulevard southwesterly to the Western Pacific Railroad and then parallel to the railroad to the proposed Line B-5. In that case the existing system on Jackson Street and a proposed supplemental line would have been adequate for the remainder of the runoff. However, it was learned later that subsequent industrial development along the Western Pacific made right of way costs for this plan prohibitive.

A revised plan was outlined by the Flood Control District in 1957 as follows:

1. To utilize the existing facilities on Jackson Street to the limit of their capacity and to increase the capacity of the proposed Line B downstream.
2. To divert the remainder of the runoff southeasterly with a pipe along Mission Boulevard for a distance of about 900′ and thence to Line B-5.
3. To negotiate with the City of Hayward to construct a parallel culvert from the present entrance in the Park to Mission Boulevard so that adequate inlet capacity could be provided. This plan had a number of undesirable features and was also quite expensive.

Final Design Studies

Our final studies demonstrated that an economical and practical solution of the drainage problems on Jackson Street, which are due to the overflow of Ward Creek, lies in a joint effort by the State, the Flood Control District and the City of Hayward. Many consultations and conferences were held concerning this matter from 1958 to 1960.

The general plan was to divert part of Ward Creek flow into Flood Control District proposed Line B-5 with a 66″ reinforced concrete pipe so that the existing system on Jackson Street would be relieved to some extent. But the State felt that these proposals would not adequately protect the new State highway and especially the Western Pacific Underpass.

A satisfactory solution was finally evolved which consisted of the construction of a dam and retention basin in Ward Creek about 3000 feet upstream from Mission Boulevard. Tentative agreement between the State, the Flood Control District and the City of Hayward was reached and preliminary design of the proposed works began in 1958 by the Hydraulics Section of Distrivt IV, Division of Highways.

Final Agreement

The co-operative agreement was finally signed on October 10, 1960. It was agreed that the Flood Control District would construct the flood control dam, retention basin, outlet works and diversion structure along Mission Boulevard, and that the State and Flood Control District would share the cost. The Flood Control District would also prepare plans and specifications, acquire all necessary rights of way, maintain all above facilities and make the necessary secondary agreements with the City of Hayward.

Description of Dam

The rolled earth dam will have a length of 195 feet at the crest and a maximum height of 70 feet. The crest width will be 22 feet and the bottom width of the dam will be approximately 415 feet. Upstream side slope will be 3½:1 and downstream slope 2:1 with a 12-foot berm. The total volume of the dam is estimated to be approximately 60,000 cubic yards. The design of the dam has been approved for safety by the Department of Water Resources.

The primary spillway will consist of a 42-inch concrete pipe beneath the dam with a drop inlet at the inlet end and a stilling basin at the downstream end. It is designed to discharge 250 second-feet at the 100-year condition with a storage volume of 130 acre-feet which would be completely drained after the storm. There will be a freeboard of 9.5 feet for the once in a hundred year storm.

The emergency spillway for the dam will be a concrete control section 40 feet wide at the entrance and narrowing to 20 feet in width 45 feet downstream, with a total length of 228 feet. It will be used for storms in excess of the once in 100-year condition.

Benefits

Tangible benefits to the State are the complete protection against flooding of Jackson Street for the once in 100-year condition and considerable savings over any other solution which could only provide partial protection to the highway.

Tangible benefits to the Flood Control District will be that the Zone 3-A system would be much more effective and require less maintenance expense.

Tangible benefits to the City of Hayward will be a significant reduction in maintenance costs for the various municipal facilities which are subject to frequent inundation.

Other benefits to all three public agencies are the relieving of City residents in the area from chronic flood damages and protection of State Highway users from frequent traffic closures and detours.

Construction of the 66″ reinforced concrete pipe diversion line along Mission Boulevard was completed in September 1961.

The contract for construction of the Ward Creek Dam was awarded in August and the project will be completed late this spring.

Routes Adopted

Commission's Actions Cover 18 Locations

During the closing months of 1961 the California Highway Commission adopted 13 freeway routes and five routes for conventional highways in various sections of the State.

The Commission also held four public hearings on freeway matters. One hearing, held in the Mammoth Elementary School in Mono County on September 29, concerned the relocation of a portion of US 395 near Crowley Lake. Another hearing, held in King City October 31, involved 19.7 miles of US 101 in Monterey County.

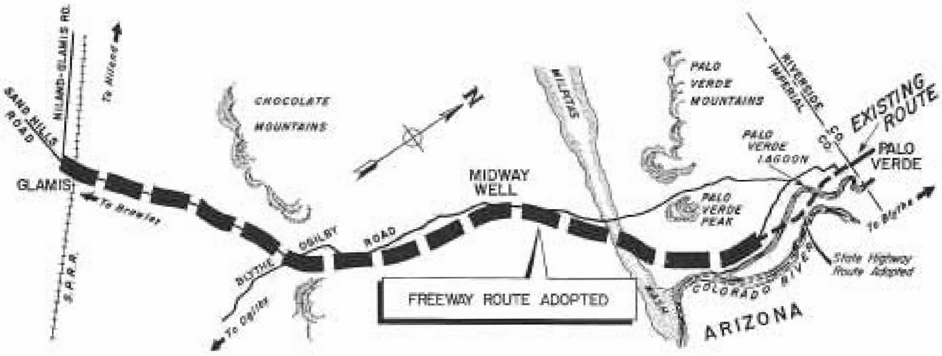
The third public hearing was held in Menlo Park on November 17 concerning a routing for 6.4 miles of State Highway 107 in San Mateo and Santa Clara Counties and the cities of Menlo Park and Palo Alto. The fourth hearing considered freeway routings for sections of Sign Routes 37 and 12 in Sonoma County. It was held in Sonoma on December 12.

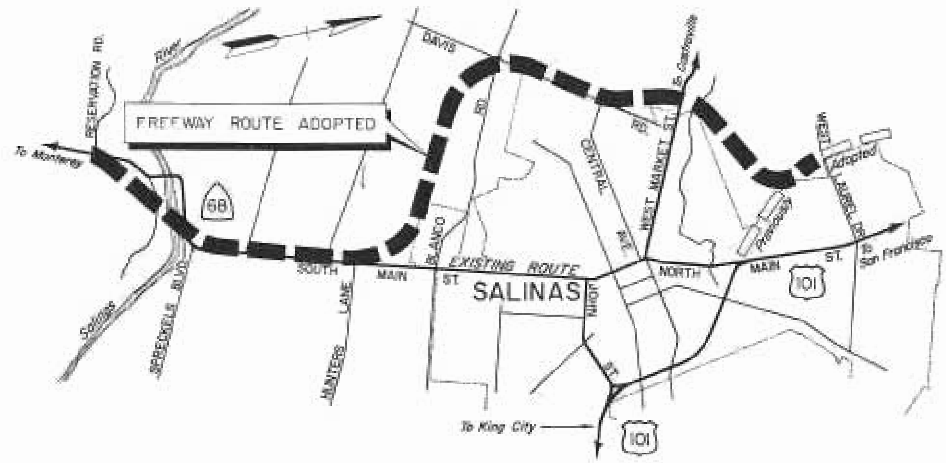
Routes Are Listed

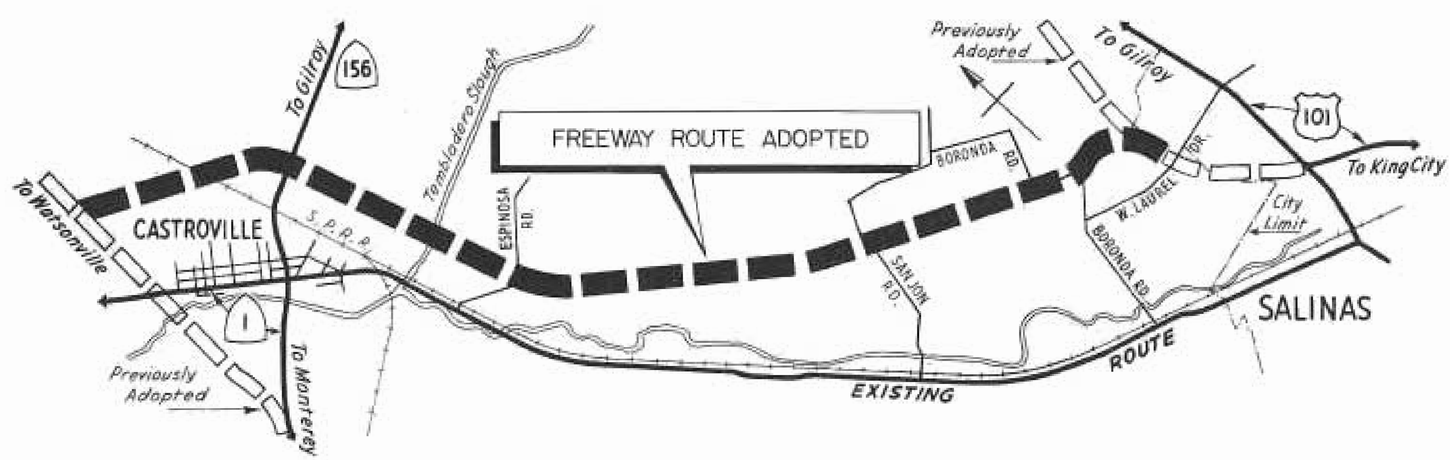
Freeway routes adopted are:

Alpine County—sections of Sign Routes 88 and 88-89 (Carson Pass Highway) which mostly follow the existing highway except that the adopted route for Sign Route 88 runs north of Red Lake while the present road curves around the lake on the south.

Amador County—8.2 miles of Sign Route 104 between the north city limit of Ione and Sign Route 16 just







west of the intersection of Sign Route 49 at Central House.

Humboldt County—two minor revisions of a previously adopted freeway route on US 299. The changes will cut across loops in the previous alignment at Pine Creek and Berry Summit, resulting in shorter distances and greater highway user benefits.

Imperial County—Glamis Road (State Highway Route 146) between Glamis and 5.3 miles south of the Riverside County line and a conventional highway route for the remaining portion of the highway extending to the county line at Palo Verde.

Mariposa and Madera Counties—26.9 miles of State Highway Route 65 in Mariposa and Madera Counties between Mariposa and Oakhurst. Route 65 is an extension southerly of State Sign Route 49, the Mother Lode Highway.

Mendocino County—8.9 miles of Sign Route 128 (Cloverdale to Mendocino Coast Road) between 0.5 mile east of Lazy Creek and Anderson Creek, west of Boonville. The adopted route is on a more direct alignment than the existing highway.

Near Salinas

Monterey County—portion of State Highway Route 117 (Sign Route 68) in and near Salinas and for State Highway Route 118 (Salinas-Castroville Highway) between Castroville and just north of Salinas.

San Bernardino County—32.8 miles of US 66 between Newberry and two miles east of Ludlow. The route runs slightly north of and parallel with the present highway between Newberry and the vicinity of Hector Road and north of and almost contiguous with the existing road between Hector Road and Pisgah Crater Road.

San Diego County — 4.2 miles of State Highway Route 280 in San Diego County and the cities of San Diego and National City. The route extends between 0.4 mile east of the adopted route for the San Diego Beltline Freeway (State Highway Route 241) and 0.4 mile east of Sweetwater Road.

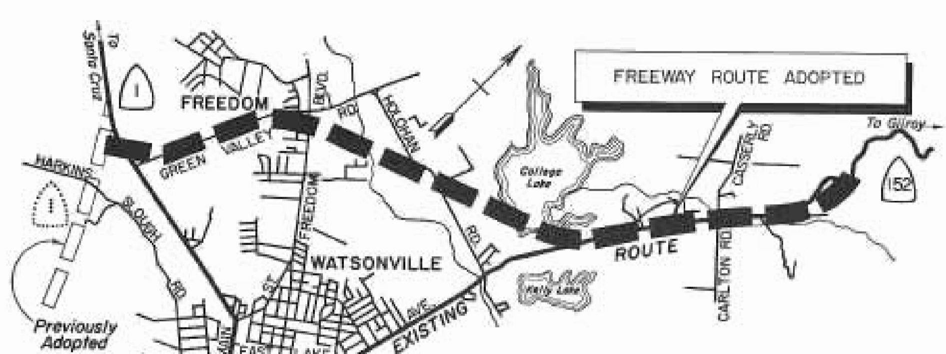
San Francisco City and County—3.4 miles of State Highway Route 253 (Embarcadero Freeway Extension) between Evans Avenue and the Embarcadero Freeway at Howard Street.

Santa Cruz County—route for the relocation of a portion of Sign Route 152 in the vicinity of Watsonville between an adopted freeway route for Sign Route 1 and one mile east of Casserly Road.

Revised Route

Tehama County—revised freeway route for US 99W in Red Bluff between Sacramento Avenue and 0.2 mile south of US 99E. The revised route runs slightly to the west of the previously adopted route, crosses the existing highway (US 99W) at Kimball Road and continues northerly to rejoin the previously adopted route just south of US 99E.

Tuolumne County—revised freeway route for 3.9 miles of Sign Route 120 (Big Oak Flat Road) between one mile east of Hardin Flat and one mile west of Carl Inn near the Yosemite National Park Boundary. The revised route places the highway to the south of rather than to the north of the South Fork of the Tuolumne River west of Ackerson Creek and closer to the existing highway. The change will reflect savings in construction costs with no reduction in traffic service.



MAINTENANCE ENGINEERS MEET IN SACRAMENTO

The first Operations-Maintenance Engineers' Meeting was held in Sacramento on November 8 and 9, 1961. This two-day meeting covered such subjects as new classifications for maintenance field personnel; new accounting methods as they obtain to maintenance operations; discussion on equipment and its use in maintenance work; problems in connection with Service and Supply regarding materials used by the Maintenance Department and other miscellaneous items. Those participating were District Maintenance Engineers, unless otherwise identified. Seated at table clockwise: R. J. Ivy, Supervising Bridge Engineer (Maintenance); L. E. Elder, District V; R. D. Kinsey, Assistant District Engineer (Maintenance) District IV; R. I. Nicholson, District III; R. J. Wilson, District II; C. G. Ure, District I; Scott Lathrop, Principal Highway Engineer, Public Information and Personnel, Sacramento; L. R. Gillis, Assistant State Highway Engineer (Operations), Sacramento; F. E. Baxter, Maintenance Engineer, Sacramento; J. P. Murphy, Deputy State Highway Engineer; J. C. Womack, State Highway Engineer; H. B. Whitnall, District XI; E. Thomas, District X; M. E. Fischer, District IX; R. H. Ramey, District VIII; F. B. Correa, Assistant District Engineer (Maintenance), District VII; T. J. Dunn, Supervising Bridge Engineer (Maintenance Bay Bridge); R. A. Qualls, District VI. Seated around room clockwise; Jack Trentham, Personnel Analyst, Sacramento; Dorothy Dixon, Personnel Analyst, Sacramento; Marian Smith, Personnel Officer, Sacramento; Lyman Olsen, Assistant Maintenance Engineer, Sacramento; Byron Borup, Assistant Maintenance Engineer, Sacramento; W. Z. Hegy, Assistant District Engineer, District I; W. M. Nett, Assistant District Engineer, District II; E. L. Miller, Assistant District Engineer, District III; L. A. Weymouth, District Engineer, District IV. Standing rear clockwise: R. B. Luckenbach, Assistant District Engineer, District XI; C. A. Shervington, District Engineer, District IX; E. L. Tinney, Assistant District Engineer, District X; Fred Everitt, Service and Supply Engineer, Sacramento; A. L. Himelhoch, District Engineer, District VII; Geo. Wofford, Assistant District Engineer, District V; E. G. Bower, Assistant District Engineer, District VIII; Frank Roush, Assistant District Engineer, District VI.

Construction Costs Show Fourth Quarter Rise

The California Highway Construction Cost Index for the fourth quarter of 1961 stands at 238.5, an increase of 8.0 index points or 3.5 percent over the third quarter.

The index for the year 1961 has been computed at 239.1, 6.6 index points or 2.8 percent higher than the figure for the year 1960.

The number of bidders per project during the fourth quarter increased from 5.0 to 6.5.

The small fluctuations during the past several years, particularly in the yearly index figures, point toward a trend of stabilization in highway costs.

A similar trend is indicated by the Bureau of Public Roads Composite Mile Index, based on Federal-Aid highway construction contracts awarded by state highway departments. The third quarter index for 1961, the latest available, decreases 2.5 points or 1.1 percent. This index also has shown only small fluctuations.

The Engineering News-Record Construction Cost Index for the fourth quarter of 1961 remained practically unchanged at 353.3, an increase of 0.4 points or 0.1 percent over the previous quarter. This figure will be subject to adjustment due to retroactive wage increases.

Vehicle Registration Passes Nine Million

Year-end vehicle registration figures for 1961 show the traditional increase to a new high total, and are especially noteworthy in exceeding 9 million. A tabulation of totals registered on payment of fees, by counties, together with a statewide total of exempt public service and government vehicles, indicates a grand total of 9,007,869. The fee-paid vehicles number 8,889,860, of which the Los Angeles County total is 3,404,147, or 38.3 percent. The new total is in accord with the estimate of the Department of Motor Vehicles for the calendar year 1961.

Maintenance crew repairing section of Bayshore Freeway in vicinity of San Mateo. A few decades ago this would have been pick and shovel job for a dozen men and several horses. Mobile aircompressor simplifies task it so can be quickly done by a few men.

NEW MAINTENANCE MAN CLASSES

The first major change to come out of the recent comprehensive survey of the Division of Highways personnel neeeds is the establishment of the new series of classification for maintenance man. This change not only clarifies the status of the maintenance man, but also recognizes the changing skill requirements in this field.

Three New Classes

Three new classes have been approved by the State Personnel Board —maintenance man I, II, and III. Highway equipment operator-laborer and highway leadingman classifications are discontinued, replaced by maintenance man II, and III, respectively. Promotion from these classifications will, as with the previous classifications, be through the classes of highway foreman, senior highway foreman, and highway superintendent.

The classification maintenance man I is to distinguish from laborer by a one-step wage differential. The laborer classification is retained, but only for assignments in other than the maintenance department, such as the equipment and materials and research departments.

New Examinations

New examinations for maintenance man I and II are now or will soon be in preparation. In the meantime, instructions have been issued from headquarters directing changes of the laborers in the maintenance department to maintenance man I where qualified. Men promoted must be working in maintenance functions, and must be licensed to operate two-axle, single-motor vehicles with one towed vehicle.

More Emphasis on Mechanization

Specifications have been prepared for the three grades of the new classification, and although the duties will be somewhat the same as for the previous classification, more emphasis is placed on knowledge of good maintenance practice and operation of equipment. These requisite knowledges and abilities will naturally become more complex as the employee advances through the grades. The emphasis is placed on developing skilled personnel for work in an increasingly mechanized field.

The II grade will be expected to have more knowledge of this field, better understanding of the upkeep and operation of a wider variety of equipment. The III grade must have advanced even farther in these abilities and skills, and in addition, will be expected to do some supervisory work. All grades will be required to have appropriate driver's licenses.

Detailed instructions on this personnel change are given in a Division of Highways circular letter.

Vietnam Highways

A California Engineer Goes to Southeast Asia

By GEORGE E. GRAY, Associate Highway Engineer

IN THE late summer of 1958, while working in District VIII, I became interested in a major highway improvement and rehabilitation program which was under way in the fledging Southeast Asia nation of South Vietnam and accepted a two-year contract as chief highway design engineer on the project.

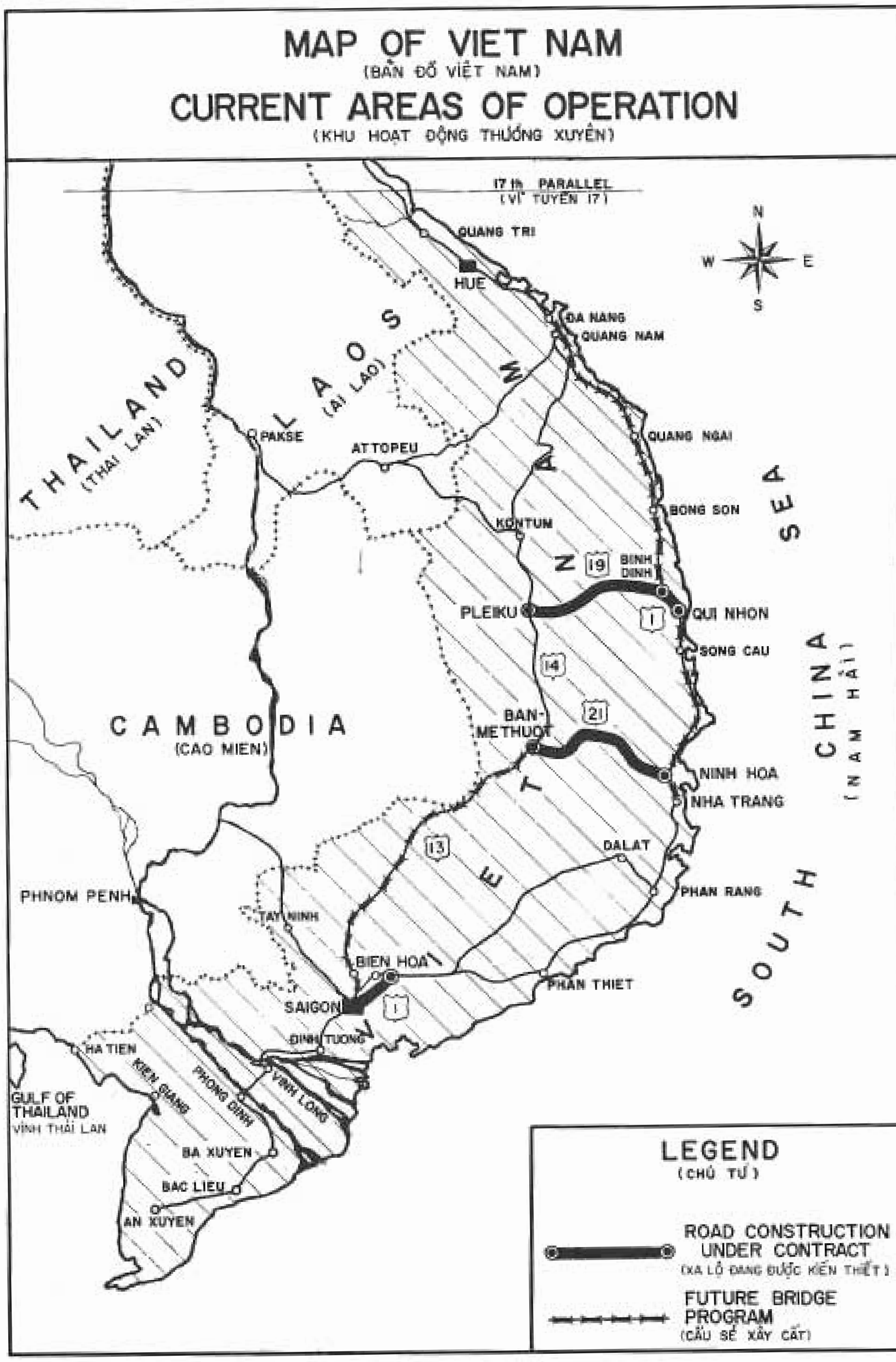
Although the program was sponsored by the International Co-operation Administration, my employer, Capitol Engineering Corporation of Dillsburg, Pennsylvania, was working under the authority of a contract with the government of Vietnam.

The construction contractor was Johnson, Drake and Piper, Inc., of Vietnam.

In essence the engineering contractor, Capitol, was to perform all the services of a typical State Highway Department except for maintenance. This latter function, along with all construction responsibility, including the manufacturing of many basic items such as reinforced concrete pipe, was undertaken by the construction firm. Both companies maintained extensive programs of on-the-job training with the aim of leaving a cadre of trained technicians at the end of the project. Their success is illustrated by the fact that as the program proceeded, more and more of the tasks were taken over by trained Vietnamese.

A New Nation

South Vietnam became a new nation as a result of the Geneva Accord of 1954. It encompasses the southeastern portion of what was commonly called French Indochina prior to World War II. To the north it is separated from Communist dominated North Vietnam by the 17th parallel. It is a nation of 12,000,000 people. During World War II, when Japan occupied the area, and during the Indochina war, from 1945 to 1954, the highway system of Vietnam not only was systematically damaged by bombing and sabotage but any maintenance work was difficult and new construction almost impossible. By July 1954, when semipeace came to the country, highway travel had practically ceased. Many of the existing bridges were narrow military structures and often



it was necessary to ford streams or to use makeshift rafts.

New construction undertaken by the Vietnamese was based on antiquated design and construction precepts, with narrow pavements and high grass-covered shoulders the rule.

The I.C.A. sponsored highway program was initiated as part of an overall aid plan directed towards helping the new nation become economically and militarily strong enough to determine its own future.

Active construction work was concentrated in the following areas:

(1) A section of Highway No. 1 between the capital city of Saigon and a major manufacturing center, Bien Hoa, approximately 32 kilometers (20 miles) north.

(2) A 100-mile section of National Route 21 between the tea-coffee-rubber center of Ban Me Thuot and the junction with National Route 1 at Ninh Hoa.

(3) A section of National Route 19 between the mountain center of Pleiku and the junction with National Route 1 at Binh Dinh and a connecting link to the seaport of Quinhon, totaling 112 miles.

Metric System Used

Design plans were based on the metric system and were similar in concept and presentation to the regular State of California plans. Design speeds used varied considerably with the terrain. One hundred k.p.h. (62 m.p.h.) was used on the Saigon-Bien-Hoa project and, wherever practical, on the northern construction. A design speed as low as 15 m.p.h. with 9 percent grades was necessary in a few mountainous locations on the northern projects.

The structural section was based on various soils information and data with a modified LBR test furnishing the dominant design criteria. Surfacing varied from 3-inch of A.C. on the Saigon-Bien-Hoa portion to a penetration type treatment on the rural routes.

Drainage design was considerably handicapped because of lack of information on rainfall and runoff. Several severe monsoon-type storms during construction served to point out deficiencies, the hard way, and the finished facilities are expected to function with no head for the yearly storm and with head for a 10-year storm. Bridge design was based on passing a 25-year storm with adequate freeboard (usually 2 feet) to allow for floating debris—at least that is the intent.

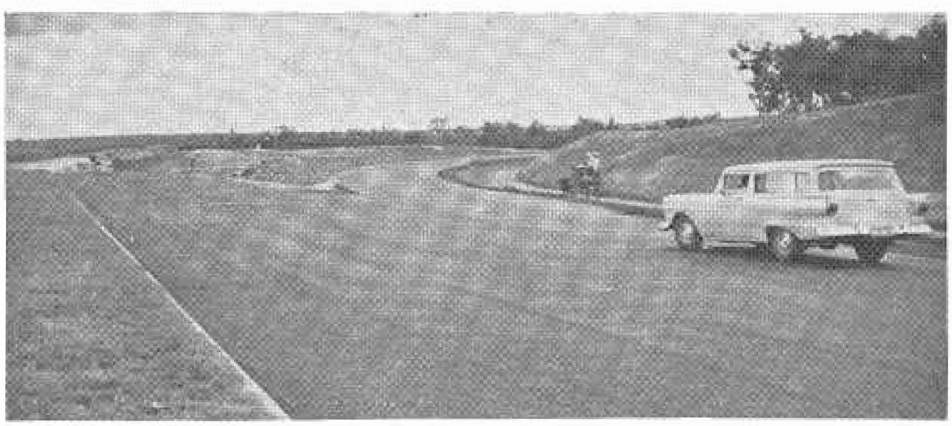
Antiquated construction methods are still being used in some sections of Viet Nam.

Settlement Problem

Construction across some of the rice paddy areas caused considerable trouble. Up to two meters (6 feet 6 inches) of surcharge with up to two years of settlement failed to consolidate the underlying marine clays in some locations. Due to the necessity of completing the highway as soon as practical, the grade was set to allow for additional settlement and the highway completed. Sand drains were not deemed practical because of the expense and the slow rate of water transfer in the fine clay.

Some slide and slipout failures occurred during construction with the major trouble occurring in the placing of the bridge approach fills in the paddy land areas. Usually flattening the fill slopes was adequate to eliminate the problem with construction of counterweight fills and berms necessary in a few isolated instances.

Most bridges on the rural routes were of 24-inch steel beam construction with some concrete "T" beams and some flatslabs also included. The two major bridges on the Saigon-Bien-Hoa route have continuous plate girders for the main spans and with the approach spans total 3,250 feet and 1,500 feet in length. The main piers for the shorter of these two structures are based on the drilled-in caisson principle similar to that being used on the Benicia-Martinez Bridge. A complete description of this system is given in the March 1961 issue of *Civil Engineering*.



A section of new divided highway near Saigon showing an off ramp. Note the water buffalo cart going down the drainage ditch.

Talking About Highways — *Comments from Here and There*

**Misses Old Route—
But Not Much**

City Editor Dick Revenaugh of the *Sacramento Union* wrote a feature calling attention to the difference between his former daily commute route on local streets and roads and the newly opened South Sacramento Freeway. He noted some things he would miss on the old route such as: ("These are the things I'll miss—but not much!")

(1) The "swing and sway of the family clunker" rounding curves.

(2) Slow driving through residential areas "so that you can get the full effect when one neighborhood tousle-head clouts another."

(3) The opportunity to "check the patronage" at a local shopping center.

(4) The "menu" at a local soup factory.

(5) Darting boulevard traffic "which set a man up for a day of combat."

"I'll miss these things," he wrote, "because today I'm modern. I put the old car in the right lane a block from my house, turned on the gas, and in 15 minutes I was walking in the front door of the office—a half hour early.

"Me and my old sedan, we're grateful. In the 15 minutes we didn't use the brakes until we got to U Street in Sacramento. We didn't dodge a single truck trying to make an impossible turn on a narrow street. We didn't worry about pedestrians or half-brained little kids chasing a ball.

"We drove the new South Sacramento Freeway for the first time and have come to realize how it feels to be a 10-minute commuter. . . .

"And probably best of all, the sedan and I, we're not going to part company as soon as we thought. I think it's going to last for 130,000 miles instead of crumbling like a one-hoss shay tomorrow.

"As I said, we're grateful and we'll bet 75,000 other southbound commuters are too."

Gripe About the Shadows

Gene Blake of the *Los Angeles Times* introduced an article on freeway route selection this way:

"Just let the word get out that a freeway is being planned for a certain community—and you never saw so many 'experts' on exactly where it should be routed.

"All of them can give many good reasons why it should be built along a route which—coincidentally, of course—will not remove or be too close to their own homes or businesses.

Some who have thoroughly enjoyed using a freeway to get somewhere else are suddenly horrified at the thought of any going through their community at all. . . .

"'Twas ever thus, wherever freeways have gone through built-up, populated areas. Not everyone can be pleased.

"Former Pasadena Mayor Ray Woods put it well when he said, 'Even if they hung freeways from skyhooks, somebody would gripe about the shadows'."

**Excellent Road Administration
In Cities and Counties**

From a speech by State Senator Randolph Collier before a meeting of the California State Chamber of Commerce in Los Angeles:

"The ultimate success of the 1947 Highway Act demonstrated the point I wish to make. Actually, it was the beginning and not the end-point of our efforts. As a revenue-producing measure it fell far short of our real needs, but it did many other things important to highway administration in California. As one example, it provided for the improvement of county road management by insisting upon consolidation of districts and qualification of road commissioners. As one of its most important features, it established the total responsibility of the State for the construction and maintenance of State highways *in cities*—an action which made California unique among the states and led to the development of our great metropolitan freeway systems.

"Following 1947 we had to bring life to the words of law. We concentrated with some vigor on certain counties. . . . And we got results! Probably one of the least appreciated facts about California's total highway program is the current excellence of its local road and street administrations."

Freeways Add to Property Values

"Property owners in a corridor where freeway construction is planned want to know how the new facility will affect the value of their holdings. Public officials and civic leaders are concerned because expressway development will take many square feet off the tax rolls.

"This matter has been studied in many parts of the country. In summary, these investigations show that freeways generally increase the value of adjacent property, whether undeveloped land or improved commerical, residential or industrial property.

"Some specific examples: In Houston, during a five-year period, land values along the Gulf Freeway increased 65 percent more in dollar value than land distant from the facility. A study by Texas A & M College of the Central Expressway in Dallas described the increase in tax valuation on abutting property as 'astounding'—the gain being on the order of 544 percent from 1941 to 1955. Communities along the route of Boston's circumferential freeway report property value increases as high as 700 percent. In Atlanta, undeveloped land rose from $100-$400 per acre to $1,200-$1,400 per acre after the freeway was built. Along the Eastshore Freeway in California, average raw land values increased from $500 to $21,000 on the average."—From *METRO*, a booklet on urban traffic problems published by the American Automobile Association.

CABLE MOVING

Continued from page 44 . . .

contained 5,400 pairs of wires. These cables carry telephone, telegraph, teletype, radio and television communications, and many hundreds of special and important voice and communication circuits that require continuous communication service.

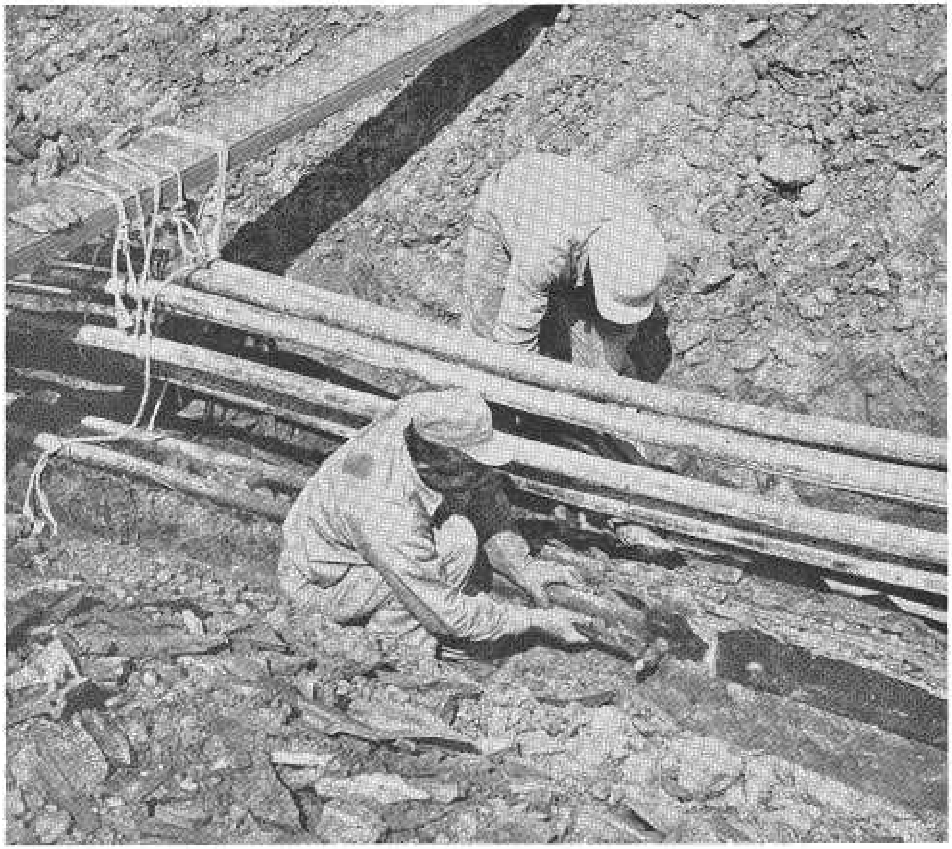
Two Plans Submitted

After extensive preliminary studies of this relocation problem by the P.T. and T. and the State Division of Highways, two methods for relocating these communication facilities were offered.

The first and most common plan would require the rerouting of the Kelso and Olive Streets cables crossing the freeway right-of-way to a new location in the Manchester Boulevard overcrossing structure. This could be accomplished by installing ducts and cables in Ash Street, in Manchester Boulevard, and in La Cienega Boulevard from Kelso Street east of Ash Street to Olive Street west of La Cienega Boulevard. In addition to the installation of many hundreds of feet of underground ducts and cable, this plan would require the splicing of many thousands of wisre.

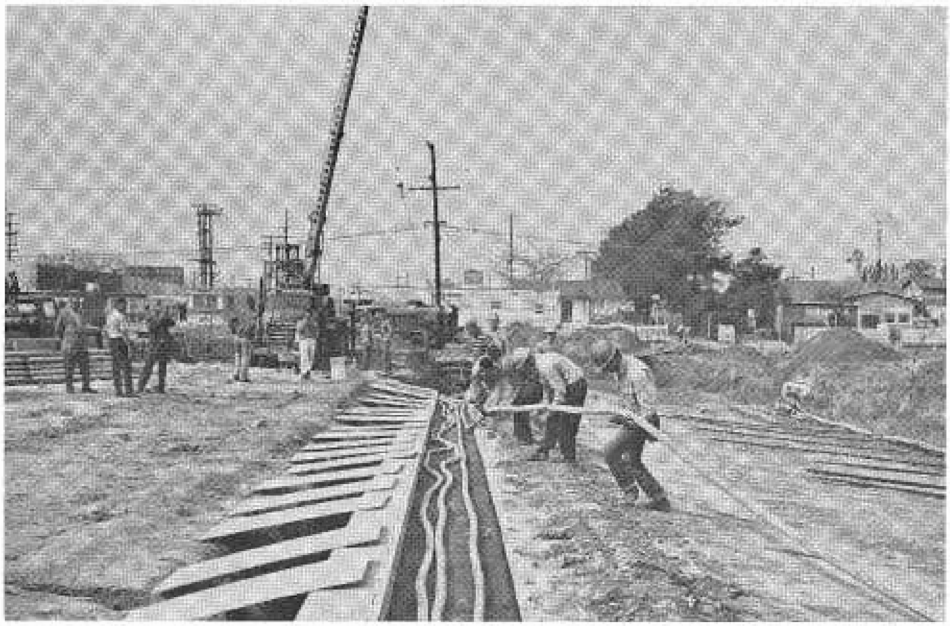
Cable splicing is a time-consuming operation even under normal conditions. Because of the urgency of the communications transmitted over these wires around the clock, the splicing of the conductors of these cables would be slower than usual since it would have to be done during the short periods of time that the circuits were not being used. This would make it necessary for telephone company personnel to work around the clock to maintain continuous service over these facilities.

The second plan involved the construction of a utility bridge across the freeway right-of-way at Olive Street and the installation of new duct and cable in Ash Street, from Kelso Street to Olive Street, and in La Cienega Boulevard from the utility bridge to Olive Street. This plan would allow all cables in Olive Street to be transferred intact to the utility bridge



Breaking and removing multiple tile telephone duct to expose cables

Timbers are lashed to the telephone cable splices for protection.



Transferring telephone cables to the new utility overcrossing bridge.

lected to avoid interference with the construction of the proposed northbound on ramp from Manchester Boulevard.

A trench about 9 feet wide and 5 feet deep was excavated across the freeway right-of-way from west of Ash Street to east of La Cienega Boulevard. This provided for the construction of the bridge superstructure at about existing city street grade, since the freeway at this location will be in cut. Two holes 16 inches in diameter were drilled from the bottom of this trench to the freeway subgrade at the exact location of each of the two abutments and five bents. Type 14BP73 "H" bearing steel piles were placed in the holes and driven to the required 55-ton bearing. This avoided the necessity of extensive excavation in order to construct the substructure and enabled the construction of the superstructure to proceed at original ground level.

At a later date when the freeway prism is excavated, the exposed piles will be encased in concrete to complete the construction of the bridge bents.

without splicing. Cables from the Kelso Street system would have to be spliced in two manholes. This plan was adopted because of the substantial savings in money and time that would be realized by not routing the cables through the Manchester Boulevard overcrossing.

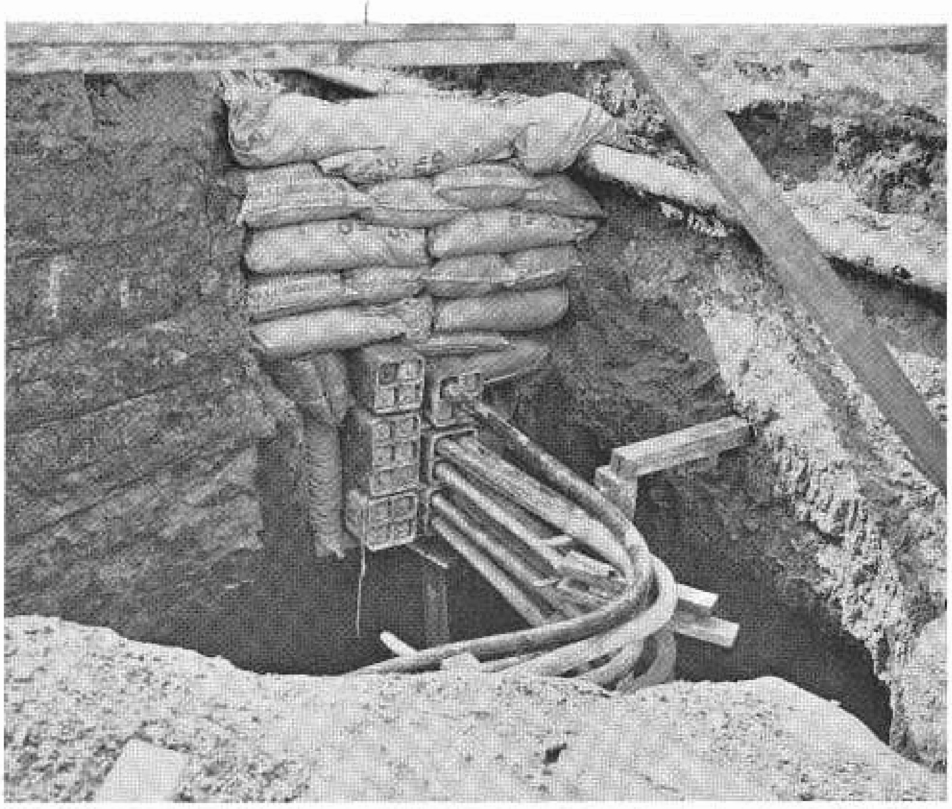
Utility Bridge Construction

The Olive Street utility bridge was built about 40 feet south of the Telephone Company duct and cable system then existing in the north side of Olive Street. This location was se-

Savings Realized

The preliminary estimate of cost and time required for the relocation through the Manchester Boulevard overcrossing under the first plan was $200,000 and eight months' time. The preliminary estimate for relocating the cable by use of a separate utility bridge under the second plan amounted to a cost of $80,000 and four months' total relocation time.

Based on the assumption the $200,000 estimate for relocating the utility facilities through the Manchester Boulevard overcrossing was essentially accurate, and using the actual utility relocation cost, the total savings amounted to $146,000. In addition, the relocation plan used saved approximately four months of utility relocation time. Of significant interest is the fact that the duct and cable installation in the utility bridge was completed in 24 working days, or less than half the 50 days' time estimated.



Telephone cables in position at the manhole location.

Structurally, the overcrossing is a 6-span continuous reinforced concrete "U" section about 397 feet long with an overall dimension of 5 feet 4 inches wide and 3 feet 6 inches deep, and 2 feet 6 inches wide with a 2-foot 10-inch deep cavity. The "U" is closed at the top with 3 x 5 foot galvanized steel plates bolted to angles imbedded in the top of the girder stems. The superstructure is supported at the bents on rigid concrete caps on the bearing piles, and at the abutments on unattached concrete caps. Sliding joints composed of asbestos sheet packing are provided at the abutments to take care of the expansion and contraction movements of the superstructure.

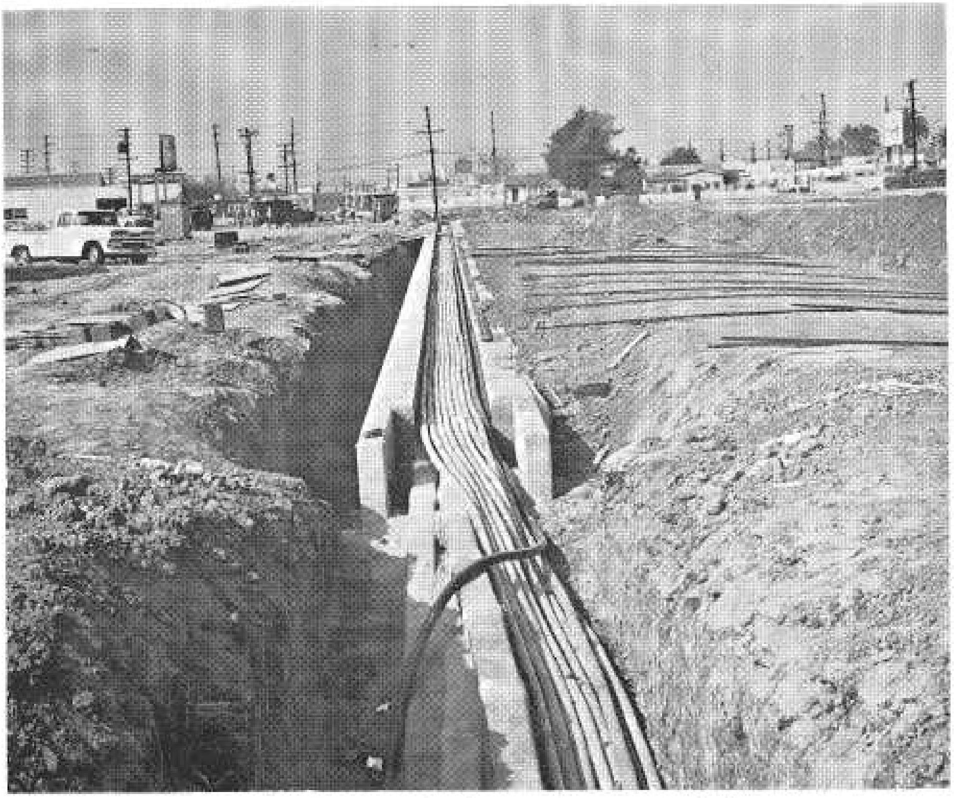
Duct Installation

After completion of the utility bridge, the Telephone Company contractor installed 24 multiple tile ducts in the bottom of the bridge cell and in the bridge approaches, and connecting to the proposed manholes in Ash Street and La Cienega Boulevard. Lightweight concrete was poured around and over these ducts in the bridge to secure them in place. The top of the concrete was leveled and smoothed about 10 inches below the top of the bridge to provide a suitable surface for the installation of the cables.

The earth was carefully removed from around the existing ducts in the north side of Olive Street, and the ground between these ducts and the bridge was graded from below the then existing duct system to the top of the bridge to provide working space for the moving of the cables. Sheets of polyethylene were placed over the north side of the structure before any earth was filled in the trench to protect the bridge concrete from being discovered.

Cables Transferred

The old multiple tile ducts in the north side of Olive Street, between Ash Street and La Cienega Boulevard and the manhole east of La Cienega Boulevard were carefully broken to expose the cables and cable splices. The first operation was to protect the cable splices, the most vulnerable part



Telephone cables relocated in the new utility overcrossing bridge.

of the cable system. Each of the cable splices was lashed to rigid timbers to protect it during moving operations. As each cable in the duct was exposed, it was raised and tied to timbers for protection and ease of handling.

When all preparations were completed, a crane was positioned to raise and move the cable splices and protecting timbers, and men were stationed at intervals along the length of the cable. Acting as a unit, the men and the crane raised each cable in turn and moved it into the bridge cavity over the multiple tile duct. The cables were placed in split tile in the bridge approaches, extending to the location of the proposed manholes at Ash Street and at La Cienega Boulevard. Since the length of the new duct system in the bridge was exactly the same as the old route, there was no need to lengthen or shorten the cables and, therefore, no cable splicing was required. After all the cables were in place, new manholes were built at the ends of the ducts across the freeway at Ash Street and La Cienega Boulevard.

It is interesting to note that in a one-foot length of all of the cables in the bridge, there are over 33,000 feet or 6½ miles of wire.

Method Is Novel

Although the construction of utility bridges is not an innovation, the method of transferring cables intact to the bridge structure was novel. This method of relocation should be considered for telephone cables containing many conductors and/or having important services that require continuous operation, or when the temporary rearrangement of utility facilities involves extensive and costly detours.

The District VII Right-of-Way Clearance Department staff wishes to acknowledge the co-operation of The Pacific Telephone and Telegraph Company representatives for their contribution in the successful development of this new "Transfer Intact Method" for the relocation of important telephone communication cables. Special appreciation is extended to Gene B. Graham of the Los Angeles office of the P. T. and T. for first suggesting this new method and for his assistance in this project.

Index of California Highways and Public Works

January to December 1961

SUBJECT INDEX

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A.S.C.E. CONVENTION ANNOUNCED

The San Diego section of the American Society of Civil Engineers has announced that the Pacific Southwest Council convention will be held in San Diego on April 5, 6, and 7.

'Tempus Fugit' Corner

The following items appeared in the January and March 1937 issues of *California Highways and Public Works.*

". . . All this evidence leads to the unalterable conclusion that the states are not yet ready to assume the economic problems involved in starting a program for divided highways. It is doubtful that such a program is even needed in most of our states. In most of the others, it appears that state highway authorities do not have sufficient control over highway revenues to meet the enormous costs of this type of a program.

"At the same time, I am not so pessimistic that I think the day will never come when such a program will be possible. It is my opinion that we state highway authorities, in future planning, should make provisions for such a program by insisting upon adequate design and adequate right-of-way. This is particularly true with regard to the design and construction of new highways."

(Excerpt from address by Murray D. Van Wagoner at A.A.S.H.O. convention in San Francisco.)

* * * * *

Bridge conscious in a large way, the people of the San Francisco Bay metropolitan area, with the San Francisco-Oakland Bay Bridge a reality, are looking forward with eager anticipation for the opening to traffic of the Golden Gate span, largest over-water suspension structure in the world.

THIRTY PROJECTS ADVERTISED

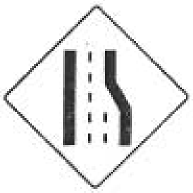
During December the Department of Public Works advertised for bids on 30 highway projects with an estimated value of $25,189,700. Since January 1, 1961, projects for $378,904,800 have been advertised. There were 30 contracts for $9,496,900 awarded during the month and 47 contracts for $40,863,800 were completed.

During December bids were opened for 26 projects for which 178 contractors' bids were received, an average of 6.8 bidders per project.

New Symbol Signs On State Highways

Motorists will encounter two new types of signs on California's state highways within the next few months.

The new signs will use symbols to indicate courses of action to be taken by the driver. Studies have indicated that drivers generally understand and act on the symbols more rapidly than on written instructions, according to the Division of Highways.



Above, on the left, is the sign which will be used to indicate a decrease in the number of lanes (in this case from three lanes to two). On freeways, before they come upon this symbol, drivers will be alerted by a sign saying, "Lane Ends, Merge Left." Variations of this symbol will depend on the number of lanes involved and direction of the merging movement.

When going from divided highways to nondivided highways having fewer lanes, a sign saying "End Divided Road" will precede the symbol which will indicate which lane is to be dropped in order to accomplish the merger. The present multiarrowed signs, which have been used on freeways to indicate a decrease in lanes ahead, and the lettered signs used on other state highways will be replaced as they wear out or are damaged.

On the right, above, is the sign which will be used in the future to indicate a winding road.

Just before the first turn of the winding road, a curve sign already in use will indicate the direction of the initial curve and usually the speed at which it can be safely taken. The new winding road sign will be located just beyond the first curve and will replace the present sign which spells out "Winding Road." The older signs will be replaced as they wear out or are damaged.

Both new signs have been recommended for use throughout the nation by the National Joint Committee on Uniform Traffic Control Devices.

R. C. "Cass" Kennedy

The many friends of Rolland Cashel (Cass) Kennedy, former secretary of the California Highway Commission, were saddened by his death on January 30 in the Veterans Administration Hospital in Oakland after a brief illness.

He had only recently accepted a position with the Engineering and Grading Contractors Association of California, and was driving home to Sacramento after making business contacts in Stockton, when he became ill.

He was a native of Wisconsin. He attended grade schools in Oregon, and majored in electrical engineering at the University of Oregon. He followed this profession for a number of years and then branched out into various other fields.

For several years he was with the *Oakland Tribune* in the automobile section, writing up the motorlog trips. Then he went into business for himself in public relations and advertising.

Kennedy was appointed secretary of the Highway Commission in November 1950 and served in that capacity until December 31, 1954.

During the four years he was secretary, he was the author of numerous articles for *California Highways and Public Works*, among which were the series "Early Days," a history of the commission.

He is survived by his wife, Florence; a son, Robert C. Kennedy of Reno; a daughter, Mrs. Florence Bartlett of Massachusetts, and seven grandchildren.

UNUSUAL ACCIDENTS DAMAGE BRIDGES

Several unusual accidents damaged state highway structures recently.

The day after Christmas an overheight hay truck knocked down the falsework on the Los Osos Road interchange on US 101 near San Luis Obispo.

A similar accident occurred when a high load traveling on Sign Route 23 in Long Beach struck the Studebaker Road overcrossing, completely shattering a prestressed concrete girder.

A United States Coast Guard cutter, answering a distress call from a yacht on fire, rammed the Sign Route 1 bridge across Elkhorn Slough when its reverse gear jammed.

Files Supervisor Coral Davis Retires

Coral Porter Davis, supervising file clerk at headquarters office of the Division of Highways, has retired after more than 40 years of state service.

Mrs. Davis started working for the Division of Motor Vehicles in 1918 and after three years came to the Division of Highways. She was employed as the stenographer for the entire drafting section of the division under office engineers Andrew W. McCurdy, Fred J. Grumm, and L. V. Campbell, successively.

CORAL P. DAVIS

In 1928, she transferred to the file room as a clerk, where she remained and worked up to the position of being in charge of headquarters files and mail.

She is a native Sacramentan. Her mother, Addie Shields Porter, came to Sacramento in 1869 from Portland, Maine, via the Isthmus of Panama and San Francisco.

Mrs. Davis was active in Civilian Defense during World War II and the Korean War, putting in 1,500 hours at the filter center and 350 hours as a Red Cross nurse's aide.

She is a past president of Sutter Parlor No. 111, Native Daughters of the Golden West; a member of Naomi Chapter, Order of Eastern Star, of the Sierra Camera Club, and of the Sierra Club. She is Directoress of the Altar Guild, St. Paul's Episcopal Church, and a member of the Executive Board of Episcopal Church Women of that church.

She has three children—a son and two daughters, nine grandchildren, and a great-granddaughter.

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NOW

Time was when a signing crew like the one from the Southern California Automobile Club shown at right could put a stack of signs in the truck, throw some posts on the racks, and sign several miles of highway before lunch. For a clue as to how long ago that was, note that the tread on the left rear tire of the vehicle says "NON SKID".

In contrast, at the top of the page is a photo of the largest highway sign ever erected in California, possibly in the whole world. Recently placed on the Santa Monica Freeway in Los Angeles, the sign was too large for standard plans, and had to be especially designed by the bridge department of the California Division of Highways. The photos below were made while the sign was being erected.

The 25-ton structure, costing more than $20,000, is 172 feet long, with a clear span of 155 feet between uprights. Like all such large "bridge" type signs, it will have indirect fluorescent lighting, and service walkways fitted with railings which fold out of the way when not in use.

THEN